TECHNISCHE UNIVERSITÄT WIEN
Vienna University of Technology

DOCTORAL-THESIS

Interdisciplinary process management in the hospital.
To form development of a multifunctional Cluster-Operation room for various medical fields - A comparative process study for operation rooms like Hybrid-Operation room, MIGTRs and Cluster-Operation room as a possibility through process optimization the health service economically.

Submitted in satisfaction of the requirements for the degree of
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Expression of thanks

The present work would not have been possible without help and support of friends, family and mentors. I thank all which have believed in me and stood aside me with the conversion of this work.

I would like to thank particularly my mother Dr. Karoline Bisschop, my daughter Liv Peintner my girlfriend Sani Azimi for her patience and her understanding.

Edited Version

The health service is chancing. The present thesis describes the necessary and basic process changes and structural changes in the health service and hospital being on basis of changed operation processes. The core competence of the hospital, the operation area, has developed during the last years rapidly, without this development is reflected in the process and operation structure of the hospital, as well as in the process management of the health service.

The present work lists the technical developments in the operation area and brings together this with economic and operational possibilities. The results are new operation rooms and hospital structures which are more economic and operate medically at a higher level.

The work indicates as investments can be saved without medical achievements and must be reduced. The developed structures oriented to process lead in contrast to available models oriented to function to an improvement of the medical achievements which interdisciplinary and multifunctional can be offered. Process changes lead necessarily to structural changes, this work indicates some possibilities.

W. Bisschop

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1. Introduction

The present work “Interdisciplinary process management in the hospital being. To form development of a multifunctional Cluster Operation room for various medical fields - A comparative process study for operation rooms like Hybrid Operation Rooms, MIGTRs and Cluster Operation room as a possibility through process optimization the health service economically. “ describes a small cutting of changes which will take place in the hospital being during the next years.

In the hospital a huge number of the developments which are conceivable especially only by the application of computer and software has taken place during the last years . This progress took place at all levels and improved the achievement at the surgical as well as administrative level. In the operation room in the same period a huge number of developments took place which could substantially change today the quality of the interventions, but also the terms of employment.

Here in the special the possibility of a technical development should be explained in the operating suite which guarantees by the move of the EDP system and in the special with the picture processing, clearly better term of employment and intervention results. This technical development demands not only new architectural structures and other expiries, but also shows a chance to clear up with omissions of the last years at this level and causes furthermore changes of the hospital management. The result is a completely new structure of process management of hospital being.

Topical publications and statistics show for many years the mismanagement in the existing health system and especially in the hospital being and indicate furthermore the interest of the population. The costs for the health service are too high and, besides, are not clear. The medical achievements and the quality limp behind. The political influence in Austria is huge, but changes are not to be detained any more. Austria follows with the international trend that the medical processes should be formed clearer, cheaper, more adapt ably and more fashionably. The market opens, the political influencing control must be taken back. Topical articles in various newspapers, internet forums and so on support this development and raise pressure on the responsible politicians and officials.

The causes for the quality of this discussion lie in the fact that it was hardly possible up to now to practice criticism to the health system in Austria. Since although generally the people

knew in this country very well about the weaknesses and problems, something was hardly discussed on wide base. Too strong this of the associations, chambers and cashes was blocked. In this country in an open, democratic health structure one was not interested up to now. Also today, in a phase in which the reforms at least are thought and prepared this happens behind closed door. The commercial figures were clarified by the persons responsible and the population hardly got idea of the actual commercial structure. The balances remained in spite of massive promotion and supports by the public authorities under fastener. The whole system, the not -information encloses not only the hospitals, but also the health insurance schemes and the lowered area, with a word the whole health sector.

With increasing financial pressure of the financing of the health system, headword: "runaway costs" deficit health insurance schemes etc. the demand for cost truth become pure. Increasingly a professional management receives move in the health service around with modern free-enterprise methods the costs and the quality under control to agree. Hospitals the hardly information up to now about the actual cost centers and the height this had, these analyze increasingly the meaning and look for alternatives.

AUFGEBLÄTTERT: 25.000 - art mistakes in the hospitals yearly.

08.03.2009 | 18:32 | (DiePresse.com)

In hospitals of Austria die per year more than 2500 people of mistakes of treatment

In hospitals of Austria 25,000 mistakes of treatment are committed yearly, 2500 people die as a result of, writes Kurt Langbein in his new book “Verschlusssache Medizin“

MEDIZIN: Hospitals of Austria critically ?

09.03.2009 | 07:49 | (DiePresse.com)

Yearly 2500 people would die in Austrian after mistakes of treatment, says medicine journalist Kurt Langbein. The hospital doctors defend themselves against the reproaches.

The Austrian health system is expensive, organizes badly and is extremely dangerous now and again, judges famous medicine journalist Kurt Langbein.

SMALL HOSPITALS: People die unnecessary deaths

Therefore, internal test reports should prove that there in small hospitals twice as many complications is as internationally commonly, reports the “Ö1 morning journal“. Also it is hidden long that certain interventions are carried out too seldom, according to Langbein.

Every second hospital installation "needlessly"

Every second patient sent in the hospital would need no hospital, diagnoses Langbein. Because hospitals receive more money for occupied beds, more beds would be booked than urgently. “We have twice as many hospital beds and hospital installations how is necessary really. This is booked, everybody knows it, only it happens nothing“. In Austria there are 6.1 beds per 1000 inhabitants, on 1000 Dutchmen there come 3.1 beds. (Spring: Neumann Heinz, Professional MBA Health Care Management, Strukturen des österreichischen Gesundheitswesens, Vienna 2009, Page 43 - WHO Health for all database 2007)

Up to 2.5 milliard euro could be saved per year, according to long leg according to "Ö1-morning journal". This money should be invested in a research independent of pharmaceutical firms and a sensible ambulant care.

“Contra productive alliances of doctors“

Long leg covers his information from an internal test report which is kept under lock and key, however. “There is here a strange and very contra productive alliance of a layer of doctors who still think that with obscure and cover up and simply nice talking the system like it is now can be maintained, Langbein says in the Ö1-morning journal“.

He added: “Unfortunately, these doctors are still the chamber officials - and the regional politicians who still see also the hospitals as her power base. It is here about more than 100,000 jobs. The health service is the biggest employer of Austria, and there one can exercise of course also political power“.

Pharmaceutical representative defends himself

Hospital pharmaceutical representative Harald Mayer holds the number of the deaths by mistake of treatment unambiguously too high taken. “In Austria to hospitals 38,000 people died in 2006, these are 50% of all deaths in Austria. To state that of it nearly 10% die after medical mistakes of treatment, I hold for a daring assertion“, according to Meyer in the Ö1-morning journal. The book of Langbein is an uncertainty of the patients. However, he admits that there is no statistics to deaths by mistake of treatment.

Classified material medicine. How she is off sick to us who profits from it and how you survive the system“. (Ecowin publishing company).

Books like this would have been inconceivable years ago. The health service and the point of view on it change. The people have become more critical and more self-determined as before. The health system, the hospital is a building site. To think about the future of hospitals, tells first to understand the existing situation of the health service. If one speaks of hospitals of the future, one speaks of the hospital as an integrated service supplier in the centre of the health care. The discussion around the "best" medicine has beside the change of financing and quality assurance the aim to cause structural changes. (Spring: Debatin Jörg F., Goyen Mathias, Schmitz Christoph, Zukunft Krankenhaus, Überleben durch Innovation, ABW Wissenschafts-publishing company, Hamburg 2006, page 81) For a working mistake a negative social climate works like a turbocharger. According to this investigation the risk rises for "critical incident" by the factor 5 by social tensions or differently formulates: 80% all "Human errors" in complicated situations could be defused by optimum social interaction in the team. (Spring: Debatin Jörg F., Goyen Mathias, Schmitz Christoph, Zukunft Krankenhaus, Überleben durch Innovation, ABW Wissenschaftsverlag, Hamburg 2006, page 131)

Health Systems

"**… the health system steers activities, in addition serve health to promote, to restore or to maintain**." (Definition WHO in 2000)

Europe shows, in the meantime, different health systems. While some countries during the last years have come along to introduce reforms on grounds of the economic pressure and to move, this Austria even before stands. The models already by some nations were moved serious differences contain partly. In the other European countries the society has come to the fore travelled around substantially further self decisive. In Germany became the health system, before to the Austrian system very much resembled "controlled collapse calmly"and by a liberal model standing in the competition substitutes. The result is that the costs could be lowered, while the quality was increased. The financing of the health systems becomes in Europe in the essentials by pure insurance amounts (the Netherlands, Germany, France),

by taxes (Portugal, Spain, Italy, Great Britain, Ireland, Denmark, Sweden, Finland), by a mixing system, steering insurance premiums (Belgium, Austria, Greece) as well as by a head-all-inclusive (Switzerland) secure.

The systems of the East European countries, Czech, Slovakia, Romania, Bulgaria, Serbia, Croatia are marked etc. of course still always by the history of the communism. Some countries are other than others, but in principle massive structural problems are still always to be solved. However, this can be also seen as a chance. Sometimes it is to be developed lighter a little bit anew, than to form the available one anew.

In Europe exist in the essentials three basic models with different national variations and adaptations which come on the specific population and economic structure.

The creation of the health system is a national and no EU right.

Beveridge Model

- National health service
- predominantly state financing
- Often state achievement supply

Representative: Great Britain

Bismarck's Model

- Social security system
- Compulsory contributions dependent on income
- Achievement supply privately, state supervision

Representative: Austria

Market Model

- Private financing and supply
- A little state interventions, controls

Representative: The USA

(Spring: Neumann Heinz, Professional MBA Health Care Management, Strukturen des österreichischen Gesundheitswesens, Vienna 2009, Page 2)

ORGANISATION	POSITION AUSTRIA	NUMBER 1	CORE COMPETENCE
WHO-RATING (2000)	9	FRANCE	INDICATOR OF DISCPLINES LIKE HEALTH CARE, PATEINTS ORIENTATION FAIRNESS
CONFERENCE BOARD OF CANADA	17 (of 24)	SWISS	MEDICAL AND NOT MEDICAL OUTCOME INDICATORS
SOCIAL AND CULTURAL PLANNING OFFICE OF THE NETHERLANDS	3 (of 25)	FRANCE	INDEX OF DIFFERENT INDICATORS OF OUTCOME FINANCE, PROCESS
EURO-HEALTH CONSUMER INDEX (2008) POWERHOUSE	3 (of 30)	NETHERLANDS	INDEX OF DIFFERENT INDICATORS OF OUTCOME RIGHTS, INFORMATION, OUTCOME SOCIAL ORIENTATION, PHARMACEUTICAL

Illustration 01: International Rating national health care service
The picture shows the listing different international ratings with regard to the judgement of the quality of the health system. Austria never lies on the first place. (Spring: Neumann Heinz, Professional MBA Health Care Management, Strukturen des österreichischen Gesundheitswesens, Vienna 2009, Page 3)

The reduction on the core competences a way out of the operational bases would be fixed, however, the problem is that the houses to to date do not differ or hardly and show therefore similar or same competence.

Still appears that movement walks in. The health also becomes a product like any other product. That what she is for private medical centers long ago. It shall freely be acquired in the market and stands in direct competition to alternative products and methods of other suppliers. Offer and inquiry will also determine this market and the customer is a king. These pithy sayings become a reality. In addition, it will be necessary that the state of the population offers a medical basic protection. These become not only pure two classes system, but more classes System will originate which offers medical achievements according to wallet and readiness of the people. For the most part these of private organizations will be led. The state will guarantee the basic care as well as the juridical basic conditions. That is at the same time that a privatization of the health service will take place and the hospitals must concentrate upon the core competences. (Spring: Ebner Heinz, Professional MBA Health Care Management, Management der Kernaufgaben, Vienna 2008, page 65)

Only who acquires suitable experiences by specialization, will be able in future to do justice to the highest high-class claims and to offer advanced methods of treatment to the use of the patients. (Spring: Debatin Jörg F., Goyen Mathias, Schmitz Christoph, Zukunft Krankenhaus, Überleben durch Innovation, ABW Wissenschaftsverlag, Hamburg 2006, page 7)

To reflect on the core competences and with it this becomes a portable scaffolding for a main focus Hospital, it is necessary to differ from the competition. It will be necessary first to come along about the contents of offered medical achievements thoughts and to offer more in achievement. Market economy originates for the health service. Only few years ago the expense account was introduced in the hospital being. Today, besides, the hospital is to be learnt to operate like a private economic company. Today a lot what in the private sector since decades to the tools of a functioning management heard, starts to become only in the hospital being a reality. Because the taxpayer bore anyway the costs at the end of the day, no need existed apparently and, moreover, one believed that a hospital is too complicated and costly to be led by means of expense account and controlling. It is to be become by the application of big EDP systems as well as suitable software, today possibly to the problems man and to create exact models. In the past not seldom human and ethical reasons were placed special emphasis to block reforms and changes and to turn away. The cost pressure does not make this today any more possible. (Spring: Holzinger Andreas, Professional MBA Health Care Management, Medizininformatik Teil I, II, und III, Vienna 2009, page 52)

Not to lose patients and to adapt the public models to the private models the patient should become more and more the customer. The customer determines and requires increasingly for his insurance achievement a maximum. Variety lets arise competition, quality as a differentiation sign. Thus the future will produce many hospital models which do not exist today.

The financial pressure demands a successful management as well as new economic models and business creativity. The depoliticization of the health service approaches, because the Austrian model is in Europe last in this form and is completely overtaken. While other countries like Great Britain, the Netherlands and the FRG have initiated long ago reforms and a trend turn have reached, begin in Austria only the discussions.

Today the reasons for the financial problems of the hospitals are known adequately and are of financial, personnel and structural nature. Financially the hospitals with the steadily rising operating expenses as well as personnel expenditure fight. The financial payment of the

achievements by the “LKF“system has taken no remedial action, the costs rise again like before. The care order and the different interest groups, management, care and doctors destroy the development of common interests.

The federalist system ruling in Austria, the independence extensive of the single federal states in basic areas protects also fights through with the health service. The basic data of the economic efficiency of the hospitals of the federal states could not be more differently. The reason for these variations and economically bad abscission lies in the missing management and is due to the strong influencing control of the politics. (Spring: Neumann Heinz, Professional MBA Health Care Management, Strukturen des österreichischen Gesundheitswesens, Vienna 2008, page 14 - IHS Health Econ 2000) There comes that the hospital being is financed by means of the camera cunning broads financing system[2]. This is meanwhile an absolutely outdated system, and affects extremely negatively.

Today hospitals fight with big problems of the procurement of staff, the qualification of the staff and also with the very rising personnel expenditure. Big ditch fights between the care and the doctors stand in the agenda. Different contracts of employment for both professional guilds fire these problems.

[2]Camera cunning broads financing system: Room, chamber, princely treasure chest. It has proceeded of the accountancy and is applied exclusively in the public sector and is the reservation procedure dominating with the authorities. The camera cunning broads financing system is based on the picture of payment streams. Starting point is a budget in the takings and issues of a period are confronted.

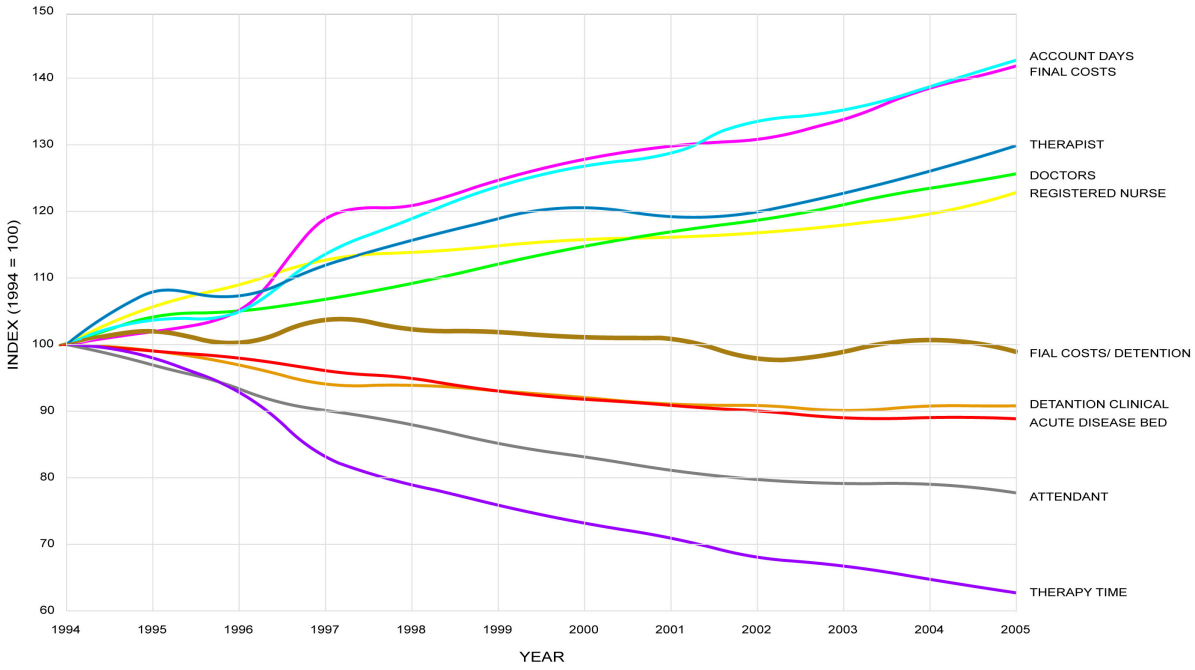


Illustration 02: Developing course intra- extramural acute accent hospitals
The graphics show the development different cost centers of the hospital and her development.
While the costs bed stay the same worth corrected virtually, the personnel expenditure is cost factors. Optimization can merely dam this development, not detain. (Spring: ÖBIG-Austria, 2007)

The hospital care is the most traditional area of the hospital and also disposes of a grown group culture, while the doctors have a modern group being in comparison to the care rather. The care can fall back on very regulated and modern working hours, the business hours are still fatiguing for doctors, and 72-100 hours per week no rarity. Bad business hours, post services and a moderate payment for the doctors, show a defective motivation. Rank fights and conflicts of competence create a work atmosphere with huge tensions, so that in accordance with studies a lot of doctors from the Burn out syndrome suffer and have a high consumption of alcohol. (Spring: Lalouschek Wolfgang, Professional MBA Health Care Management, Burnout in Medizin und Pflege, Vienna 2009, page 6)

Among the doctors there are strong tensions. Ditch fights determine the life in the hospital. Burn out, harassment, sexual abuse are no rarity. The consumption of alcohol, the drug abuse, the separation and suicide rates among the doctors speaks volumes and is well documented

statistically. The system in which these people work generated an inhuman sphere which belongs changed.

Illustration 03: Locations of the acute hospitals and the care regions in 2010
The graphics show the situation and density of the different hospitals and the respective care regions are Yellow the areas of concentration which have partly a huge density. (Spring: Zentralverzeichnis der Krankenanstalten,Austria 2006)

The structural problems originate from the extreme political dependence of the hospitals, as well as from the instruction restraint by the politics. Also for the health service Austria exists of nine territorial zones. The federal states do not co-operate in the health interests, they plan and invest up to the border line of their country without care what is the need of this region. Thus hospitals exist in the frontier and on both sides, on both sides they are insufficient occupied. Both hospitals agree a CT by means of supports financed and in both fell, are absent the patients. (Hainburg, Lower Austria and Kittsee, Burgenland or Mödling Baden both in Lower Austria) (Spring: Report Rechnungshof Austria Nov. 2011)

The construction of hospitals is extremely prestigious and is used as a political stage. In the past hospitals were built Austria without any need study. Also even today the hospitals who can be never led economically successfully originate in Austria in close vicinity to each other. (Baden-Mödling)

Of a population of 8.5 million people approx. 272 hospitals face from what 17% are profit-oriented, 83% are public and to him being close bearer, land organizations to assign how charitable bearers etc. The control of the public bearers is very party-oriented and reflects the political power relations of the federal state.

A comparison in addition, another EU country, the Netherlands has 16.5 million inhabitants and half as a lot of hospitals, however, these are financed to 94% private of benefit to the public. The politics keeps out in the Netherlands of the surgical business and creates merely the legal basic conditions. Financial problems and panic announcements in the media are not known in the Netherlands on this subject. The yearly discussions that it`s no more possible to finance the health care system or that the cashes lack the money is an Austrian peculiarity and this fear structure is absent in most EU countries. Besides, it concerns the political power plays which are delivered about the media in public.

COUNTRIES	AREA	POPULATION	NUMBER HOSPITALS	URBAN CATCHMENT	PUBLIC RESP BODY	PRIVAT RESP BODY	PRIVAT PROFIT ORIENTED BODY
BELGIUM	30.528 Km^2	10.839.905	218	140 Km^2	ca. 40%	ca. 60%	a few
GERMANY	357.021 Km^2	81.799.600	1.868	191 Km^2	37 %	39 %	24 %
FRANCE	547.206 Km^2	61.000.000	4.150	132 Km^2	ca. 25%	ca. 35%	ca. 40%
NETHERLANDS	**41.528 Km^2**	16.680.000	136	305 Km^2	6 %	94 %	--
AUSTRIA	**83.879 Km^2**	8.430.558	272	308 Km^2	64 %	19 %	17 %
SWISS	41.285 Km^2	7.870.100	345	119 Km^2	ca. 60%	ca. 25%	ca.. 15%

Illustration 04: Carrier structure after sick person's institutions, exemplarily in international comparison
The graphics show the sluggish structure relations different EU countries. For Belgium and France include these figures psychiatric hospitals, for the FRG and the Netherlands exclude the figures the psychiatric hospital. It documents the density of the hospital per country. (Spring: own representation in support IHS Health Econ in 2006)

A structural problem which is known in general is the daily high frequency of the patients in the outpatient clinics of the hospitals. This problem stands exemplarily for the cause of the structural problems. Since the different achievements in the hospital are paid from different pots. The Finance Rivers for the financing of the health service are extremely complicated in Austria and blind. The stationary department of the hospital is paid in Austria by the countries, for the costs of the day patients the alliance arises. The hospitals are led by the countries. The government has to clear up therefore generally no interest in it with the everyday chaos in the outpatient clinics as long as the alliance pays. A change and improvement of the structure would shift the costs

of the alliance to the countries. Because the decision of reorganization lies, however, with the hospital operators and with it with the countries, is to be assumed from the fact that it does not come so fast for such a change.

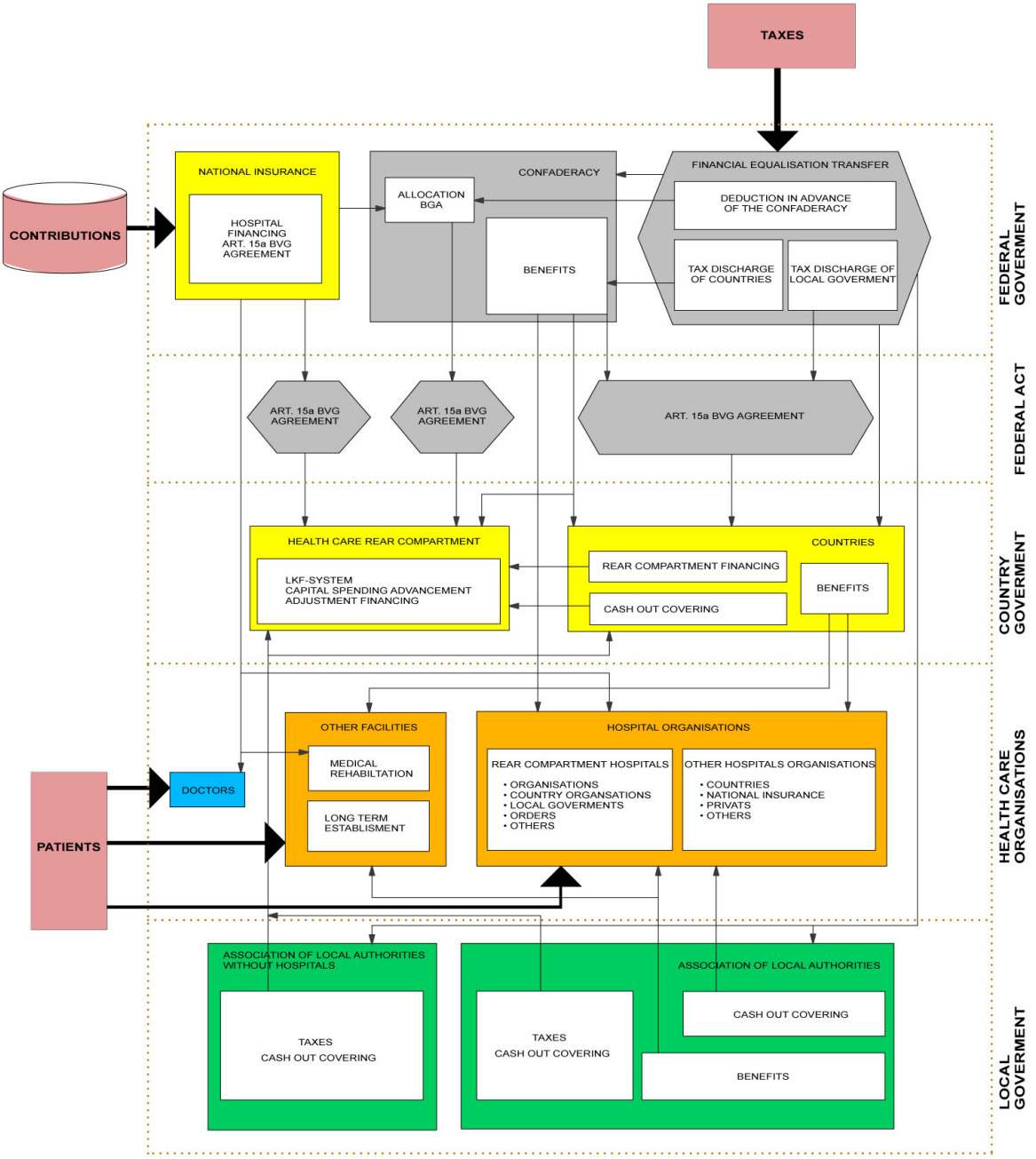


Illustration 05: Financial transfer of health care Austria

The graphics show the financing pots and the monetary rivers of the health service in Austria. This system is very complicated and it is out of control. The Government will reformed it since a couple of years. (Spring: own representation in support of Bröthaler, J., Bauer, H., Schönbäck, W., Österreichs Gemeinden im Netz der finanziellen Transfers: Steuerung, Föderung, Belastung, Springerverlag New York (2006)

The Patients and the employees of the hospital remain with such a political position on the distance, it leads to the consumption of resources and structural mistake which allow no high-quality medical quality continue. Hence, many different financing pots and the extremely complicated financing system complicate clear solutions and decisions at all levels. This is the real problem of the health service in Austria which belongs urgently changed. Only if the competence and with it also the costs is distributed clearly and is regulated, one can think in a reorganization. However, in addition the political influencing control must be reduced what would run out to a privatization of the health service.

The management of the area health insurance schemes lies in the hand of the country, also here private structures are totally absent. Private structures would stand to each other in competition and this would entail that an offer variety would originate which would be able to come on the changed needs of the policy holders, to offer new models and to create an effective and wide health spectrum. In Austria compulsory insurance exists and this is at the same time a compulsory insurance. An option for a certain underwriter does not exist. Therefore the offered achievements are also limited out of competition and extremely. This system damages itself, finally, in the long term and is not to be agreed any more with an enlightened society. It is only one matter of time, until it comes to reforms and the supplier, the policy holder and patients, options are offered.

The problems in the health service are at all levels of political nature. The politics has created structural basic conditions which are not able with the demographic development and the consumer behavior of the population any more to step holds. Mismanagement and incompetence as well as political independence distinguish these sluggish slow health bearers. By the worldwide economic crises of the last years grows increasingly the pressure on the federal states, because the cashes are empty and new finance pots cannot be opened by tax rises. The society is in the layout. The people orientate itself increasingly on the Internet and compare the medical achievements in the free market with each other. Achievements are produced for the most part abroad. A little bit what is not possible in Austria generally. Although the health service is a national law and keeps out the EU extensively from the creation, asset allocation and financing, the pressure grows by the EU also in Austria. Some countries of the EU have overtaken the quality / achievement of the Austrian health service long ago and can offer cheaper high-quality medicine.

The change in the hospital market is released by the financial pressure. There are problems not only with the finances, but in all areas. However, as long as something can be financed, it comes for no basic changes. Fact is: Quality and economic efficiency of the medicine stand more and more in the point of view of the general interest. Who wants to prevent the destabilizing, radical achievement dismantling in this situation, the productiveness of the health system must clearly improve. Therefore, the health suppliers and, besides, in particular the hospital enterprisers a huge cost pressure are put out for some time. (Spring: Debatin Jörg F., Goyen Mathias, Schmitz Christoph, Zukunft Krankenhaus, Überleben durch Innovation, ABW Wissenschaftsverlag, Hamburg 2006, page VII)

Another signal are the people who can be treated in Hungary, Slovenia or India or China. Not seldom this is connected with a shopping time or holiday time. The people have changed long ago her expectations what must perform the health service. The Austrian system is apparent to cover the needs of the patients at the moment not in the situation, which is why these, these achievements abroad consume.

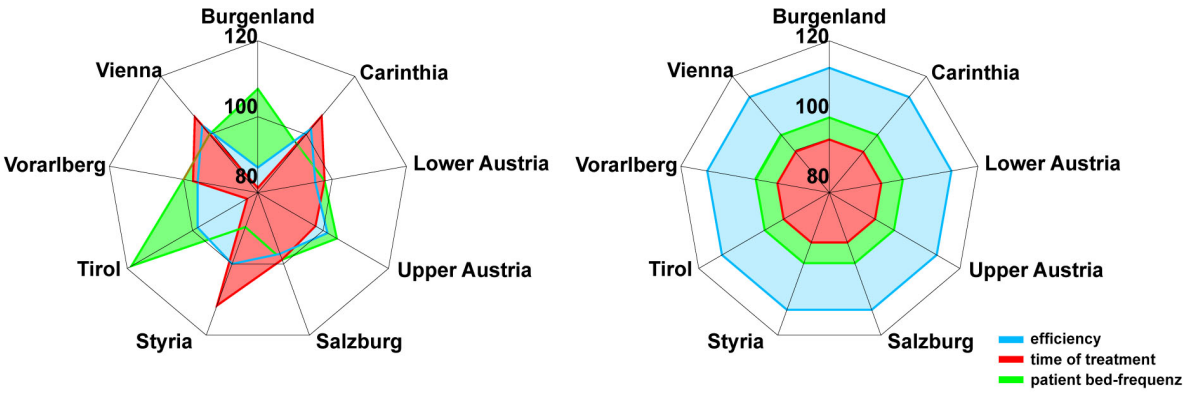


Illustration 06: Hospital extent of utilization in the federal state comparison
The graphics show the basic data of the single federal states in the comparison. While the time of the treatment should be held very low (red), compares LKF points, the efficiency must be raised (blue) this goes along with a high one bed-put down. The inefficiency of the hospital being indicates the obviously made runaways of single federal states. It seems that the hospital management in Austria doesn´t understand what fact is. (Spring: own representation in support of BMGFJ, IHS Health Econ 2008)

The existing health system is not financeable thus anymore and the already taken place technical progress will make necessary changes possible which were not feasible earlier. The technology has made during the last years, also in medical interests, a huge progress. The

rapid development is to be explained primarily by the widespread application of the EDP generally and by computer-assisted systems in the special.

The quick and easy processing of gigantic data amounts comes along by the management, however, also with everyday investigations, or while putting into archives the data sensibly.

Computer systems make the administrative system clearer and better taxable. Processing of gigantic data amounts is the strength of EDP systems. The hospital is able in such a way, substantially more efficiently e.g. to carry out Controlling and to get to know more above the costs and need structure. Today in the planning and creation of departments of hospitals costly simulations can lead to better planning results.

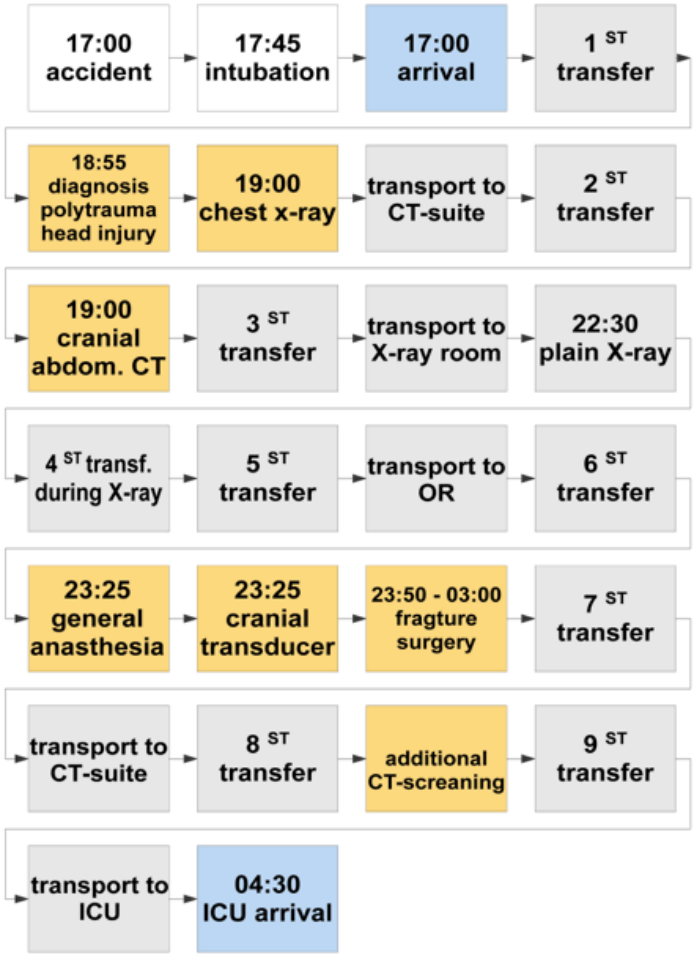


Illustration 07: Case study of an accident

The graphics show an example of a patient, 35 years who had around 17:00h an accident, around 04:30 the next day, 11:30 hours later, she got the necessary treatment and reached the intensive care unit. Orange the steps of medical measures grey the transports and transfer achievements. It is striking, how big the portion in transport and transfer achievements is. (Spring: Jacob A.L. The multifunctional therapy room of the future: image guidance, interdiciplinarity, integration and impact on patient pathways, European Radiology No. 10, page 1763-1769, Springer Verlag New York (2000) Fig. 2 page 1766)

While the work and the expiries within an operating theater are strongly adjusted for a certain intervention and are described, these describing structures as soon as the intervention is absent is concluded. There is no general description, no Guide Lines which steers the case of an admission up to the dismissal of a patient, in all possibilities and regulates. Chaos is the result, single decisions are disorganized and completely uneconomical partly and wrong. The shown case study is no exception, even if it indicates an extreme case. It is the result of a linear concatenation of processes which is marked primarily by transports and transfer achievements. The low portion in medical achievements and the loss linked with it of times and resources are striking.

The workflow after an accident on the intensive care unit looks similar and comes, finally, to the same result. The transport and transfer achievements, which a patient gets to know are huge and dominate the Procedure in the hospital. While the medical achievements are structured in the different departments and are pulled together, the patients must be transported by a department to the next. (Transfer achievement) The risk for the patient increases with every Transport-/transfer achievement terrifically, at the same time the costs rise for the hospital and resources are destroyed. To reduce these transports and transfer achievements (3T-frequency) is an essential beginning to optimize processes in the hospital and to structure better. This beginning carries on in the long term in addition the lawsuits in the hospital to form a new and to order.

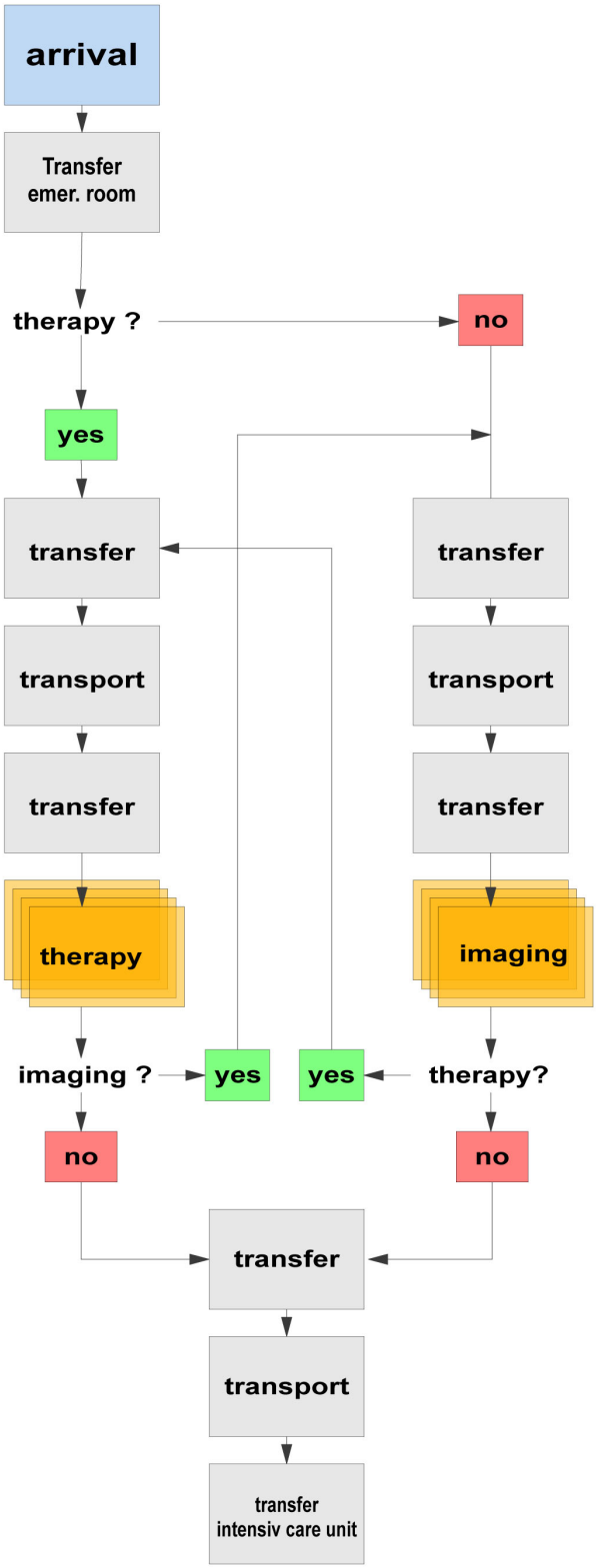


Illustration 08: Diagnostically therapeutic workflow emergency operation
The graphics show the workflow of a customary emergency operation like today he takes place as a rule. After the admission it comes to the transport to the emergency operation, perhaps, a convalescence phase is to be included in the plan. Every local change is connected with 3T- sequence. There is a high risk by the 3T-frequency. If no other screening or intervention ulna therapy is necessary, the patient leaves the emergency operation and comes on the intensive care unit (3T-frequency = transfer, transport, transfer) (Spring: Jacob A.L. The multifunctional therapy room of the future: image guidance, interdiciplinarity, integration and impact on patient pathways, European Radiologie No. 10, page 1763-1769, Springer Verlag New York (2000) Fig. 2 page 1766)

2. Diversification Strategies of the Hospital

The hospital can be defined as equipment whose core business exists in the healing and care of patients for whom a supporting care going out ambulant achievements must be reproached. (Spring: Diez K., Ein prozessorientiertes Modell zur Verrechnung von Faclity Management Kosten am Beispiel der Funktionsstelle Operationsbereich im Krankenhaus, Universitätsverlag Karlsruhe, 2009, page 11) By direct competition there originates competition. By making obviously of medical added value or by emphasizing of core competences the hospitals can differ from the competition. One makes a distinction between general achievements and electoral achievements. One understands by general achievements the achievements which are necessary taking into account the efficiency of the hospital in particular cases in kind and gravity of the illness for the medically suitable and sufficient care of the patient. (KHEntgG, in 2005, §2 Abs2) Electoral achievements are other stationary achievements produced by the hospital (KHEntgG, in 2005, §17). Hospitals pass of different specialized divisions of medical fields the Top-Down as a rule are led and are independent of each other. There is among the departments absolutely competition what is not logical first. The result is that territories originate, in the barriers are established and the cooperation in the everyday events every now and then is complicated. There originate interfaces with huge friction losses. Hence, every interface is a source of error, as well as a barrier for the transference of information and, hence, requires an additional expenditure in coordination and improvisation. Interfaces are particularly to be followed and high vote expenditure, extensive resource reproach, them require multiple achievements of the employees and delay decisions. The extreme dependence which rescues a huge mistake potential and costs in itself originates from blurred demarcations. (Spring: Neumann Heinz, Professionel MBA Health Care Management, Strukturen des österreichischen Gesundheitswesens, Vienna 2008, page 40)

On the patient covered interfaces can be called as a change of the on the principle of the division of labour our acting attachment figures or as a crossing in the different functional areas or facilities within and/or equipment-covering care chain. Presently many historically grown processes run in the hospital suboptimal. They are often fragmented and unstructured and form a group round the everyday instructions of the looking doctors. Traditionally it is thought in the hospital in functions which lead to typical interface problems. (Spring: Braun von Reinersdorff, Andrea, Strategische Krankenhausführung, Von Lean Management zum Balanced Hospital Management, Hans Huber publishing company, 2 circulation 2007, page 194)

Illustration 09: Hospital interface as a source of error
The graphics shows a symbolic organization structure of a hospital. Every interface requires an additional expenditure, there appear new actors, a new other achievement spectrum originates, as well as a perception anew, definition, perspective and culture. (Spring: Neumann Heinz, Professional MBA Health Care Management, Prozessmanagement, Vienna 2009, Page 44 - TOPICS Project 2003 - “together optimizing processes in clinical systems)

2.1. Core Competence of Hospitals

The competition of hospitals takes place in future in a still unstructured arena without firmly defined rules. (Spring: Braun von Reinersdorff, Andrea, Strategische Krankenhausführung, Von Lean Management zum Balanced Hospital Management, Hans Huber publishing company, 2 circulation 2007, page 63) The cost pressure leads to the change.

The achievement offer will change and the general achievements will decrease, and the electoral A strategy of the hospital in future to differ from competing houses will be by the definition of main focuses. The specialization leads to diversification-strategies of the houses what means that any more all general achievements are not offered, for it determined especially high grade and qualitatively. The advantages of such a development are obvious and express themselves by low costs, more specific processes and higher medical quality. The danger of such a development is cream skinning[3]. Achievements will increase, away from the generalist to the specialist. The legislator is asked to prevent this by juridical basic conditions. In future hospitals will act profit-oriented and must be led, in addition it is to be created urgently his

enterprise values and identification values. This is absent till this day, hospitals have generally no identification values. Surveys have shown that nobody owes for which a certain house stands by which it differs from other houses. (Spring: Stöttinger Barbara, Professional MBA Health Care Management, Marketing und Marktforschung, Vienna 2008, Page 35) If one speaks of the hospital of the future, one speaks of the hospital as an integrated service supplier in the centre of the health care. The stand-alone hospital will become extinct. (Spring: Debatin Jörg F., Goyen Mathias, Schmitz Christoph, Zukunft Krankenhaus, Überleben durch Innovation, ABW Wissenschaftsverlag, Hamburg 2006, page 51)

Exceptions are the medical centers, like Saint Anna child hospital, the Semmelweisklinik etc. these medical centers are perceived differently. These differences in the perception exist because just these medical centers pursue advertisement and work out main focuses, so that they contrast with the other houses. This is brought home by advertisement and marketing to the patient.

Product, solution, achievement will become the loose words during the next years just for hospitals like for customary companies

- best product - e.g.: the best medical achievements
- best achievement - e.g.: what they make, they are able very well
- best solution - that is.: they know her customers very well

All three values can never undertake equally well, therefore, the values are divided into three groups. These values form a triangle which has a main focus according to enterprise; besides, both other points may not be neglected. The values must stand in a balance, the enterprise, best of all, three values - product, solution, and achievement covers, is the most successful in the market.

The hospitals that concentrate only upon one of three values and neglect both others will not be able to exist in future. (Spring: Stöttinger Barbara, Professional MBA Health Care Management, Marketing und Marktforschung, Vienna 2008, Page 69)

[3] cream skinning: one understands skimming the most profitable patients The patients who are less profitable remain impossible from the special treatment and are pushed over to the care hospitals.

For the operation area this is called that it is not enough to concentrate exclusively upon surgical achievements, but this all around must be right in future also. Superiority creates projection; indeed, this projection must be essential and have a value. Values are measurable and, hence, give-able. Therefore hospitals will present in future her achievements in advertisement and must position themselves to the competition of the market.

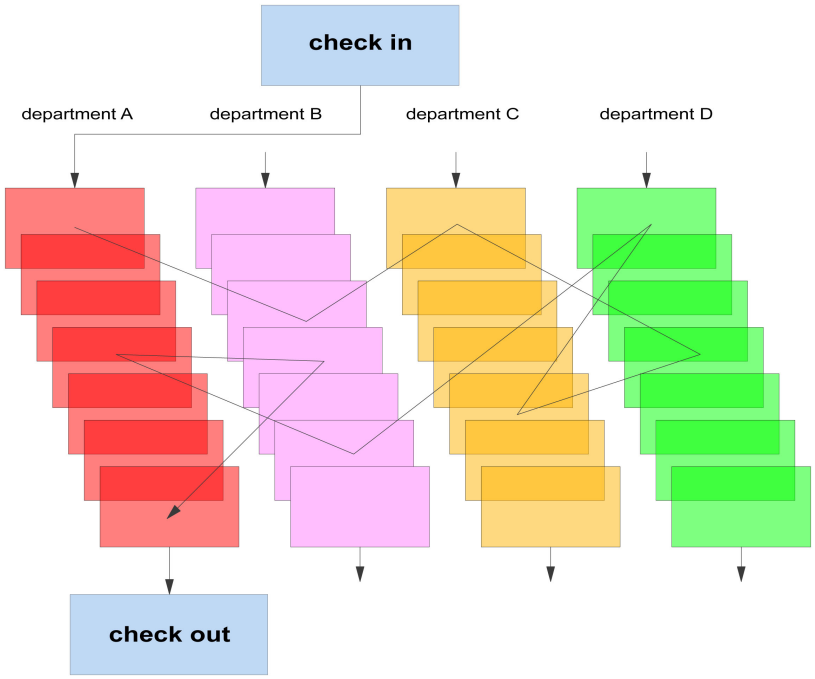


Illustration 10: Ghettos of spezialist in hospitals
The graphics show expiries of a patient after the admission up to the dismissal in a conventional hospital. The patient usually claims several achievements of different departments, he becomes this as a rule, in patient taken up and is examined or treats. The result is, an immense number in transfer and transport achievements, as well as huge economic losses. (Spring: own representation - Debatin Jörg F., Goyen Mathias, Schmitz Christoph, Zukunft Krankenhaus, Überleben durch Innovation, ABW Wissenschaftspublishing company, Hamburg 2006, page 31)

Hospitals invest straight in highly qualified staff and technical equipment around new, better achievements to be able to offer. However, the possibility by specific strategies a high-class increase of the treatment to suggest advantages, e.g., by means of a Hybrid-operation theater patients does not exist for every hospital. High capital costs, a limited patient's amount, as well as the need certain specialized divisions and professional specialists to call only some should be considered. By the reorganization of the Austrian health market hospitals are, for example, with a Hybrid-operation how to see part of a planning of main hospitals. Main hospitals show the result of diversification strategies in the health service and create variety. The hospital manager must learn to understand in view of a competitive sphere becoming more dynamically the interaction between the hospital, the competitor and the whole sphere. The

sharp competition of the hospitals today, requires that them according to her aims and competence her target market selects and positions itself in the market. (Spring: Debatin Jörg F., Goyen Mathias, Schmitz Christoph, Zukunft Krankenhaus, Überleben durch Innovation, ABW Wissenschaftsverlag, Hamburg 2006, page 32)

The following qualities mark a strategical competitive advantage

- it must matter to the patient – the advantages must predominate.
- it must be discernible – make the use visible.
- it must be long-lasting - development, research strengthen this, positioning
- it may not be cash easily copy - entrance barriers are of use like know-how, costs and situation.

The form of main hospitals stands in a topographic dependence, however, depends also on many other factors. It will go in the first beginnings not without master planning area-covering as well as barrier-overcoming and border-overcoming. A total concept must be developed for the location and the market of a hospital. The market does not become first can become leave. Main focuses must be determined and be formulated. The adjusted market needs rule of the game and accompanying measures for the deregulation, the basic conditions must be fixed legally. Background of management instruments with a consideration oriented to process. In the functional, professional 3 column organizations, functions of the same kind or duties are concentrated against it in suitable achievement to managements. Thus the structure dominates in the present organization form of the hospital the process. (Spring: Braun von Reinersdorff, Andrea, Strategische Krankenhausführung, Von Lean Management zum Balanced Hospital Management, Hans Huber publishing company, 2 circulation 2007, page 195) The content of the master planning will be, like a big device planning, the representation of the necessary main focuses, in a region, district, and federal state.

There are main hospitals partly today already, only not in this clarity and sharpness. To the today's "main hospitals" new main focuses and thereby new houses created will originate from diversification of the hospitals. It is conceivable that new not available models originate from synergetic effects. Today already there exist hospitals, so-called clinics[4] which have specialized in a field. To call birth, accident, rehabilitation-, beauty, children, women, denial (alcohol and drugs), radiation medical centers and university hospitals only around some. In fu-

ture there will be other ones: are conceivable, e.g.: cancer, vessel, epidemics (like AIDS), hormone, transplant, metabolism medical centers.

It will become a part of the draught to form out medical centers who have furnished a certain technical equipment, like a Hybrid-operation, a particle accelerator (MedAustron), or can offer a certain service, for example, a hospital hotel. It is to be assumed from the fact that the market will differently develop in the town than in the country. While in a town rather everything is offered, medical centers are specified in the country rather on certain achievements. Very big houses like the AKH, will train multifunctional That is the hospitals change to medical centers and reduce the offer of achievements. They are to be concentrated in future constrainedly upon certain achievements and to realize her core competence. Merely in the big areas of concentration houses will continue who offer all achievements, because here a suitable market exists for all achievement cases. These basic care medical centers could get also another job like research and apprenticeship and dispose thereby of all technical possibility and protect the location twice. See Vienna AKH or polymedical centers in the FRG operation theaters and fulfill a research assignment as a part of the university.

2.2. Surgery as a Core Competence

One of the most essential core competences one ascribes to the hospital and inseparably with the hospital is connected, are the surgical interventions. This has historical backgrounds, because earlier it was to be carried out to the hospitals reserved surgical interventions. The population has a big trust in the medically surgical achievements of the hospital. For the originating competition with a restructuring of the health market this means that the entrance threshold high lies, because the achievements are to be copied not easily and uniqueness is given. The competitive advantage for the hospital lies paradoxically in the fact that the total expenses, the production costs, as well as the operating expenses of a hospital and especially an operation theater are extremely high. It is a lot of staff to lead a lot of know-how, however, also a lot of experience urgently a hospital with an operation theater.

A hospital needs a certain topographic catchment area with a certain population structure and population density. The composition of the population determines the demands for the hospital, the patients determine the market.

For bigger houses the concentration on the main focus becomes an operation area be an advantage. Smaller houses will separate their operation theaters and alternative achievements must offer. A possibility furthermore operations insists to offer if there also are here specializations. For example, small hospitals can offer the special achievements which are coupled under circumstances with a geographic specific feature.

Another possibility would be a casualty surgery and emergency surgery; this is already an existing model and is offered by the AUVA. (Austria insurance institution) Other possibilities would be children`s clinic and clinic for women.C-curve

handles and sports medical centers in which specific groups are operated and are treated as well as are offered beauty-operation mostly in combination with Beauty-Farms and wellness to hotels.

[4]With the concept "Clinic" was reacted to the fact that the concept Hospital and Hospital has already become outdated and the concept Clinic, even if is used partly in a wrong connection. With clinic a hospital or parts is meant in general . (Spring: Wikipedia 2010)

2.3. Models of Surgery

Beside the already existing operation models which put out, however, always, up to few exceptions, like beauty medical centers, pine ambulatories, a part of the hospital there will be in close future also new operation models.

The existing models and processes in the operation theater are grown models and reflect the problems in the hospital company in detail again. The arrangement of the functional place operation is hierarchical and structured functionally; the process is subordinated to the function.

A reinforced specialization takes place because this is the only chance to lower the costs and to tax away enough patients of the market. Specialization originates from the concentration on core competences. Hospitals have a care order and cannot virtually specialize. Besides, they may not comparative advertise. Hence, the existing basic conditions are extremely difficult for a specialization. On the one hand a reinforced specialization takes place because this only chance is to be lowered the costs and to tax away enough patients of the market. On the other hand, a specialization takes place by the concentration on the core competence automatically. The diversification of the hospital as a Hybrid hospital model would entail that certain fields would lead under circumstances to a union. The Hybrid-operation theater does not make sense for all medical fields, he is suited particularly for the angelology, neurosurgery, cardiology, orthopedics and casualty surgery as well as the surgery of the internal medicine. In other words, by the development of the generalist to specialists, hospitals with and without Hybrid-operation theater will originate. The costs and the missing specialists show "natural" barriers, which is why it will come to another fragmentation. Hence, Hybrid-operation theaters shall be found rather in areas of concentration with a separate order and a sufficient catchment area. To achieve a sufficient extent of utilization sensible synergies should be formed between single disciplines. This lowers not only the costs like installation costs and operating expenses, but also creates an added value. Basically: With realization of training centers of clear size, cost savings can be realized with concurrent high-class improvement. Besides, the above all following factors are vital: Increase of the care quality, improvement of the economic efficiency, cost reduction by synergies, raised flexibility and reactivity, grouping of administrative expiries, decentralization of management competence. (Spring: Debatin Jörg F., Goyen Mathias, Schmitz Christoph, Zukunft Krankenhaus, Überleben durch Innovation, ABW Wissenschaftsverlag, Hamburg 2006, page 21)

Sensible Hybrid operation synergies arise, for example, by folding up the following disciplines

- cardiology - angelology
- accident surgery - orthopedy
- neurosurgery – nurgery

(Spring: Walther T. Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, 15.01.2010)

To form synergies indicates always to enter compromises, in these cases this means that the least standards must be fulfilled for one of both disciplines. In case of the cardiology angiographies it is the size of the room and the efficiency of the C-curve. Since in contrast to the angiographies, are present during a heart operation up to 14 people in the operation theater room and the achievement of the C-curve must be exceptionally good. The synergy between the cardiology and the Angelology still makes sense because both medical disciplines work on the vessel and work about the big vessels towards the surgical place. The cardiology is, so to speak, a specialization of the angiographies.

Hence, the work on vessels and heart flaps gets by with a Hybrid-operation theater of similar equipment and for the interventions in the heart, a C-curve with a maximum achievement is necessary. However, for the interventions to vessels of the limbs reaches an easy C-curve with a substantially lower achievement. With the pool of a casualty surgery and an orthopedics the conditions are probably still easier produce able. Without having to consider much too big differences of the demands of the equipment. Indeed, positions itself here the problem that an accident operation theater, can be hardly completely booked up for the orthopedics. One could use the operation theater only if there is no need and accidents. How with the synergy between the neurosurgery and the surgery will have to be entered at the demands of the neurosurgery, because these demands are substantially higher and more extensive. ever, this seems to plan ahead to be impossible.

The subject Synergy in the Hybrid Operation theater shows that this sense makes. However, there are many different demands which are to be considered according to discipline. The problems are in detail, in the form of the intervention room and, on the other hand, the necessary achievement of the C-curve is vital according to main focus, as well as the spatial ar-

rangement and size of the intervention room. A complicated job shows the planning of Hybrid-operations for different professional disciplines taking into account the single claims and without compromises there will be no result. However, a confrontation of the costs of two single Hybrid-operations makes clear the saving potential.

Substantially for economic leading of an operation theater are generally

- the number of interventions
- the complexity of the interventions
- the "success" of the intervention, complications,
- equipment and operating expenses of the operation theater,
- empty times of the operation theater in proportion to the operation durations

2.4. Operation Function vs. Operation Process Orientation

The development of different operation-orders hangs together above all to optimize operation processes and to use saving potentials. Besides, the saving limits itself in the conventional area as a rule to folding up of next rooms and ways, while the processes remain untouched and, hence, conventionally function-oriented in the operation theater. The development of a conventional operation theater to the operation cluster is not only a spatial new arrangement, but a change of the process structure of the operation theaters. With the ZOP usable areas are folded up together, this changes in the expiries in comparison to a customary single operation nothing. The process of a Hybrid-operation theater differs from of a ZOP very strongly is still led off the Hybrid-operation conventionally. The top Down management, with that the chief surgeon in the operation theater heads has no place in a not conventionally controlled operation. The MIGTR shows a paradigm change of the process in the operation theater. Away from a functionally straightened primary structure to a prioritization of the processes in the operation room.

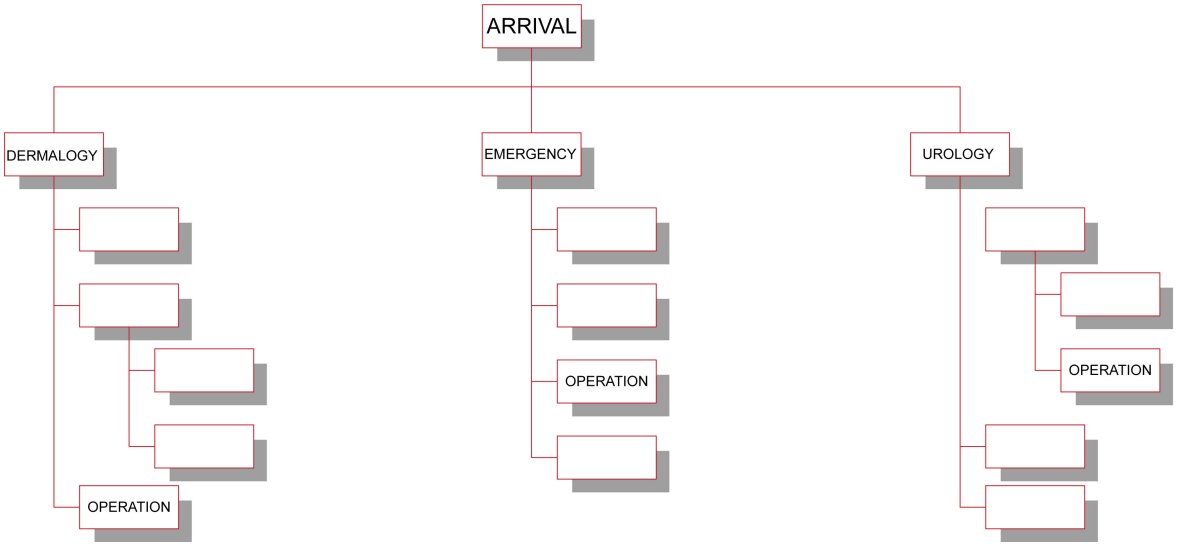


Illustration 11: Hospital division structure
The graphics show that the hospital model is divided in Austria into three columns, those of the management, the care and the doctors. This shows an organization straightened hierarchically and vertically and contains a strict content division of labour up to the singles-implementation level. Multiple hierarchy of the most different stamping originates from it. It is characteristic of a top down structure (Spring: own representation)

Possible structural parameters of such a conversion to a structure oriented process would be

- From case to case cooperation of experts of different fields.
- Occasional cooperation of experts of different fields from the psychic and physical area.
- Coordination comprehensive therapy process with case-wise consultation of professional experts.
- Comprehensive patient's care oriented process.

The listing indicates the change and the change oriented to function to a hospital structure oriented process. (Eichhorn S., Schmidt-Rettig B., Proficenter - Organisation und Prozessorientierung, Budget-, Prozess- und Qualitätsverantwortung im Krankenhaus, Editor Eichhorn & Schmidt-Rettig, 1999, page 20)

The existing spatial as well as organizational structures in a customary hospital do not master this change. The processes and with it also the personnel structures are not aimed to allow comprehensive patient's care oriented process.

While conventionally existing hospital structures a functional specialization with stick places has promoted and has developed (besides the whole infrastructural need was aimed on it), a process-oriented hospital radically requires other expiries and spatial forms.

A conventional central operation room (COR) is easier structured and everybody is same in the essentials. There exist different spatial models, according to geometry of the available room, so that are connected slightly different process sequences.

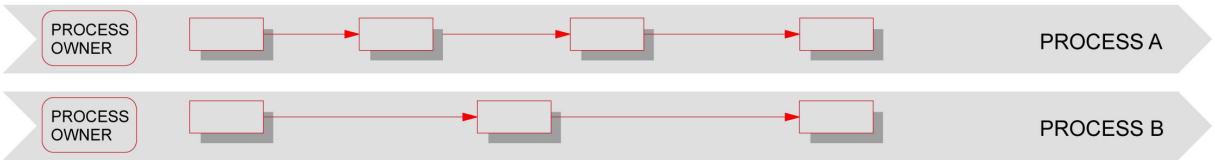


Illustration 12: Hospital process structure
The graphics show a structure of oriented to process in the hospital being. The specialized divisions make available staff for the coping of the process.There is no top down structure. The process belongs to the process owner. (Spring: own representation)

The process is led by the responsible chief surgeon, and exists primarily of an intra surgical phase. The pre and postal-surgical phase are strongly coined a little. Temporal changes during the operation room concern this operation room and lead regularly to losses and by suspension achievements of the hospital are caught.

Cost shares of such unplanned processes in COR are economically very high because synergy possibilities are not taxed away, processes in parallel run, many transfer, transport lines are needed, are nothing unusual multi-operations are nothing unusual and concern temporal movements all following OR-possibilities to lead process optimization are hardly possible, which is why also the suspension achievements are cost-intensive and budget-incriminating.

A hybrid-operation theater requires a more complicated operation process than a COR, which is why the costs are first higher at first sight. As with every operation, the process of the hybrid-operation room is also divided in pre, intra-and postal-surgical phase, banality the stamping of the phases is substantially stronger, than with a conventional operation. With the Hybrid-operation room the main attention on all three phases lies equally and this changes the operation process decisively. Interventions in hybrid-operation theaters is teamwork and in the intervention room, as well as in the controlling room medicine-technical employees accompany the process. The surgeon is a part of the team. The production costs of the Hybrid-operation room are substantially higher than those of a conventional operation theater.

Decisively for the different costs of both operation rooms are on the one hand the involved people as well as the substantially higher capital costs, as well as the whole infrastructure of a

Hybrid-operation rooms. The different operation models cannot be compared simply so. The most essential differences exist in the operation management and the personnel and organizational signs caused thereby. While a customary conventional operation room can be structured partly rather small and simply, a functioning hybrid-operation theater needs according to intervention main focus at least 70m2 to 100m2. The complexity continues by the management and control of the operation room, the operation management is indispensable for a hybrid-operation.

A MIGTR, multifunctional therapy room has a size from approx. 120m2 and needs like a Hybrid-operation room numerous next rooms, such as a controlling room, technology room etc. to a conventional operation room are absent. The difference between a MIGTR and a hybrid-operation room is the arrangement of the operation room and the operation functions accommodated in the operation room. The process of a hybrid-operation is still very similar of a conventional intervention and is led also by a surgeon responsible for head. The expiry in a MIGTR is process oriented and team oriented and, hence, differs basically from the process of a Hybrid-operation room.

A team from surgeons and specialists carries out together the interventions in a MIGTR, aim is to carry out all operations in the patient in an appointment. This is a paradigm change. While in a conventional operation room and Hybrid Operation room a clear top down hierarchy (the whole power of decision lies with the responsible surgeon) excists, are these structures oriented to process with the MIGTR and the surgeons of different disciplines work together in the team and compile together a whole solution. No other operations come up in the ideal case to the patient, Controlling and follow-operations are cancelled. Hence, such an operation process in a MIGTR is at first costly and, hence, costlier. It is a matter of examining, when and for which model and from which dimension a MIGTR is possible.

The education of cluster has tradition in the hospital. The education of a COR is already the first step in the direction of cluster education. The room clusters are divided in support of DIN13080 and are valued. A cluster exists like a grape from different surgical functional units and should substitute for the conventional Central Operation Room. With the education of an operation cluster one tries to bundle up the functions of the same rooms for economic and organizational reasons. Organizationally the education of a cluster shows a change from oriented to function to expiries oriented to process.

2.5. Structures Oriented to Process

The advantage of expiries oriented processes is not often slightly noticeable superficially. The complexity of the expiries in the hospitals has risen steadily. Once easy sequences and connections have become costlier and costlier and more complicated. Once manageable hospitals have grown from year to year. The technical progress brought not only many innovations with itself, but also new coherence. This integration has led to the fact that the hospital structures are complicated and blind. Today most hospitals are led centrally steered instead of decentralized. The right moment was overlooked to move the structure of the houses.

The today's arrangement oriented to function of the hospital, is based on the functional specialization of the doctors and the arrangement of the fields of the hospitals. A stick place oriented to process would originate from the installation of a patient's representative which breaks open the stiff functional specialization of the departments. Patients would thereby have only one contact and all measures, like operations, treatments would be co-ordinated by the patient's representative and would be steered. The prioritization of the function by the specialized divisions would be broken through.

The next step could be a cooperation from case to case of experts of different disciplines which forms a process team from functional specialists. These are partially already used in hospitals. With special cases this has already paid off. The patient gets a comprehensive medical treatment. The more measures are taken the functional order of the medical fields to break through and to substitute by means of process structures, the more the patient and his healing moves in the centre.

A matrix model originates from the education of a process main focus as well as by the reinforced cooperation of different experts. This mixing model leads from case to case to the cooperation of functional and process specified organization units. The organization of the hospital is divided in specialized divisions. Nevertheless, the processes are patient oriented and treatment oriented, which is why it comes to big transfer and transport achievements. Many advantages would be thereby visible for both sides. A universal result orientation as well as a high degree of action orientation and action security would exist. The cooperation of the acting people by the strong support of the interdisciplinary would be improved. Furthermore many problems would become distraught, which determine today the everyday life between the acting people in the hospital.

The Case management, functional and process-specified organization units, organizations with access to functional stick places lead at times to the cooperation of experts of different fields. This hospital will be more process than function oriented. The improvisation was strongly lowered; Guide-Lines SOP (standard operation procedures) determine the process.

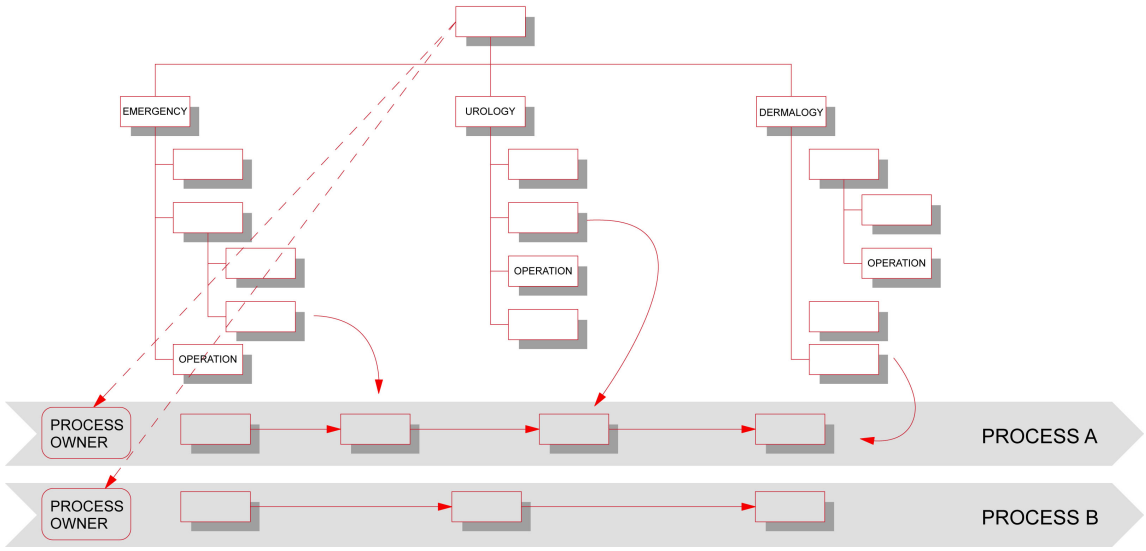


Illustration 13: Combination of division and process structure in hospital beeing
This representation shows the model of an integration of a process model in a functional model. The process is steered by a process owner responsibly. The existing departments send suitable medical staff around the process (A to allow B). (Spring: Own representation in support in: Dahlgaard K., Tratmeyer P., Kooperatives Prozessmanagement im Krankenhaus: Optimierte Zusammenarbeit zwischen Arztedienst und Pflege nützt Qualität und Effizienz. Prozessorganisation. Luchterhand, Band 2, 2006, page 58)

A consolidation one in the time course and about all suppliers to stable high class levels determines the process expiry. An increase of the transparency and with it a comparability would lift the security of treatment. This coordination for comprehensive therapy processes with case wise consultation of professional experts leads finally OR to a comprehensive OR process. A strong reduction of the interfaces has taken place what brings an increase of the vote quality in itself again. This does not mean above all a high-class increase by reduction of the friction losses and communication expenditure as well as by lowering to value scooping activities. This is taxed away in time profit and quality of treatment and comes to the patient, staff as well as the medical progress and the budget too good ones. The self steering structures operate adapt ably and promote at the same time the dismantling of efficiency-restraining top down structures.

Resources are used by such structures more precisely and are applied more aim oriented, this lowers the costs and raises the efficiency of the hospital. Hence, in general can be assumed from the fact that treatments oriented to process more efficiently, cheaper, with less losses, (friction losses and communication losses) as well as are more aim oriented. It contains a higher quality for treated, as well as trading people. It comes for an optimization of the application of the resources and finances what lowers the time of treatment and the medical costs. The realization of hospitals and with it operations they are structured process-oriented, means not only a rebuilding of the management and the management structure of the house, but it also means, the infrastructural changes and rebuilding are to be given urgently around this organization principle to the necessary frames. A reorganization and restructuring of the hospital is to be stopped urgently around the today's development of the steadily rising costs and to increase the partly falling quality.

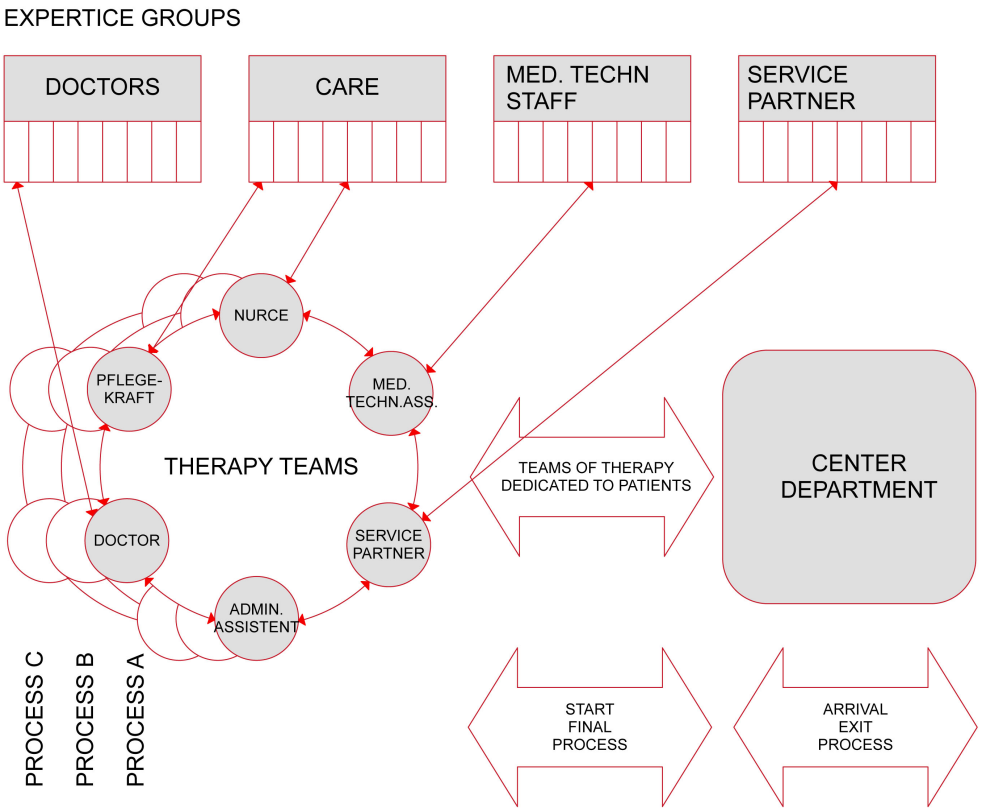


Illustration 14: Model process oriented treatment

The picture shows the expiries of a beginning of treatment oriented to process in a hospital. Responsibility and responsibility transference as a key to the success. Obliging process standards as a base of the responsibility. (Spring: Own representation in support in: Dahlgaard K., Tratmeyer P., Kooperatives Prozessmanagement im Krankenhaus: Optimierte Zusammenarbeit zwischen Arztedienst und Pflege nützt Qualität und Effizienz. Prozessorganisation. Luchterhand, Band 2, 2006, page 58)

To form these shown possibilities around interventions surgical on the one hand in a hospital more efficiently and more effectively and to work, on the other hand, more aim-oriented on the patient and to reduce the physical load, succeeds on the one hand only by available resources and a perfect re-orientation. However, at the same time this is hardly conceivable beyond a hospital, because the personnel and financial expenditures have grown largely and the projection in the trust that hospitals are the places in which operations take place already historically.

The health market is in the layout and will new form. Outpatient clinics and new hospital forms will originate and remove old forms partially. Partially these new models are not at all new and already exist in a form as a part of the hospital as a clinic. By the originating privatization and growing competition under the houses, must be won over around patients. Locations will only continue in the long term if the economic survival is protected. Today all hospitals are generalists, there is a legal care duty, and all achievements are offered independently as economically this achievement is.

An economic efficiency check of the medical achievements takes place till this day, in the rarest cases, in the necessary depth. Without Controlling no hospital will be able to exist in future. The care order the houses today will have to fulfill in future are lost and only to certain houses are preserved. To be able to exist in the market, the hospital management must know exactly above the costs and achievements and is aimed at "her" customers. Free enterprise methods and tools come to the use.

Till this day it is decided by the health insurance schemes over the heads of the patients away and although the patient is carrier of achievement, he has no options. Also here a paradigm change takes place, this will change. The patients become customers, it will become possible to choose the suitable underwriter accordingly of his lines.

The underwriters will differ by her achievements. The market gets in movement and the patient will profit. For the achievement suppliers health insurance schemes and hospitals mean this one big change, because the customers will weigh the offered achievements and compare.

Today his patients are sure to a health insurance scheme and a hospital relatively if the structure is liberalized, one must take care of every patient. The Internet will help with a choice of the "right" hospital, ranking lists and positive negative assessments are led.

Patients do not flow out any more as today by chance in a hospital, but these become level-cash dimensions. These developments entail that the houses will concentrate upon her "skill" that core competences become conscious, as well as that then the development of core competences is central.

The question after the core competence becomes in future of the rotary hinge of any planning for the health service, the hospital being become. Hospitals in search of the essentials and the unique to differ from the competitors and to have thereby a competitive advantage.

The core competence is in times of the Outsourcings and the diversification strategies a popular catchword and hangs together quite strongly with the quality of resources and, hence, is the lifeline of an enterprise. With the core competences it concerns exclusively around human know-how and with it to people engaged qualities. These belong cultivated, developed, to the environment are tied together conformist and over and over again with new strategies the values of all linked up partners creates.

The possibility to carry out operations is without every doubt the core business and with it to the core competence of a hospital. These values must be built up and be maintained - there originates a brand with contents. However, all this depends on the available competence of the house. Enterprises protect her competitiveness by product innovations in line with market requirements. This can be developments of treatment or operation technologies. To differ from the competitor, however, these signs must have a "copy protection". If the qualities are slightly imitate able, the achievement will not develop to a core competence, because the uniqueness is absent. In the centre the medical achievements will stand, the service will still win in the hospital being strongly in meaning and complete the offer. The service in the hospital being will still win strongly in meaning and then the experience with complicated technical expiries or good surgeons or technical equipment is perceived to the competence and from the customer also as those. If this change is transported outwardly and is of high quality, it will contribute to the fact that the positioning of the house gets an individual character which contributes to the fact that the house in the market can assert itself.

The changed process of a hospital being, or of an operation process, the improvement of the quality, the reduction of the costs and the load for the patient as well as the changed offer competitive advantages create. Core processes take in case of rearrangement, reorganization

and a reorientation of the hospitals a central role. In this case the process of the diagnostics, the treatment and care becomes by a team, compound consisting of different professional guilds. The advantage of the treatment and care by a team expresses itself by the harmonization of the standards of treatment and nursing standard. The action is tuned extensively in the team and follows the default of treatment. Patients are loaded less and ad hoc decisions are avoided extensively. Doctors and orderlies are informed widely equally well and balanced informatively.

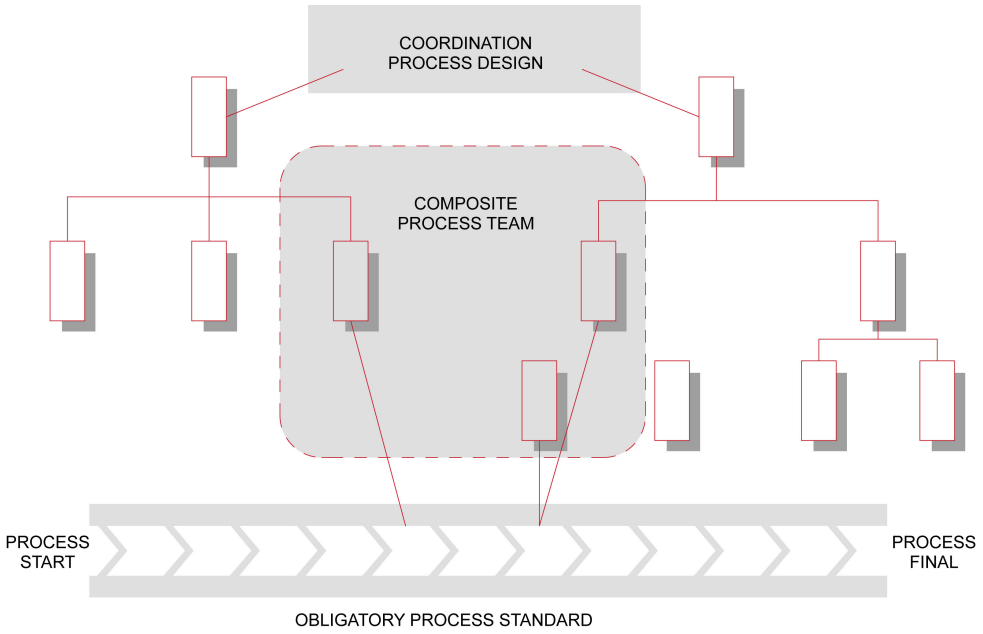


Illustration 15: Process team organization
The picture shows the treatment of a patient by a process-oriented team whose education and vote a part of the process architecture of the hospital is formed as model. (Spring: Own representation in support in: Dahlgaard K., Tratmeyer P., Kooperatives Prozessmanagement im Krankenhaus: Optimierte Zusammenarbeit zwischen Arztedienst und Pflege nützt Qualität und Effizienz. Prozessorganisation. Luchterhand, Band 2, 2006, page 58)

The standardization and education of clearances are necessary sides of an organization oriented to process. The whole process of the admission up to the dismissal is predefined. A large part of the care process of a hospital is level-cash and, hence, taxable.

Approximately 80% of all actions follow a predefined routine expiry, from remaining 20%

- if a part considerably deviates
- if a part deviates only slightly and returns later to the routine expiry
- If a part must be taken during the treatment on the basis of complications by the routine expiry.

The listing shows the shares of the routine and non-routine Actions (German hospital society „to count, data, facts“, in 2005)

For highly specified facilities and for structures like the hospital being, a hybrid form is recommended. This should protect the pool of know-how and the available resources and guarantee, however, the area-covering and intergroup cooperation in the teams with patients.

Hence, on process base there are originate competence centre’s, the former medical departments and autonomous teams directly on the patient work and are composed individually according to demand.

3. General Operation Systems

At the moment in Austria different operation systems hardly exist, this is primarily due to the fact that the regulation is too strong by the legal vote and the competition is absent. According to hospital operator it comes with the operation intervention and the contact with the patient only to slight differences. This standardization of the processes is based on the fact that the interventions are strongly adjusted and are described by Guide-Lines, SOP (standard operation Procedure). Another reason for the uniform operation-Procedure is that the interventions are described by their financial payment by the LKF system, competitive hospital financing indirectly. Deviationism creates unpaid achievements and damages the already difficult financial situation. While the operation process is structured and is given, the processes are hardly defined before and after the operation.

The area operation is traditionally a very autonomous and self operating area in the hospital. Operation processes are structured hierarchically and organized and follow exact definitions and Guide-Lines, SOPs, directives, etc. according to field are divided operation systems. Thus we make a distinction in cardiology, neurosurgery, casualty surgery, orthopedics, casualty surgery, etc. The operations (interventions) of different fields have different expiries and sequences. This entails that as a rule the operation area is the most cost intensive area of the hospital and belongs to the core competence of the hospital, which is why he is for the hospital of immense significance. The establishment costs, as well as the operating expenses are higher than of every other department of the hospital. The income by the operation theater is the economic base for the hospital. The number of the interventions stands in a directly proportional connection with the income of the house and, hence, shows an essential source of

income. (Spring: Pfeiffer Peter, Professional MBA Health Care Management, Finanzierung von Gesundheitsorganisationen, Vienna 2009, page 44-45)

At the same time operation rooms contribute to the image of the hospital and, hence, are also an important advertising media what can have, however, also negative results. With a “non-success“ of an operation, the look of the patient is focused exclusively on the intervention, the hospital runs the risk in such a way to be reduced to this achievement. This shows which meaning and value the operation for the hospital takes and how subjective the perception is from the point of view of the patient.

By changes in the market it will come necessarily also to a competition of the hospitals together. The essential achievements are confronted and compared. The hospital and especially the surgeons will get in a diminished competition in which the core competences are compared and valued. Which house has at disposal the best and newest equipment in and around the operation theater which surgeons are occupied and which references are given, will be judged. What does not state as a rule a lot about the medical quality as a whole? (Spring: Neumann Heinz, Professional MBA Health Care Management, Strukturen des österreichischen Gesundheitswesens, Vienna 2008, page 64)

The economic pressure makes the hospitals in future more efficiently and operate more economically. The cost-intensive operation area exists particularly of many and high cost components which it is a matter to optimize. These are in the essentials organizational sequences, before and after the intervention. The conventional intervention has arrived on the border of the optimization. Improve the OR organization and the hospital management which administers the company of the operations as well as the financial component, gets involved and expenses-sided. The problems can be looked of course not in isolation and they do not begin only at the operation table. They are system-immanent and, hence, it requires comprehensively attempts and solutions. Hence, there may be with the conversion of the reforms also no taboos. The focus will be steered on the core competence and one will have to call himself in the consciousness that there are competing hospitals with a similar achievement offer.

It becomes from economic view unavoidably to examine the actual situation in the operation room and to optimize available processes and expiries. To understand the whole problems in and in order the operation, all parameters have to go like processes to call process duration, rhythms and cycles only around some, looked and questions become. Besides, above all the

creation of the operation processes and their aims shall be looked. The surgery is a medical discipline which goes out from the view principle. Clarifications in the approach take place above all by X-ray examination and blood counts etc. But the most essential "findings" are the insight while opening the body by the surgeon. This has historical reasons and today could be used, however, differently. To the surgeon it was to be got in the past only after opening the body, on exposing the affected place possibly, an exact diagnosis and an overview about the situation and size of the measure. However, this also means that one has forged ahead from an operation to the next. Several operations approached as a rule the patient and not seldom there was for the end still a control-operation. New technical possibilities, today to all at the head of the computer-assisted systems in combination with already known representation possibilities like CT, MRG, ultrasound etc. enable to show 3-dimensional, individual spirited representations of the inside of the patient. (Spring: Ebner Heinz, Professional MBA Health Care Management, Management der Kernaufgaben, Vienna 2008, page 39)

The patient can be examined thus for his personal specific features and be measured. Thereby it is to be prepared possibly exact operation plans and the intervention before he takes place by shut which allow a minimum of interventions and a maximum in precision. The surgeon falls back during the operation on this preliminary planning and, besides, the medical-technical employees support him by means of the EDP. (Spring: Walther T. Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, 15.01.2010)

Fact is that already in the preliminary planning all knowledge about situation, size and extent of the measures etc. is announced. It is not brought only while opening the body in experience which individual personal peculiarities the patient has, but already by the representations of the pre surgical phase. The doctor can thereby plan quite differently and operate. It is possible to examine several interventions all at once, to plan and to move. A change of the operation processes is the condition to use such new technical possibilities. The pre-surgical phase wins in weight and serves the operation preparation by illustration and measurement of the patient around during the operation to grant navigation in the patient. These are totally new possibilities and were not available to the doctors up to now. On the possibilities and results of such operation technologies, on the operation process and the architecture should be entered later.

(Spring: Amelung Volker, Professional MBA Health Care Management, Internationale Systemvergleiche im Gesundheitswesen, Vienna 2008, page 61)

3.1. Financing of Operations

The cost concept ruling in the business management corresponds to the cost concept decreasing on narrow brook related to value. Then the costs are the valued consumption of goods and services for the production and the sales of operational achievements and the maintenance of the capacities necessary for it. (Spring: Diez K., Ein prozessorientiertes Modell zur Verrechnung von Faclity Management Kosten am Beispiel der Funktionsstelle Operationsbereich im Krankenhaus, Universitätsverlag Karlsruhe, 2009, page 18 para. 2.3.2) The economic component of the operation theater is reflected in Austria in the system LKF, "the competitive hospital financing" (LKF points), after in the hospital the produced achievements are settled. Hence, the financing of the operations, costs as a yield, takes place in the essentials by the LKF system. Besides, the costs of the measures are satisfied afterwards financially. The hospital finances the achievements by means of loans before. The loan costs are led as a cost position and are born by the system. The hospitals must deliver to an advance planning on the basis of the statistics to the country and apply for a number of LKF points. It is a matter this to reach then next calendar year. The system LKF makes a distinction in surgical and nursing achievements. For the produced achievements LKF points are collected and satisfied the next year. The accumulated points are exchanged at the end of a management period for cash money by the government (Spring: Pfeiffer Peter, Professional MBA Health Care Management, Finanzierung von Gesundheitsorganisationen, Vienna 2009, page 35). However, the politics has during an achievement period the chance to depreciate the value of the LKF points on or off what also happens as a rule. As a rule devaluation takes place, which is why the run on the points is big. The result is that the calculations and preliminary planning of the hospitals are not right, deficits originate and the produced achievement becomes less and less a value. This entails that every hospital collects more than estimates, virtually as a precaution because is calculated, so to speak, in advance on the fact that the points will suffer a value loss. (budget forecast to end of year) This behavior lowers the value of the LKF points further. (Spring: Heinisch Michael, Professional MBA Health Care Management, Controlling in Gesundheitsorganisationen, Vienna 2009, page 101) Thus seen this system has failed, because the advance planning is not right, the account is not right, the exchange value is not right and the accumulated LKF points do not agree with the really produced achievement. The costs stand in no connection with the produced achievement; runaway costs in the health service are the result. This situation makes difficult to show the true costs of single positions and stations clear and realistically and to grasp exact data.

3.2. Operation Room Costs

One understands by an operation an independent medical, therapeutic or diagnostic intervention in a patient in the operation room or under operation terms.“ (Spring: Keun F., Prott R., Einführung in die Krankenhaus-Kostenrechnung: Anpassung an neue Rahmenbedingen, 63 überarbeitete Auflage, Wiesbaden, Gabler Verlag, 2006, page 200) in the OP room the before diagnosed damages and illnesses of the patients are treated so far this cannot be removed by other medical means. (Spring: Neufert P. and C, Neff L., Franken C., Bauentwurfslehre, 37. Erweiterte und überarbeitete Auflage August 2002, Vieweg und Sohn Verlag, Wiesbaden 2002, page 572) All measures of an intervention are encoded and are based on the Dutch version of the Internationally Classification of Procedures in Medicine (ICMP)

The linking of the Facility management processes with the primary processes in the hospital forms furthermore the basis for a future-oriented strategically building planning. (Spring: Diez K., Ein prozessorientiertes Modell zur Verrechnung von Faclity Management Kosten am Beispiel der Funktionsstelle Operationsbereich im Krankenhaus, Universitätsverlag Karlsruhe, 2009, page 172) To grasp the costs of an operation the commercial process, the operation, in his part achievements and cost positions must be broken open. Therefore, the operation exists of two main cases, the real intervention and the anesthesia. These main cases can be divided in three phases: In the preparatory phase, in the phase of the intervention and the evaluation phase. Finally, all main cases are broken open in part processes and, finally, in actions. Basically one believes to know what costs are. In case of closer consideration the thing is not so easy at all. The concept costs always needs a suitable context. Thus there are among experts absolutely discussions about what is to be understood exactly by the concept "Costs". Today no hospital is to be defined in the situation the actual costs of the house and the stations. Till this day cost control and expense account hardly takes place in the health service. One does not know above the actual costs in the health service. (Spring: Bogensberger Stefan, Professional MBA Health Care Management, Finanz- und Rechnungswesen 2 - Skript, Vienna 2008, page 4)

The problem that the costs of medical measures are unknown has in the health service in Austria tradition, and has grown historically. The budget basis is the camera cunning broads financing system which is a completely outdated procedure to the accountancy. The missing competition in the Austrian health service strengthens the tense financial situation. It was not to be gained control up to now urgently the costs and to determine the true costs of the com-

pany, because the political authorities have always taken over, year after year, the costs. The deficits are covered every year by the state and the country, all the same how economically the hospital really worked, controls are absent. The duties of the expense account and achievement calculation are not prescribed legally or are regulated. In addition, an expense account is not prescribed legally, hence, it will leave the hospital operator as exactly and precisely they handle with the management of the finances provided to you.

For the surgical day business and with it for the economic success of the hospital it is essential to know the costs and the income by the operation company. The costs for the company of the operations consists of different cost category groups and to optimize this it is necessary to plan the allocation of the OR rooms well and to prepare.

Listing of the cost category groups for operation rooms

(spring: DECAGRAM in 2007)

- personnel expenditure (doctors, care, med. tech. service)
- material costs medicament
- material costs grafts implants
- material costs med. need
- staff material costs med. infrastructure
- staff material costs not med. infrastructure

The composition of the costs of the cost groups contains different problems, because they are composed from different cost shares and cost data. Some these costs are not only on a single operation, like the use of once-gloves, put down cash. It is a matter of keeping an eye on the essential positions and on cost factors and of reducing by improved processes. E.g., the costs are relevant for the aerial processing which takes place of the cleaning /re- installing of the operation theater between the single interventions as well as the proportionate production costs of the rooms. To be able to reduce and to recognize the cost factors and to be able to reduce must be made visible as the costs consist and how they hang together. A concealed cost factor is e.g. „not optimized use“ of the operation theaters. By failures of the interventions which come about of part by delays operation costs result, without income faces. But also by the not level-according banked time involved of an intervention additional costs result. By

temporal covering by interventions failures of subsequent interventions are no rarity and relevant for costs.

The costs for the cleaning consist of the costs for the cleansing measure (approx. 25% of the total expenses), from the costs for the supply and as costs for the general cleaning, but also by the opportunity costs.

The time to the cleaning and preparation of an operation between two interventions puts also a big economic expense factor there. The costs for the cleaning sit down from the costs for the cleansing measure approx. 25% of the total expenses, but also by the ostensible loss because the room unused remains. Like the costs of opportunity[5], these costs must be included. Because the time for the cleaning and preparation nearly 50% of the operation duration of the operation rooms takes up, a huge optimization potential exists here.

The operation costs of the operation day company are high. These consist of operating expenses and costs of the intervention. The sum of the costs should be covered by the LKF system. This is not the case when in isolated cases the complications are so big that the duration as well as the expenditure sprinkles the frame. In this case the hospital on the difference stays down. Because these isolated cases are, these differences are included proportionately in the costs. Hence, the phases offer more saving potential between the operations and the time of the care.

The operation costs of the operation day company are high. These consist of operating expenses and costs of the intervention. The sum of the costs should be covered by the LKF system. This is not the case when in isolated cases the complications are so big that the duration as well as the expenditure the frames sprinkle in this case the hospital on the difference stays down. Because these isolated cases are, these differences are included proportionately in the costs. With the help of the graphics "LKF-Points" becomes clear that the intervention is paid in comparison to the care substantially higher, although the care is more time-consuming. To optimize existing operation processes, hence, tells to tune the operation processes better on each other. By available guide Lines and SOP is the potential to optimize an intervention, slightly. It can be optimized with the existing operation methods hardly more.

[5] cost of opportunity (renunciation costs or shadow price) one understands escaped proceeds which originate from the fact that available possibilities for the use are not perceived by resources. (Wikipedia, in 2011)

The operation processes are already optimized in themselves and hardly order more of elbowroom expiries to vote better. The phases between the interventions and the time of the care offer more saving potential. Unless, the operation processes do not run optimally what is as a rule the case. At the moment though most operation interventions are given by SOP, but by bad coordination and missing workflows before and after the intervention, by are absent from whole workflows.

Operation interventions can be well systematized and defined by given workflows. The responsible surgeons cannot fancy this often yet. There becomes most with the dignity of the person, argues with ethics and morality. The worry that the surgeon neglects to the production line worker exists. This will be one of the reasons, why the reforms start so timidly. The large parts of all interventions are standard interventions and can be steered with it in given roads. The processes all around the operation are well a plan and calculably and with it the costs are formable. An optimization of the processes lowers the costs and creates room for new possibilities.

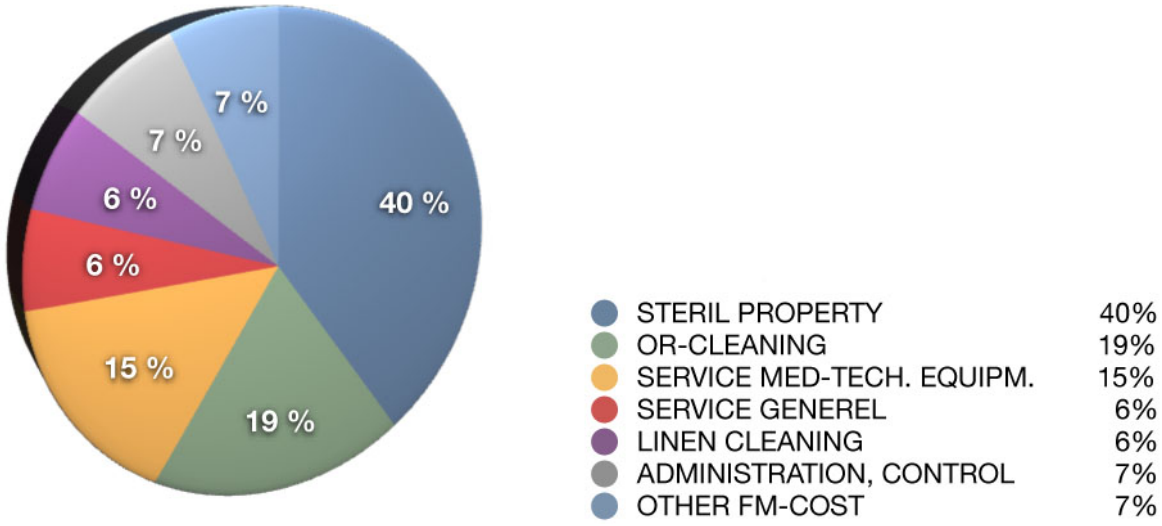


Illustration 16: FM Product shares for the OR
The picture shows the composition of the FM costs for the operation area. Is striking, that the costs (Spring: Diez Karin, Ein prozessorientiertes Modell zur Verrechnung von Faclity Management Kosten am Beispiel der Funktionsstelle Operationsbereich im Krankenhaus In 2009, page 134)

So that an economic success originates, the hospital bearer must know above the actual costs in the hospital. Just in the sensitive high price segment like the operation area it is of great importance to know the value of every position and every achievement by an exact cost pursuit. Really this is not the case. - Economic results are annual payment problems and finance

problems of all hospitals. Comes that the costs are not same for the same intervention for the different hospitals.

This is due to the fact that it exist differences by existing buildings, operating expenses etc. This cost portion can become high in such a way, that the one and same intervention for which a hospital a success explains, while to be successful another hospital these fixed costs not mastered. Then the fixed costs are the cost factors.

HOSPITAL	1	2	3	4
FM-cost function	fKH1(t)=0,19*t +19,22 +5,5*18,75	fKH2(t)=0,23*t +12,84 +5,5*23,60	fKH3(t)=0,42*t +33,46 +5,5*60,99	fKH4(t)=0,18*t +23,39 +5,5*33,16
medial OR total time in min.	**156**	158	207	222
number of realized OR	**388**	153	111	56
cost per OR Hip-TEP in EUR.	**151,50**	179,13	455,21	244,96
% part classification of procedure in DRG 148Z	73	67	16	5
InEK-proceeds 148Z (85%) OR division in EUR.	188,53	188,53	188,53	188,53
profit/ loss in EUR.	**+37,03**	+9,40	-266,68	-56,43
% part classification of procedure in DRG 105Z	10	28	52	38
InEK-proceeds 105Z (85%) OR division in EUR.	249,14	249,14	249,14	249,14
profit/ loss in EUR.	**+97,63**	+70,01	-206,07	+4,18

Illustration 17: Cost comparison operation Hip-TEP

The table compares four different hospitals of different size and problems. The hospital 1 has well appeared to the hip-operation and carries out this as a matter of routine in 156 min. The hospital gains for one hip-operation 97,63-during the hospital 3 by bad planning's thereby gains too much infrastructure with itself drags and cannot make up for these fixed costs with the low number in hip-operations. It is striking that the costs for one hip-operation are 3 times higher in this hospital. (Spring: Diez Karin, Ein prozessorientiertes Modell zur Verrechnung von Faclity Management Kosten am Beispiel der Funktionsstelle Operationsbereich im Krankenhaus In 2009, page 145)

A study of Diez Karin in 2009 shows that the same hip-operation causes different costs in four different hospitals and can yield for one hospital profits and cause for another losses. The hospital 1 performs most hip-operations; this creates in the best times and gains the highest profit per intervention of 97.63 EUR during the hospital 4 only one profit of 4.18 EUR per intervention gained. (Hospital 3 is a special case because the construction of too many operation rooms has fought negatively to beech. - Some operation rooms stand empty and cause costs, no income, these is responsible for the fat deficit of-206,07 EUR.) This very impressive confrontation shows the connections between routine and costs, time and profit. The hospital management is also demanded to tune the required infrastructure precisely to the market in which the respective hospital is. With sinking routine there rise the intervention times, the costs and the profits rise sink.

Hospitals finance themselves about the surgical interventions and measures, as well as about the care of patients. While the operation interventions are strongly adjusted by the SOP time wise and in the expiry and are given, variability sticks to the nursing achievements against it up to a certain magnitude. This is individual partly and dependent on person. The nursing achievements are thereby seldom really gainful, but are cost-covering in the most favorable case. Hospitals should act like every other company profit-oriented and plan. To fulfill this is difficult because the legal basic conditions speak against it. Today thus one is glad as a rule in to create no much too big deficits. (Spring: Heinisch Michael, Professional MBA Health Care Management, Controlling in Gesundheitsorganisationen, Vienna 2009, page 69)

Both financial pivot legs of the hospital, surgical interventions and nursing achievement are to be looked differently. While the surgical interventions are well calculable, the care with a rest risk is afflicted. That is also that the financial application of the means, the staff and the infrastructure of the surgical interventions and the care are to be valued very differently. While one operation last very briefly, but have a high expense factor with regard to staff and infrastructure, this has turned back with the care.

In other cases this relation is different between the expenditures of the intervention and the care again. Generally the care forms lower costs for the infrastructure, this for it, however, for one in the comparison, substantially longer period. While an operation lasts on average 1-2 hours, the care needs 4 - 8,8 days, or during hours 96 - 211 hours. This is a factor of 100 - 200 fields, from partly differences of 300-fold exist. The system LKF, in Germany DKG, values the intervention and the care for the operator virtually immediately. This means the hospital gets for an intervention the sum X and for the care of this intervention for the required nursing days the sum XY. (Spring: Heinisch Michael, Professional MBA Health Care Management, Controlling in Gesundheitsorganisationen, Vienna 2009, page 102)

While the costs are well level-cash for the surgical measures and calculable, the nursing achievements contain variables them the costs raise and reduce the profits.

To lower the risks in the care, must be preplanned more precisely, the operations must be tuned more precisely and more individually to the patient. In addition more data of the patient must be available before the intervention. Individual specific features, like exact situation of the organ, the vessel must be clarified etc. before the intervention, be measured and be determined. Thereby one is not able only while opening the body to get an exact overview as this

is the case, but already before the measure in the classical surgery. Thus cut seam times can be reduced and the magnitude of the intervention strongly be limited. Perhaps, necessary means and people, or implants and medicaments, can be provided or be produced even individually by which the load of the intervention is reduced.

The next nursing expenditure sinks. If by an exact preliminary planning the opening lets itself avoid large parts of the body, like the chest, the patient can be dismissed as a rule 2-3 days later. For the cost unit controlling this means that the costs of all cost group kinds can be reduced. This lowering of the nursing expenditure lowers at the same time the costs for the management and the infrastructure, as well as the overhead costs which aliquot in deduction are to be brought. As a result of observed shortening of the nursing times of the patient results in a reinforced bed dismantling and an increase of the competition under the hospitals. (Spring: Bogensberger Stefan, Professional MBA Health Care Management, Finanz- und Rechnungswesen 2 - Skript, Vienna 2008, page 27)

To understand the cost positions and to know in detail is the condition to be able to steer able to steer the company and to be able to steer (Bogensberger S.) is to be able to steer .Therefore the expense account tools for the hospital management to guide the house and just in the high price segment like the operation incessantly to keep the cost situation under control. The more it is surprised that modern management methods are used only for few years in the health service. The complexity of the processes in the hospital as well as the fact that these are many single services entail that many expense factors remain in secrecy, e.g., filling of patient's curve, to the possession position of guests toilets etc.

To show this and to make visible, is also a condition for changes. The costs and her height initiate the consciousness for the change. The hospital costs and with it the operation costs, become in Austria, as already mentioned, satisfied by means of the LKF system. Besides, it concerns a point system. Every intervention is compensated with points and the next care also. The points intended for lists of illnesses and interventions. It consciously shows an uncoupling between medical achievement and monetary payment. The management tries hard so many points to write as possible. In addition not only legal ways are also walked. With the consciousness, to create a good medical achievement, this has nothing more to do.

The camera cunning broads financing system aggravates the "run" after the points, the level must be reached, otherwise the estimated points are shortened and posts must be stroked.

Hence, the point collecting is central as a process optimization, because the points are given for the process. The feedbacks that with activities make loads of the taxpayer too many points are estimated will be rather rare, because the hospital managers would damage themselves with it themselves. On the contrary, it is tried to approach in the points of this treatment. Intensive treatments are defined so and get a surcharge in points for the additional expenditure. There are calculated furthermore, according to intervention, a number of days of treatment. If these are used, the other surcharge is declining and has subsided one day. The hospital management must calculate on the basis of the statistics and demand analyses and requirements analysis. It is planned in advance by means of the statistics. The statistics gives the figures of the measures, which means variations are natural and normal.

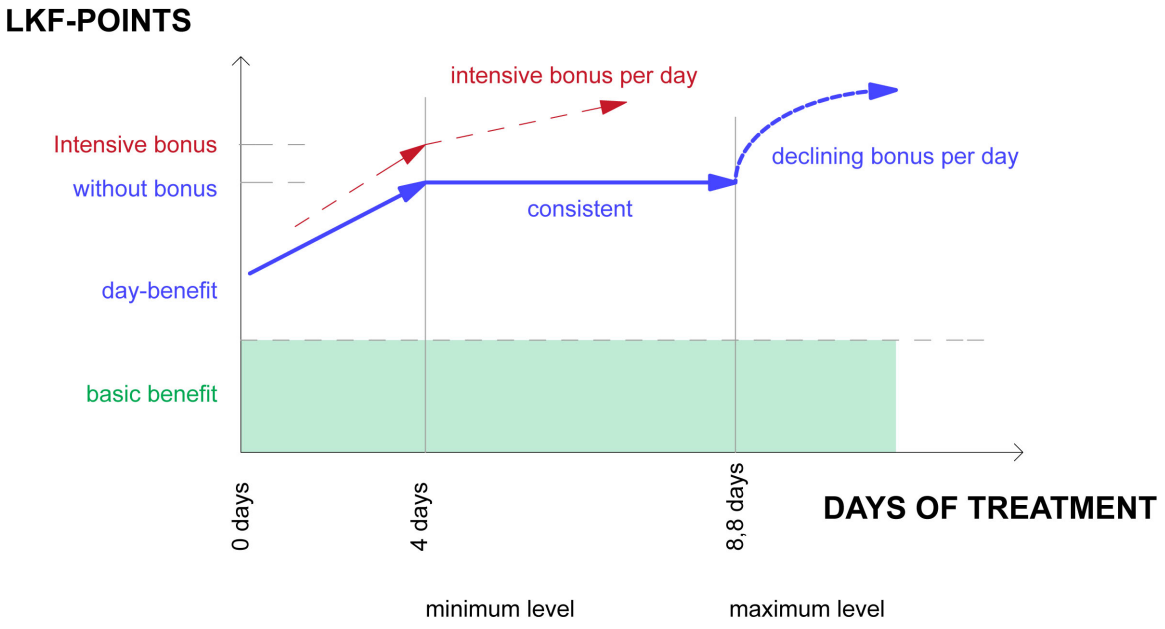


Illustration 18: LKF-system
The graphics show the methodology of point system LKF. This system was introduced in 1997 after the test in Vorarlberg and Lower Austria and should lower the steadily rising costs of the hospitals. (Spring: Pfeiffer Peter, Professional MBA Health Care Management, Finanzierung von Gesundheitsorganisationen, Vienna 2009, page 45)

As a result the point need is applied with the government, it is a matter this to reach, otherwise the income is not right. If one performs more, however, this presses the change of the points. Then the points lose increasingly to value, the more about the calculated achievement is performed. Because this is quite usual ones, it is calculated with a loss which is a result that more points are collected than planned. Mark Since 1997 the so-called competitive hospital

financing (LKF) in Austria is valid. I.e., hospitals subtract after a point system with which according to kind of the produced achievement a different number sucked. Achievement products it can be subtracted. All together a certain limited whole budget exists possibly for Vienna. This is put down with the final account on the total number of the achievement points produced by the Viennese hospitals. The actual value of an achievement point arises therefore only in each case at the end of a financial year ORF on-line (2001).

Hence, the finance country advice lowers every year, the value of the LKF points. The produced achievement of the hospitals always becomes less worth, which is why the hospitals collect more points than estimates what lower the value again. The system has got out of control and undermines itself. The payment of the interventions and the assessment of the LKF points is checked regularly and corrected. These are centralistic ally steered methods and have nothing to do with a free market economy. No incentive system is medically good to work and to act economically properly but to get for it a system that is over to define achievements so possibly many points. The creativity is promoted to reach achievements. The LKF system is to be produced no incentive system good medical achievements and to act economically responsibly. The system defines points for achievements and uncouples this from the actual achievement. It promotes rather the creativity possibly many points for less achievement to get hold. Hence, the settlement system LKF does not consider the saving potential, creates no incentive to minimize costs and does not promote the business-medical creativity. For the land politician these are tools of political influencing control and hold the influence of the land politicians in the hospitals straight. The achievement component is a fixed size according to illness, the day component increases during four days and shows with it a real taking. The reimbursement of the costs of the intervention puts out as a rule approx. 50% of the total receipts to the restoration of the health.

If the operation has occurred extremely successfully and carefully, the patient can quickly leave the hospital (optimum would be after 4 days). The points for the operation and for the maximum nursing expenditure are totally satisfied. The more successfully the operation runs, the more the hospital earns, indeed, the profits are capped and the incentive is limited. (Spring: Pfeiffer Peter, Professional MBA Health Care Management, Finanzierung von Gesundheitsorganisationen, Vienna 2009, page 44)

This kind of profits is the only possibility for a hospital in Austria at the moment to be successful on business and economically. The scope of action is extremely low and limits itself to

the manipulation and creativity with the collecting of the points. Indeed, these operational profits in truth are economical losses, because the achievement expiries pass everybody at high level, far away of every competition and partly with huge financial losses. It comes within the hospital to across subsidizations. However, without this financial support of a company loss it will also not go in future. Hence, a whole optimization of the processes and processes must take place by process Optimization measures. Furthermore the market must open and be free. In addition, it is unavoidable to check the situation of the locations of the hospitals and to come to an agreement strategically. The competition thought and double tracked is still absent in this country and is nothing unusual.

3.3. Operation Room Management

The operation management describes the process in and around the operation room. This does not begin only with the reservation of an operation room for an intervention, but with the supply of the operation rooms. The Facility management has to provide the job the operation rooms for the day company and to wait the operation rooms technically, medically as well as hygienically and to look. The basic problem is that the processes and sequences are not planned in the hospital for the various specialized divisions till this day, also affects with the operation management.

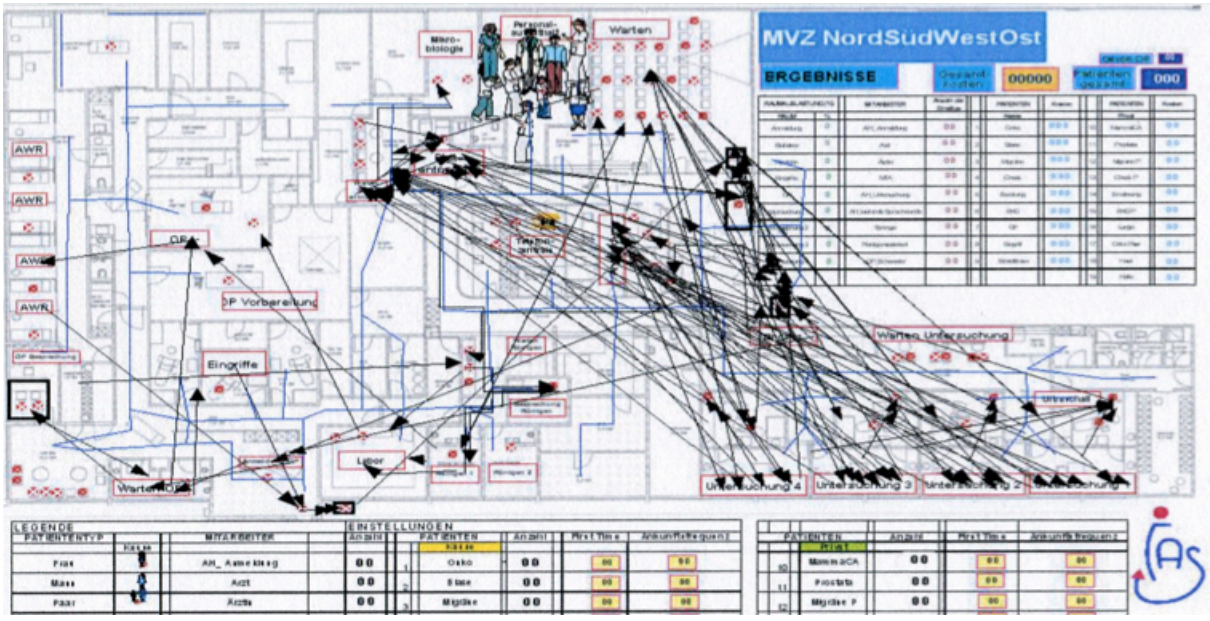


Illustration 19: Simulation of hospital process paths
The graphics show a simulation on the basis of process paths and patient's stream analyses of a hospital modell. (Spring: Kühn Klaus, VAO-Simulation bringt Prozesse und bauliche Gegebenheiten in Einklang und hilft bei Entscheidungsfindungen, Skript, München, 2010, page 13)

While the processes of the operations, intra surgical are planned phase-precisely, this planning is already absent with pre-and postal-surgical phase. Differently than in the hotel business where with "blue prints" the guest of the checking in up to checking out controlled and nothing to the chance will leave, such process representations do not exist for patient's expiries in the hospital as a whole process.

Differently than in the hotel business one has neglected in the hospital being in the past to explain with customer stream analyses and simulations, the patient's processes. Process expiries could be saved by such simulations and analyses and connections better understood, time and resources. There are, in the meantime, software products in the market, research institute (Munich) which simulate hospital processes and whose expiries explain.

The achievements, analyses and structural improvements offered by consultants help to understand the problems in the hospital better. Besides, it concerns the linking of the patient's data with the plans of hospitals and their representation of situation and function in the hospital. Many problems obviously understandably shown, it are illustrated first the ways from patients understandably, with the aim to reduce the transfer and transport achievements. There originate visualized representations of workflows, flowcharts, process paths which should be the basis of planning and rebuilding. Besides, it is about the problem of the static process representation. Generally nobody can hardly fancy something under beam or cakes graphics. Many problems obviously are clear and are posed only by the linking of the data with the plans of hospitals and the representation of situation and function in the hospital. There originate visualized representations of workflows, flowcharts and process paths which help to see the problems new and to structure the processes better.

To develop Blue Prints, workflows, Guidelines, SOP `s for the various hospital departments and to develop this to a whole, would entail that every employee in the hospital would have to keep in future stronger to process structures. The process would thereby follow less the chance or old confirmed habits will leave, but to regulated roads and structures. Required resources would be listed and be retrievable. Blue Prints describe, like at the hotel the whole process of a patient, who, where, when and what is required. This development shows that to itself the health market has woken after decades of the stagnation and changes.

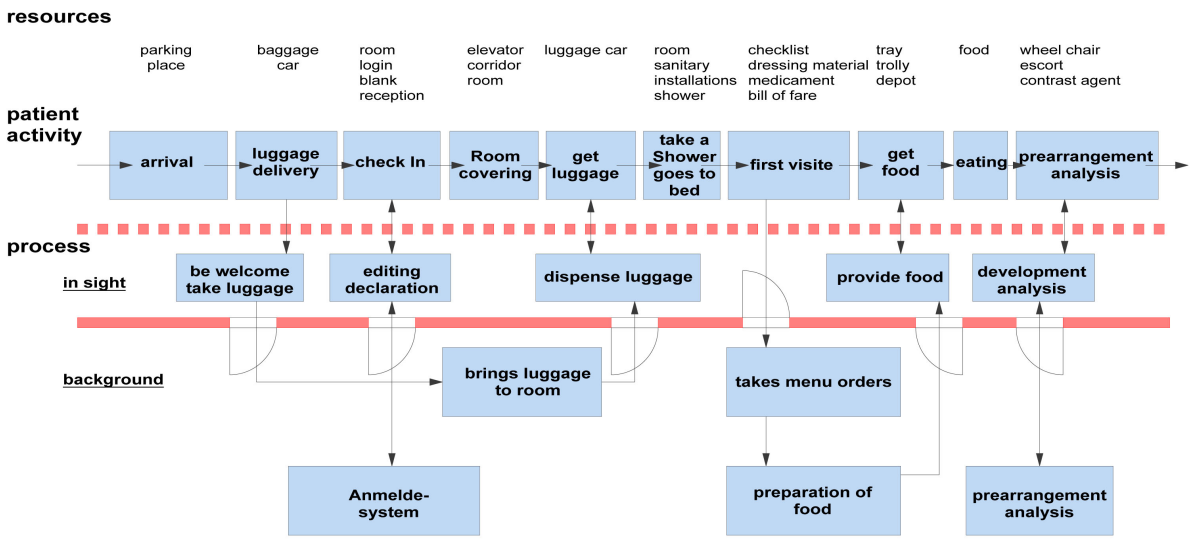


Illustration 20: Blue Print

The graphics show one in support of the hotel business to provided Blue Print how he could look, for example, for the hospital patient's admission. The Blue Print helps it obviously to make where improvements are possible. Which equipment when where must be available? Check lists and Guidelines can be derived from it. The horizontal expiry is striking. (Spring: own representation)

Changes already in most European countries have occurred. Spatial and personnel barriers become quickly visible and can become changed. Expiries are optimized and spatial obstacles are removed.

For the whole hospital and for the operation organization, such process structures should exist like this Blue Prints. The working process representations become not only the surgical area as the treatment and care of the patients enclose, but describe to organizational expiries of every single patient. The aim is to let end the individual specific features of a patient, not in individual expiries, but to lead in regulated roads. By the systematization and regulation the patient wanders through a sequence of the actions where at the end he is cured. One of the next big indispensable steps will show the production of "Blue Prints" for the hospital company to improve the processes in the hospital. The existing Guide-Lines and check lists must be strongly changed and be voted above all to each other. "Blue Prints" have to go from the admission, the first contact about the checking in, covering the room up to the treatment, intervention, care and recovery, as well as dismissal and check out, everything is defined and led in roads. Existing directives of treatment, Guidelines as well as SOP `should form and brought together a whole, a reorganization of the processes as an aim. With the checking in checking out is already fixed and picked out as a central theme as at a hotel pursued. First hang with it check in and checkout close together.

program elements	capacity exploitation	retention time	personal productivity	personal cost per head
KLINOVA				
occupy management	+	+		+
therapy levels			+	
therapy teams			+	+
intended therapy sequences	+	+		
PROP	+	+		+
ZNA	+	+		+
city hospital PLUS				
infrastructurel assets	+		+	
center, profession organisation	+		+	+

Illustration 21: Economic consideration KLINOVA
The illustrated table indicates the positive effect (+) by change of the existing processes on the program elements. Numerous existing problem fields are picked out as a central theme by the program elements. (Spring: Own representation in support in Seidel-Kwem B.,: Neumann Heinz, Professional MBA Health Care Management, Prozessmanagement, Vienna 2008, page 464)

For the operation organization, but also for the whole hospital such workflows, like these Blue Prints, should exist. The working process representations become not only the administrative area as the admission and care of the patients enclose, but also the treatments and interventions. They rules and lead not in individual, but in regulated roads. The patient wanders through a sequence of actions at whose end he is cured.

One of the next big indispensable steps will show the production of "Blue Prints" for the hospital company to improve the processes in the hospital. The existing Guide-Lines and check lists must be strongly changed and be voted above all on each other. "Blue Prints" have to go from the admission, the first contact about the checking in, covering the room up to the treatment, intervention, care and recovery, as well as dismissal and checkout, everything is defined and led in roads. Existing directives of treatment, Guidelines as well as SOPs should form brought together and a whole, a reorganization of the processes as an aim. No limits are besides set to the details of the process representation and in contrast to the existing Guidelines and SOPs which describe single operation processes there will be whole representations. Organizational charts of all departments of all processes.

The restructuring of the hospitals affects among other things positively the productiveness and economic efficiency, it lowers the costs and improves the capacity exploitation for planned expiries of treatment.

Processes have influence on the creation and education of rooms and buildings. This applies just to the hospital. Patient's stream analyses and process organization play an essential role for the free from problems functioning. Today's models are overtaken and must be restructured. This has as economic connections and should serve to lower the costs and to avoid losses. Realized programs were the so-called "**FIT**" programs, **FIT 1, 2, 3** (FIT= progress, innovation, team ability) Three modernization and rationalization programs they are tuned on each other and are based had to modernize the aim the hospital being and to come, besides, particularly on the available process structure. Besides, it was around about it critical costs-achievement analysis not to give the restructuring medical achievements and in order the re-building medical suppliers a special attention.

The main focus of **FIT 1** was PULSE, (achievement concentration) and KLINOVA (process improvement and change management program). Example the program KLINOVA - corner point of a reorganization program with the aim of the reorganization patient-close processes (medical centre Barmbeck administrative district Hamburg)

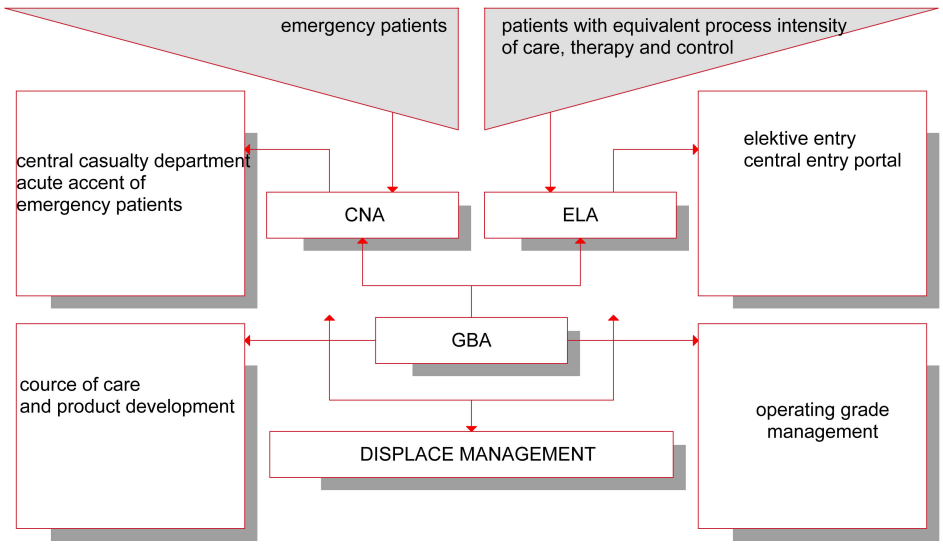


Illustration 22: Process reorganization

The graphics show an alternative whole organizational structure of the processes for the hospital. (Own representation in support in: Seidel-Kwem B., Neumann Heinz, Professional MBA Health Care Management, Prozess-management, Vienna 2008, page 467)

FIT 2 is a matter of raising the concentration on the core competences - The removal of all non-medical achievements like personnel management, logistics, Facility management or accountancy and their transportation in modular services, in subsidiaries belonging to enterprise, service companies, external suppliers to the efficiency increase and reduction in costs.

FIT 3 (restructuring of medical achievement performance) Achievement concentration, process optimization (KLINOVA), education of sector-covering packages of treatment as well as the development of new business segments (fitness, wellness, clinical research, development and Consulting) are an aim of this program. Scale effect and synergies: Should least case figures allow with specified achievements and at accordingly big hospitals, high-class increase as well as fixed costs digression. Synergies in process creation and structural definition: If Interdisciplinary creates a higher flexibility with the team of treatment as well as with the availability of the specialists.

While the operator takes over the guidance of the house and the job of the consile[6] in the essentials, the hospital is responsible among other things for the clinical research, the control of the investments, the planned expiries of treatment as well as for the advanced training and continuing education. The allocation of duties is anew split between the hospital management and the surgical stick of the hospital, while the main focus of the job in it lies a centre for highly specified achievements to form. (Heart, ENT-, Gastro-, Women, Cancer-Clinic)

In addition, specifically the definition of these aims led to an improvement of the working hours, to planned expiries of treatment, to a professional admission and dismissal management, to a centre management, as well as to services close to patient. (Lohmann H., Neumann Heinz, Professional MBA Health Care Management, Prozessmanagement, Vienna 2008, page 455)

KLINOVA

Klinova is a complete rebuilding of the medical ones as well as the nursing achievements, as well as a new draught for all processes in the hospital in the room Hamburg became moved.

The project teams, KINOVA, formed discussion and expert forums and fixed programs. The teams operated independently and the besides originating different main focuses led to a whole solution for the house.

Besides, the definition was essential, among the rest, of the following fundamental aims

- Operation-Reengineering
- Reorganization of patients to processes
- Introduction of treatment step draughts
- Central provisional accommodation
- Education of centers

Solutions should flow in and are moved, from it originate of enterprise standards. In addition, specifically the definition of these aims led, to an improvement of the working hours, to planned expiries of treatment, to a professional admission and dismissal management and to a centre management, as well as services too close to patient.

The project KINOVA (FRG) tries to solve the problems which exist today in Austria also. Hence, one will come in Austria not there to go with similar projects the problems in. The educated processes are result-oriented and form a common denominator from the practice from different springs. The suggested solutions have flowed in onto a whole model and from it standards have originated as a result of enterprise.

[6]The concept often finds in the hospital use if a consul is requested by a doctor of another field. The commissioned doctor (consultant or consular doctor) lays down his recommendations to the diagnostics or therapy mostly in writing, also this document is called consul (or consular report). An institutionalized offer is called mostly consular service for the judgment and co care of patients which can be requested by other doctors for their patients.

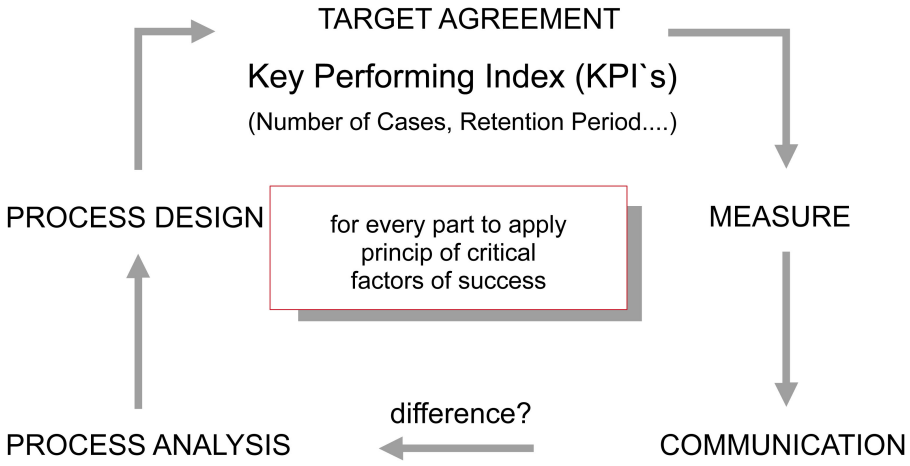


Illustration 23: Result orientation process
The picture shows the control cycle for the control and increase of the result quality in the hospital. (Spring: own representation in support of Ohm G. S. Neumann Heinz, Professional MBA Health Care Management, Prozess-management, Vienna 2008, page 473)

[7]Economies of scale is defined in of the business administration the dependence of the production amount from the amount of the used factors of production. The (marginal) scale yield corresponds to the gradient of the level response function. He registers around which amount the production amount changes if the application of all factors of production is raised (marginal) by a certain factor. Spring: Wikipedia 2010)

3.4. Operation Room Workflow

The workflow of an operation is depending on the kind of the intervention and from the architectural circumstances of the operation. The economic efficiency of the intervention depends on like the relation of the intervention (real intervention = intra surgical phase) and the other phases (Pre-preparation, preparation and cleaning) is material and, finally, how high the expenditure and is immaterial, a lot of time this operation takes up. The workflow of an operation must be planned. As a rule expiries of all customary interventions are exactly described and given. The equipment and creation of the operation has a big influence on the sequences.

With the establishment of operation rooms the economic efficiency check of the operation room is an essential parameter, the workflow of such a check is an essential component. In principle 24H is possible for company, really this is seldom the case and the shares of the standing times between the interventions are partly huge. This raises the costs of the operation room or lowers the economic efficiency. Hence, it is dramatic if the duration of the planned interventions is not held or interventions fall out. This leads partly to big losses, because the other interventions can move not without problems simply forwards. Comes that as already mentioned, the supply of the operation room for the next intervention be prepared, the patient must be ready and prepared. So that, however, the operation company functions smoothly, the cleansing staff "standby" is ready and waits for her application.

An operation room is used as a rule only for 50% of the available time for interventions, other 50% get lost for the preparation and cleaning.

That is the fact that is able with maximum use of 24H, interventions take place at most in 12H. The easier the intervention, the shorter the duration, becomes the more uneconomical the relation. 50% of the achievement of an operation room cannot be used. With longer operations this relation improves a little. If the maintenance times, (change of people and filter etc.) and the periodical general cleanings of the operation room also are added, the anyway not good relation gets further worse. Less than 50% of the time stands for interventions to the use.

The expiries all around a conventional OR are strongly regulated and given. SOP (standard operation process) describes the expiries and every handle during the intervention. The SOP are provided by the departments themselves and come with it strongly on the house-internal situation. Blue Prints, as one knows this from the hotel business, would better show these ex-

piries there, these process representations all processes also graphically integrate. To embed the SOP in a whole solution of all processes in the hospital it does not exist to To date.

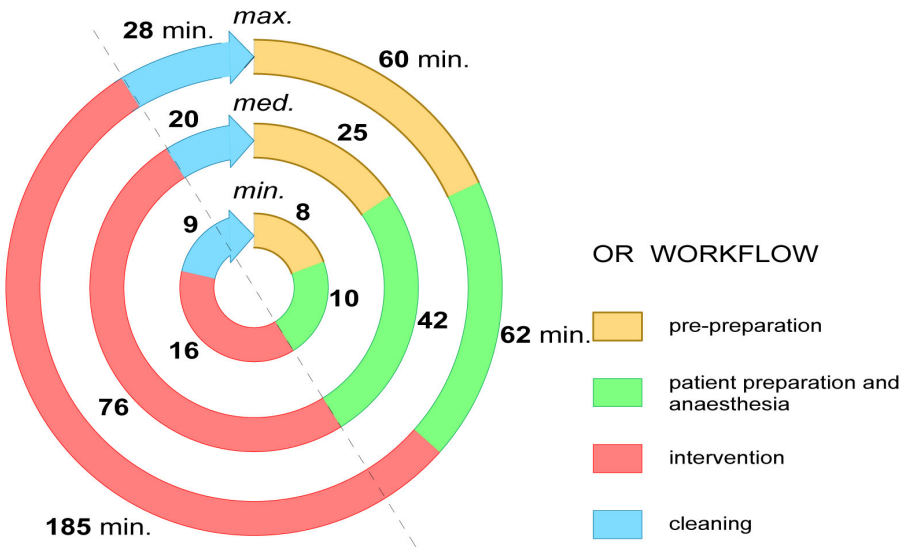


Illustration 24: OR workflow of conventional operations
The picture points periods for the operation room generally. The graphics make a distinction in three interventions; minimum, media and maximum interventions it is striking that in all cases for which real operation remain (red) only half of the time the remaining time of the booked OR, is used for the preparation of the patient and cleaning of the operation room. (Spring: ten Cate et al, Integrating surgery and radiology in one suite: A multicenter study, Journal of vascular surgery, volume 40, number 3, 2004, page 496)

The city of Vienna, the KAV (Kranken Anstalten Verbund, 10 public hospitals of Vienna) begins exactly here. In 2009 the planning processes were improved with the introduction of the software “Opera“ all around the operation room. Aim is to improve the processes and to form the duration and expenditures clear. That's why in the Viennese AKH (KAV) the project “Opera“ was developed in 2009 and part-experienced. Besides, it concerns the installation of the software the “Opera“ which exist of 3 modules. With this program the extent of utilization of the operation rooms as well as the documentation should improve. With it a high-class increase is created and the costs of the operations are lowered by optimization.

Modul OPERA (Vienna KAV)

- Operative Planning
- Intra operative documentation incl. Material management
- Post operative documentation

3 modules should be installed in the form of 3 projects following on each other and to each of 3 modules a suitable pilot project should walk at the head in a hospital of the sick person's institutions of group (KAV).

The objective is

- Uniform operation planning
- Efficiency increase of the operation extent of utilization
- Decrease of the waiting periods on selective operations
- Transparency of the waiting periods
- Uniform and common intra surgical documentation of all professional guilds active in the operation room
- Structure and resource planning
- Uniform and common postal-surgical documentation all postal-surgically to active professional guilds.
- High-class management

PRE SURGICAL PHASE

In the pre surgical phase the patient is prepared for the operation and is taken over, e.g., after a heavy accident, or an emergency from another medical department, like urology, internal medicine, orthopedics etc. If the decision is liked that the patient is operated, then it comes by the internist under inclusion of the surgeon of the respective department to an internal operation release.

The transport and the transfer in the surgery shows juridical the handing over of the responsibility for a patient of a department to the next. Part of the takeover is to make available all data and facts of the patient with or to request and to examine. The possible measures which allow an operation, finally, or preventing are to be cleared in the approach. This can be easy shaves and clarifications, like the availability of set of dentures to elements, demands of other blood values, but also individual wishes and images as well as the knowledge of anomalies and allergies. (e.g.: moslem women wish female medical staff) If the patient all default for the release of the operation fulfill, an operation-appointment is discussed with the surgery and is fixed.

Operation interventions of conventional operations

Approx. 30 min before the planned operation appointment the get and bring-service is informed; the patient receives a transport achievement. The identification by information of the surname (as well as given name, available) of the patients / patients, room number (if available), kind of the intervention and the surgeon. (or in exceptional cases after arrangement with anesthetist and surgeon).

Transport

The transport of the patient in the surgery occurs as a rule in his own bed, or, however, through a transporter. The transporter is an object similar to bed, smaller and agile. New models are adaptive with the operation table and can show thus a real working relief with discontinuation of transfer achievements.

The takeover is carried out by the takeover and the infiltration of the patient in the operation area, by the operation team, the chief surgeon. From this moment the surgery is responsible for the welfare of the patient up to the out coming and the takeover by the nursing department. The patient reaches first with other patients in a preparatory room. This is a room which belongs to the operation area where the patient waits for his operation.

Putting into another bed cannot be avoided from hygienic and sterility reasons, also by modern transfer and transport systems completely. However, this transfer and transport systems make easier the expiry and reduce the expenditure. In emergency situations if the hygiene must be neglected and the processes follow own laws, the transporter can show his true use. The patient is brought in his bed to the sluice and there on an OR transporter he transfers with which one to the operation table is brought and now is ready for the operation on the operation table.

Primary preparatory measures

Preparation of the OR table and the patient's sluice. The operation table in the intervention room is prepared by the operation sister for the measure and before the patient is transferred, all preparations must be concluded.

These are in the essentials

Lay stretched out patient's cloth on the patient's sluice

- Choice of the operation table
- Warmed up optical editions like Esemtan[8] heating mat, to 1x optical varnish, patient's cloths alternatively max. 10 min. red light lamp – body temperature
- Headrests, cover, operation table accessories (arm bowls, head clips, leg roles etc.)
- Patient's seat belt

Secondarily measures

Allow to pleasant surroundings for the patient.

- Provide rest
- Constantly information about expiry and activities gives
- Protect intimate sphere of the patients
- Individual needs / wishes consider

Takeover of the patients / female patients in the patient's sluice (IMC)

The escort (get and bring service) announces the patients / female patients by the arrival in the patient's sluice in the operation department.

- Greeting by the responsible nursing person of the IMC.
- Put in to the headgear, filing of the operation shirt.
- Control of the ATS or bandages on correct seat free of fold
- (With absence of the ATS a bandage is put on as an alternative).
- Removing dentures, hearing aids, glasses, hairpieces, rings, piercing
- (can be removed at special wish only shortly before anesthesia introduction)
- Removing hairpieces and wigs
- (are able at special wish and after arrangement with the anesthetist / to him
- Anesthetists are left, provided that no metal parts are integrated)
- Handing over of the patient's documents to the operation assistant.

Written information to the operation staff on the form „sheet of information for the nursing operation team“ if jewelry, to substitute, prosthesis, hairpieces were not filed on the station.

Greeting

- Personal image of the operation assistant with name and function.
- Check of the identity of the patients / patients
- Gender, given name and surname as well as date of birth of the patients / patients.
- Open question after the name is put:
- What is your name? When are you born?
- Information with ID tape is compared.
- Checked identity of the patients / patients becomes with the topical operation program
- compared. The array should be considered.

Check of the following documents by the operation assistant

- Patient's etiquettes, cardex and X-ray picture bag is controlled on identity.
- Missing documents request.
- Forwarding of important information, existing nursing diagnoses to the instruments.
- (Form: Sheet of information for the nursing operation team, as well as nursing overview)

Realisation of the operation documentation

- Open patient's file in the computer or anew put in.
- Nursing protocol operation, when required implant light,
- Settlement sheet and anesthesia-achievement sheet, preparation light,
- Release note for operation report,
- Medical arrangement protocol operation

[8]Esemtan is an electrically heat able base, heating mat and protects the patient during the operation against under cooling. This lies on the operation table under the infertile optical varnish and covers from the operation table him urged stream. The heat able base is warmed at most on body temperature, because the operation room for hygienic reasons has no usual ambient temperature.

Infiltration

- A temperature control before transferring the patients / female patients on the operation table, becomes with the hand the temperature control of the optical edition (Esemtan) carried out this body temperature should have.
- Follow from possible reactions from patients with medicine
- (temporal, spatial disorientates)
- Explain of the sluice process.
- Follow from possible impediments and movement restrictions.
- Consideration of individual needs.
- At wishes come: additional storage aid (e.g.: knee role, cover etc.)
- Open questions allow clearing and clearing by surgeons and anesthetists.
- Avoid from incriminating sights
- (e.g.: how blood, freshly operated patients etc.)
- Transfer of the patient in the introduction room OR with invested patient
- Seat belt in the thigh and cover.

Introduction room operation

- Offer of the storage aid (knee role).
- Realization of preparatory measures for the anesthesia)
- (e.g., ECG electrodes attach)
- Clarification with surgeon whether a skin preparation is necessary.
- If necessary, see standard „pre surgical preparation of the skin“.
- Connection of the splints at the OR table.
- Prepare of the Sink, yellow „esteem of denture“ (marked with patients
- Label), if dentures, hearing aids, glasses, hairpieces, rings, Piercing does book yet
- This is delivered intra operative by the operation assistant in the IMC.
- Greeting of the patient by the surgeon and anesthetist

The available check lists and Guide-Lines have the disadvantage that they describe a linear expiry. This reflects the organizational structure of the hospital in single parallel departments

again. This structure has the disadvantage that extremely a lot of time gets lost for transport and transfer achievements. This method is not structured process-oriented and patients must be always transferred by a department to the next are transported and. The risk by injuries, complications, infections for the patient and with it for the hospital rises, is bound furthermore efficiency and the relation between main and besides achievement (Gainful achievements and costs-causing achievements) gets worse. Furthermore such besides achievements need a huge number of the infrastructural measures which explain also cost factors.

INTRA SURGICAL PHASE

The intra surgical phase describes the period from beginning of the anesthesia up to waking the patient after the operation. In this time the real intervention takes place in the essentials, and shows at the same time the time span of the anesthesia.

It concerns according to operation and complexity of the intervention, a standard operation procedure (SOP). (Other concepts exist around this process to describe; in different hospitals different concepts are used.) The SOP describes in detail the sequences and achievements, as well as the necessary aid of an operation. Every intervention is an individual event, patients are different. During the operations different people are in the operation room, they behave in exactly defined roles, her action and the expiries follow defined paths. There is a strictly hierarchical decisive structure and this includes an instruction right. All partners follow the word of the responsible surgeon who has to bear, in the end, the whole responsibility for the success or failure of the operation.

The necessary technical equipment can be different according to operation and according to field. This entails that the place need must be laid out in the operation room as differently, or the operation room must be formed in such a way that all possible equipment variations have place. This concerns the operation apparatus as well as the required staff. The result of such studies comes in the end that a usual conventional intervention room encloses approx. 36m2 and 5.0 x 4.5 m a minimum explains.

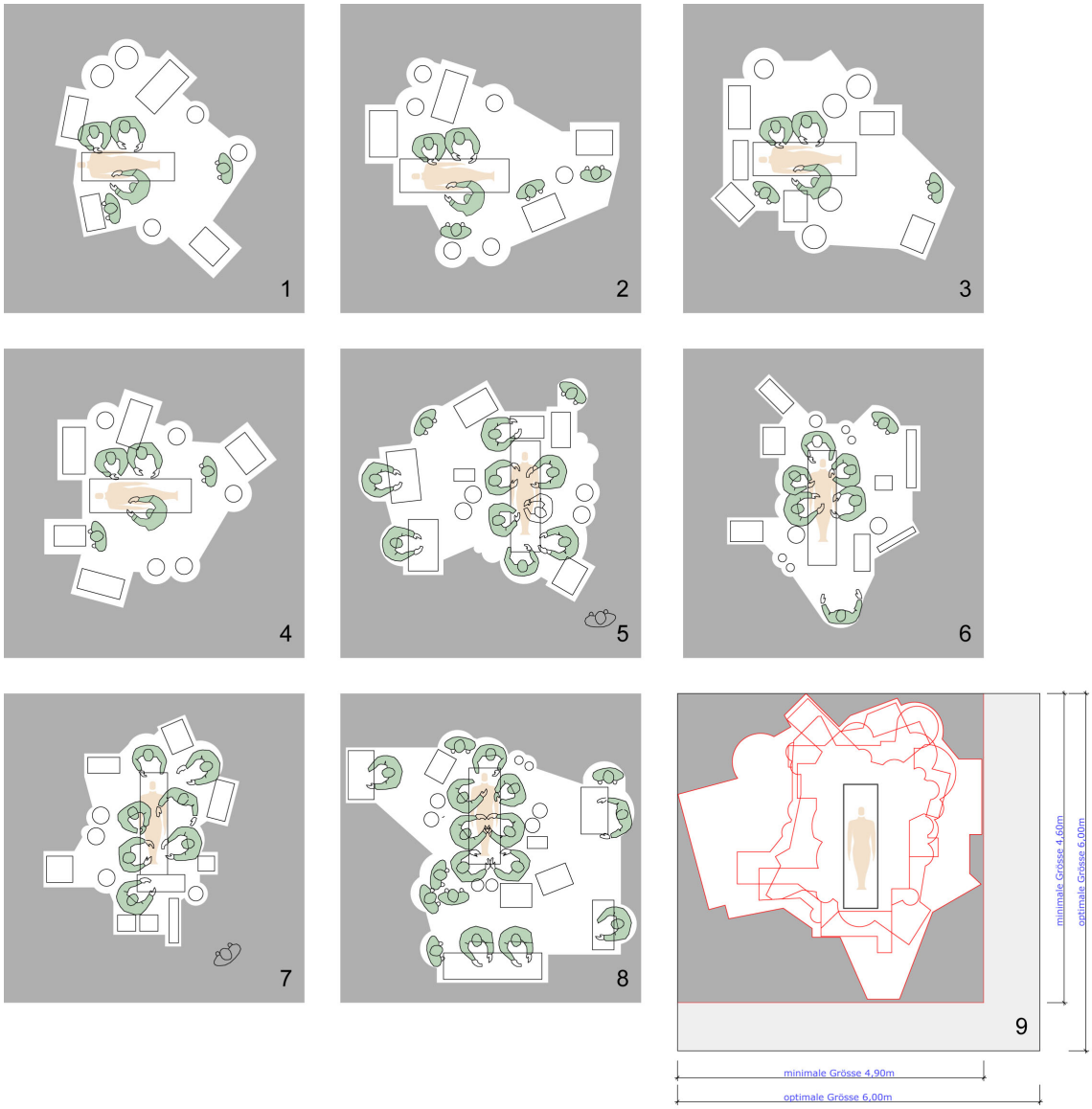


Illustration 25: Analysis of the place need of different operations
The graphics show the place need of different interventions in the operation room. From the left to the right. 1-gastrekomy, 2-Colostomy, 3-cholzystektomy, 4-appendectomy, heart operation 5, lung resection 6, 7-pyloromyotomy, 8 heart-operation with heart lung machine, 9-the sum of all demands, optimum operation room (Spring: Nedeljkov G., Ural O., Krapfenbauer R., Innovations in sciences and technology for the future, International Association for Housing Science, Band 1, 1988)

POST-SURGICAL PHASE

The phase after the concluded intervention. The operation assistant waits in the operation room to the final control by the instruments is finished and leaves only the operation room when his question „is the patients / female patients was answered to the conduct released“ by the scrub nurse positively.

Pay attention to the security of the patient and to a pleasant atmosphere

- Provide rest (raised noise delicacy of the patient in the wake phase)
- Protect intimate sphere of the patient.
- Constantly information about expiry and activities gives.
- Securing of perhaps invested drainages, rinses and drips.

Prepare of the conduct

- Inform of the getting and Bring service (HBD) by the OR assistant with information
- Names of the patient and the surgeon.
- Remove knee role etc.
- ATS or bandages check for correct seat free of fold
- Put on body belt
- Avoid warm loss
- (Patient's cover, “bairhuggerfilm“ give in IMC)
- Prepare patient's documents and X-ray pictures for transport
- Check ID tape
- (should the ID tape intra operative have been taken, it must be renewed)

Conduct

- The takeover of the patient occurs (IMC sided) through the DGKS of the IMC and the HBD.
- Explain sluice process to the patient.
- The conduct of the patient occurs through the OR assistant in presence of the anesthetist.
- When required the second OR assistant or an OR sister is necessary.
- An operation assistant is not allowed to go out alone.
- On movement restrictions, drainages, associations and drips pay attention.
- Drainage systems and drips lay during the sluice process on the patient (pleuradrainage are clamped during the sluice process with two clips in each case)

Handling over to the DGKS of the IMC and the HBD

- Handing over of the patient's documentation and X-Ray pictures by means of info pocket

- Medical information relevant for care is transmitted by the OR-DGKS or the surgeon to the DGKS of the IMC.
- Dismiss of the patient.
- Sluice windows / close door.

(Spring: Anderwald Gabriela, Interview, OR-Nurse Goldenes Kreuz Vienna, 2010)

4. Hybrid Operation Room

During the last 10 years there were because of the rapid development of the computer-assisted systems in the medicine numerous technical innovations in the hospital. A development is of the Hybrid-operation room. The concept "Hybrid" comes from Latin and is called mixture, synthesis of two foreign "beings" (Wikipedia, in 2010).

By definition it concerns with the Hybrid-operation room the combination conservative, intervention and surgical rooms. As an example a cardio more surgically Hybrid Operation room with which beside a fully equipped heart-surgical operation room, also a full angiographies arrangement is inserted would be called. The Hybrid Operation room allows the simultaneous intra operative diagnostics and therapy of emergencies (without time delay and transports) as well as planned complicated interventions. An immediate therapy control exists by the integration of all picture-giving procedures in the operation room what means a profit in security and quality (Spring: Philips, Sence and Simplicity, 7. Medizintechnik-Tagung, Inselspital Bern, Thema Hybrid-OP, paper, Swiss, page 9, 2010).

The synthesis of the Hybrid-operation room opens, e.g., in case of the heart surgery absolutely new therapy options. Cardio surgical emergencies can be diagnosed in the Hybrid Operation room without every time delay simultaneous and be treated, without additional risky transports become necessary. The spectrum of treatment reaches from the catheter supported therapy of narrowed aortic valves up to the care of acute aortic illnesses which can be treated now surgically, endovascular or in a combination of both procedures.

In addition, the Hybrid Operation room permits the immediate postal-surgical therapy control after the echocardiography. For the patient this one considerable profit means in security of treatment and quality of treatment. Not only borders of treatment, but also formerly attached field borders are overcome by the cooperation of experts from the different fields in the Hybrid Operation room.

Illustration 26: Heart surgical application at Hybrid Operation Room (OR)
The graphics show the place need of the team during the operation. Not optimally is that the leading surgeon must turn round to the screens during the intervention which shows an essential picture at the possession. 9-10 people crowd around the operation table, come additional operation tables and other accessories like lights screens etc. The C-curve is big and in the centre of the event, this is one of the problems in the moment. (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 1,15.01.2010)

The overcoming of field borders by cooperation of multidiscipline experts is demanded. Complicated interventions of different fields are thereby simultaneous and also are sequential possible, this lifts not only the quality and brings the patient in the centre, it also spares the patient (Spring: Philips, Sence and Simplicity, 7. Medizintechnik-Tagung, Inselspital Bern, Thema Hybrid-OP, paper, Swiss, page 8, 2010)

A Hybrid-operation room unites all capacities of an operation room with multimodal state of the art picture (angioscopy, CT, endoscopy, etc.). The intra operative simulation and navigation, is one of the most essential progress in the area of the operation room. A conventional apparatus admits hardly or very hard the control during the intervention. The patient would have to be transferred and beside an infection danger, a lot of time would also get lost. The Hybrid Operation room is infertile and the patient remains at the operation table (Spring: Wirtz C.R., Neurochirurgische Anwendungen im Hybrid-OP/ Artis Zeego, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Gefässmedizin, Regensburg FRG, page 9, 15.01.2010)

Though the image quality of a CT is higher, but the expenditure is bigger accordingly. Exactly here begins the Hybrid Operation room.

The Hybrid Operation room allows with the help of the EDP on a real-time basis, during the intervention, high-resolution pictures which are generated immediately by specialists in the controlling room and are dyed. The pictures of the photographed body parts of the inside of the patient are available from all sides. Sculptural 3D pictures are generated, and these allow thus to the doctor the greatest possible insight into the patient. (Spring: Thomann G, Interview, Hybrid-OR-Manager Philips, Vienna, 2010)

The pictures of the planning can be overlaid with the pictures of the intervention. Afterwards they will measure by means of the EDP-Mess scores and pretends, so that, e.g., exact placing of an implant, like a heart flap, for the first time in this precision in precision becomes possible (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 21, 15.01.2010)

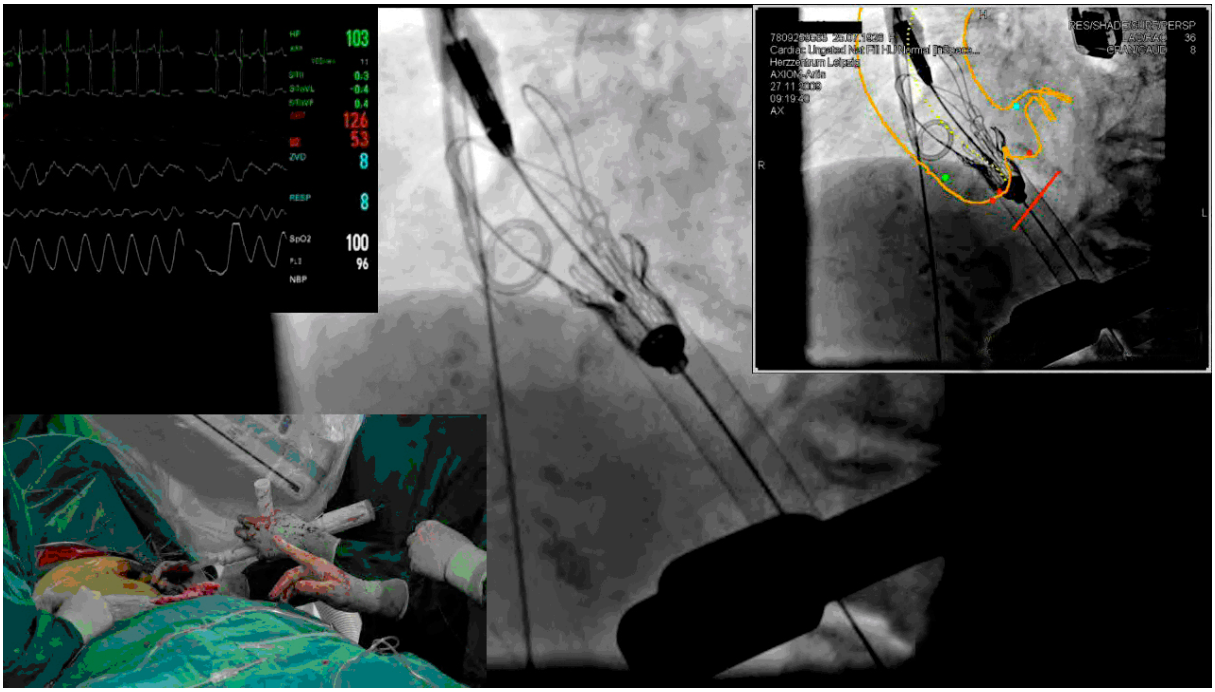


Illustration 27: Cardiologists transfer a heart flap
Picture middle, without Matching. Picture on the top right, with Matching and representation of the outlines of the vessel. The red line is a projecting circle which shows to the doctor that the situation of the heart flap is right. If the situation of the heart flap is not projecting, this red line would be an ellipse and the situation of the heart flap would be wrong. (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, , page 21, 15.01.2010)

In 2003 there were the first, real Hybrid OR arrangements in the FRG. Pulled in consideration became they already in 1995 by the vascular surgery, indeed, this long time remained only one vision (Spring: Wirtz C.R., Neurochirurgische Anwendungen im Hybrid-OP/ Artis Zeego, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Gefässmedizin, Regensburg FRG, page 4, 2010) Today in 2010 approx. 12 arrangements exist in the FRG. Because Germany disposes of most hybrid-operation rooms worldwide it belongs with it to a forerunner in Europe or in the world.

At the moment in Austria one single arrangement exists in Graz. It was put into operation at the end of June, 2010. Besides, it concerns a cover-mounted arrangement with an installation bridge of the company Philips. The construction time amounted a year, the preliminary planning phase another year and the planning order was given merely for a cardio-operation room, and then it was converted into a hybrid-operation room. Easily is to be recognized here that the speed of the development catches up the planners (Spring: Thomann G, Interview, Hybrid-OR-Manager Philips, Vienna, 2010)

In Vienna a hybrid-operation arrangement was provided in the magnitude of a preliminary planning for the AKH. The conversion was not realized on account of the very high architectural costs for the rebuilding of the existing building. The planning was not really satisfactory, because it is very difficult in the AKH to create something new with the existing static grid. The costs of the rebuilding would have been enormously high (Spring: Joch A., Interview, medical technical Manager Siemens, Vienna, 2010) It shall be expected that the city of Vienna allows including in the plan one or several Hybrid-operation rooms, the north AKH located in planning. The thematization of the rebuilding or new building is essentials, because the highly competitive devices as well as the C-curve need a suitable architectural statics which is not given in most cases in the continuance. The spatial conditions, the room height and axis mass are too small as a rule to change this are cost-costly and not are partly simply possible. (Spring: Joch A., Interview, medical technical Manager Siemens, Vienna, 2010) There comes that the room plan of a Hybrid Operation room, the spatial organization, a change in thinking requires. The room of a Hybrid-operation room is bigger than a customary operation room, it is to be seen to the fact, that the storerooms accordingly largely (div. Professional disciplines), well accessibly (near the operation table) as well as generously and clear are formed. Various professional disciplines store her medical products and must find when required quickly and without problems the required product such as Stents, flaps, im-

plants etc. (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 19, 2010) This is a not yet concluded, new development. Numerous changes and improvements are to be expected. Various medical professional disciplines press in the topic and raise naturally new problems specific for field (Spring: Strobel N., C-Arm CT (synco DynaCT) und 2D/3D Überlagerungen zur Überlagerung von Abdominellen Aortenaneurysmen Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 18, 2010) In future new possibilities of treatment are to be expected, because the application of a Hybrid-operation room opens new dimensions for the treatment of a patient (Spring: Kettenbach J., Interview, radiologist, Vienna, 2010) Thus can be preplanned very individually and the intervention precisely prepared be voted. Personal individual physical differences become visible before the intervention and are considered. Medical-technical products are made precisely after default of a presentation and are ready before the intervention. Surprises are limited to a minimum. Then this know-how can become further used immediately also to the training. The access to the picture and the planning serves as training information (Spring: Steinbauer M., Implementierung von neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 5, 2010) During the intervention the C-curve serves to observe to the production of the pictures of the patient around the intervention live (on a real-time basis) or to navigate by the body minimum-invasive. A comparison with the knowledge attained in the planning takes place by the employees in the controlling room, so that the made pictures are available to the surgeon processed. Thus the doctor virtually has every phase of the operation under control (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 23, 2010) The interventions can be reduced to a minimum, this saves not only time and money, but they are also substantially less incriminating for the patient (Spring: Gebhard F., Hybrid-OP in der Unfallmedizin, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 10, 2010) As a result of that the patient needs less care and is faster recovered. It will come for the tailor-made individual planning, operation, treatment and care. By the planning the devices are already used to the measurement and analysis. During the intervention it is controlled, observed and afterwards checked without controlling operations (Spring: Steinbauer M., Implementierung von neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 8, 2010)

The Hybrid Operation room wins more and more in meaning and the statistics shows that more and more operations are carried out in the Hybrid Operation room. It will become the standard to plan ahead specifically for patient and to prepare thus interventions individually and to form. What means in the extreme case that under certain circumstances, the same intervention requires different medical-technical details and sequences with two patients? This concerns above all anatomical specific features or other complications, as well as z. B:. The transferring of certain aid like implants, etc. (Spring: Gebhard F., Hybrid-OP in der Unfallmedizin, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 13, 2010) During the intervention the success of the operation can be controlled by means of a C-curve. During the intervention the data of the preliminary investigation are balanced with those of the intervention and are stored. The C-curve admits interoperating during the intervention and delivers exact, sharp pictures which are computer-generated and are dyed what means quite a new image quality. The need in Hybrid-operation rooms rises because complicated interventions become more and more the agenda. The expectations of the patients (headword Media presence) as well as clarification by the media become higher and higher (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 6, 2010)

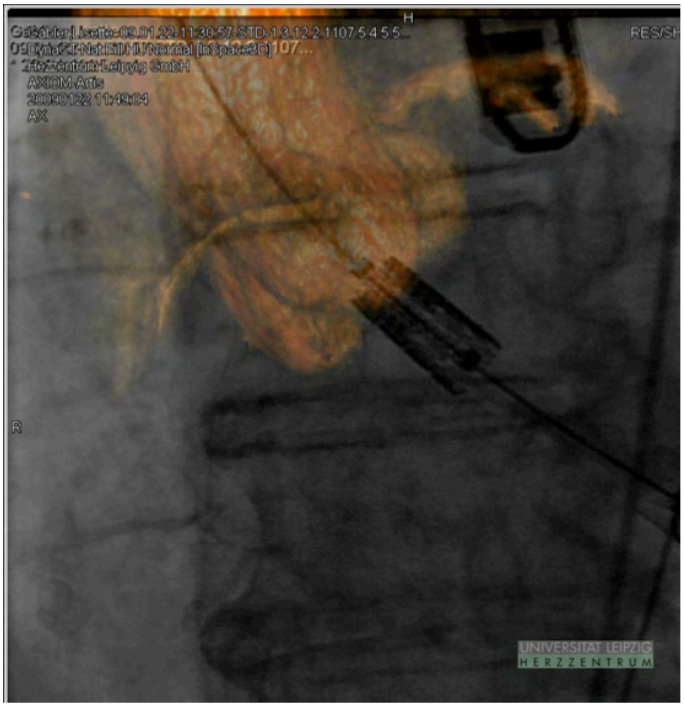


Illustration 28: Computer generated Hybrid OR picture of a vessel
The picture shows a vessel by means of a C-curve was distinguished and was measured. In the connection becomes this vessel, real time rendering and is dyed. Turning and tricks like a three dimensional model is possible by the available 3D-information. (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 30, 2010)

Modern interventions and long screening times of the patient are the result, so that the need rises to operate more exactly and purposeful. So that the ray load does not concern unnecessary organs and fabrics, the application of the C-curve must be set down over and over again. The ray load of a C-curve in the Hybrid Operation room is similarly high to which of a computer tomography (CT) with the CT big body segments can be photographed all at once what lowers the ray load in relation (Spring: Kettenbach J., Interview, rodiologist, Vienna, 2010)

	DynaCT	CT
head	2 mSv (1)	3 mSv (1)
liver	6 mSv	5 mSv
lumbar vertebra	8 mSv (1)	9 mSv (1)

(1) Hohl et al., DRK 2007

Illustration 29: Confrontation actual dose, syngo DynaCT and CT.
The table compares the ray load of a C-curve (DynaCT) and a customary CT. with different investigations. (Siemens, Magnetom Verio, in 2008)

The control of the work of the intervention gets a higher and higher value. The conditions for the control without other interventions like control-operations are that the image quality must be exact. The service must be to be managed from the surgeon feasibly and without foreign help. The patient's accessibility must be guaranteed. Everything must function quickly and uncomplicated (Spring: Umscheid T., Erfahrungen mit einer deckenhängenden Anlage im OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 27, 2010)

There are different models and different manufacturers of the C-curves who create different achievements (KW) and thereby different definitions. The devices have a different place need, the costs vary as immensely. To the cost the accompanying costs are not to be underestimated for additional or specific measures. It are to be planned beside architectural measures like the room size and room organization of the operation room, the camp, the technology room, changes in the expiry and the operation management (Spring: Joch A., Interview, medical technical Manager Siemens, Vienna, 2010)

Illustration 30: Surgeons with a C-curve at work 1
The picture points like different surgeons on the patient work and produce constantly a screening on site, in the operation room. With needs the C-curve, by means of the remote control which is on the one hand at the table on the other hand in the head of the C-curve is got and used. (Siemens Medical Solutions Angiography 2010).

4.1. Hybrid OR Interventions

In future the application of Hybrid Operation will bring a huge number of changes. Numerous medical fields are able and should work in an operation room together. The Hybrid Operation room supports this process not only has he demanded him. Thus it will be possible that the different surgical departments, the angelology, the neurosurgery and the cardiology operate together.

It can be operated minimum-invasive as well as conventionally. Also combinations of both are possible according to need.

The control can occur immediately without transfer transport lines also between the single steps. The patient remains at the operation table and is able after few minutes further treated.

This possibility creates security and shortens the procedure as a whole. The surgeons can control single steps of her work and if necessary correct.

Illustration 31: Surgeons with C-curve at the work 2
The picture points like different surgeons with patients at the work. A screening in the operation room creates security. The situation and the function of implants can be controlled immediately. (Homepage Philips 2010).

Conventional operation room versus Hybrid Operation room (check list)

The differences of a conventional operation to a Hybrid Operation are serious. While in a conventional operation, the chief surgeon on himself is put and all people accompany him, is announced in a Hybrid Operation team-work. The surgeon must deliver some of his power of decision and count on his colleagues, as well as on the medical-technical staff in the controlling room. Differences of a conventional operation to a Hybrid Operation are:

structural-constructive differences

- With a Hybrid Operation room other next rooms are available such as a store room, control room, technic room.
- The enlargement of the intervention room is necessary from 40 to 100m2
- A rise of the room height is a condition from 3.0 to 3,3-3,5m
- An improvement of the statics of the house, the movements of the C-curve must be taken up.

Spatial-organizational differences

- other motion sequences of the auxiliaries are necessary
- the C-curve shows an obstacle
- new geometry of the operation table, this is very long and shows an obstacle
- the C-curve must be led over and over again to the operation table and needs this movement room

Differences of workflow

- the operation process is determined by the work with the C-curve
- the operation is stopped and driven by means of the remote control near.
- the C-curve puts according to intervention div. Controlling pictures here (4-8x per intervention)
- the pictures are balanced with the pictures of the pre-operation phase and are discussed.
- Communication between doctors, however, also between doctor and controlling room.
- during the controlling process of the curve become flaps, Stents and other implants
- laid and positioned and controlled. Communication doctor.
- Between the controls the C-curve is removed from the table.

Procedural differences

- the operation phases, pre-, intra-and postal-surgical phases are coined much stronger
- the intervention is comprehensively, careful and more exactly
- the processes are specialized covering and, hence, interdisciplinary
- in the operation process changes concern the whole organization of the house

Personal differences

- The Hybrid Operation room needs more personal in the operation room and the control room

Cost

- the total expenses are substantially higher. This are production costs, operating expenses

4.2. Hybrid Operation Workflow

Here as an example a workflow of a planned intervention, the transfer of a stent should be indicated with an endovascular aorta aneurysma repair.

PRE SURGICAL PHASE

In the pre surgical phase of the Hybrid OPs numerous investigations of the patient take place for the intervention by means of the Hybrid OP.

Aim is to get very exact and expressive series of pictures and to prepare the expiry of the minimum-invasive intervention exactly.

In addition it is necessary to generate the pictures by means of EDP to 3D pictures. It finds an exact measurement of the patient, e.g.: Heart coronary arteries, heart flaps, vascular narrowing etc. instead of. The pre surgical phase serves to prepare the intervention by means of the C-curve.

Between pre-and intra surgical phase a choice of the pictures is generated by the medical-technical staff of the controlling room under consultation with the responsible surgeon, is processed for the OP, and is stored. The patient will measure internally and pretends; measuring points for the navigation are put and serve later the exact orientation. With it the surgeon is able to bring near regardless of the exact ability for reproduction of the situation of the body and the inside of the body, again to the place of the intervention. Because it concerns soft parts, small differences and the situation and form are enough change.

The course of the intervention is discussed with the patient. Furthermore the usual measures, how before a conventional intervention become grieved. Various investigations, blood decrease, questionnaires, etc. the possible measures which allow an operation, finally or prevent, are to be done in the approach. This can be easy shaves and clarifications, how clarifying of availability of set of dentures elements, requirement of other blood values, but also individual wishes and images as well as the knowledge of anomalies and allergies as well as denomination questions. (Women from Arabia, moslems wish female medical staff) The operation planning plans to include in the plan the right people before the intervention and to make available the necessary aid, as well as to book the operation room accordingly of the intervention appointment and to equip (screens, dumb waiters, heart lungs machine etc.)

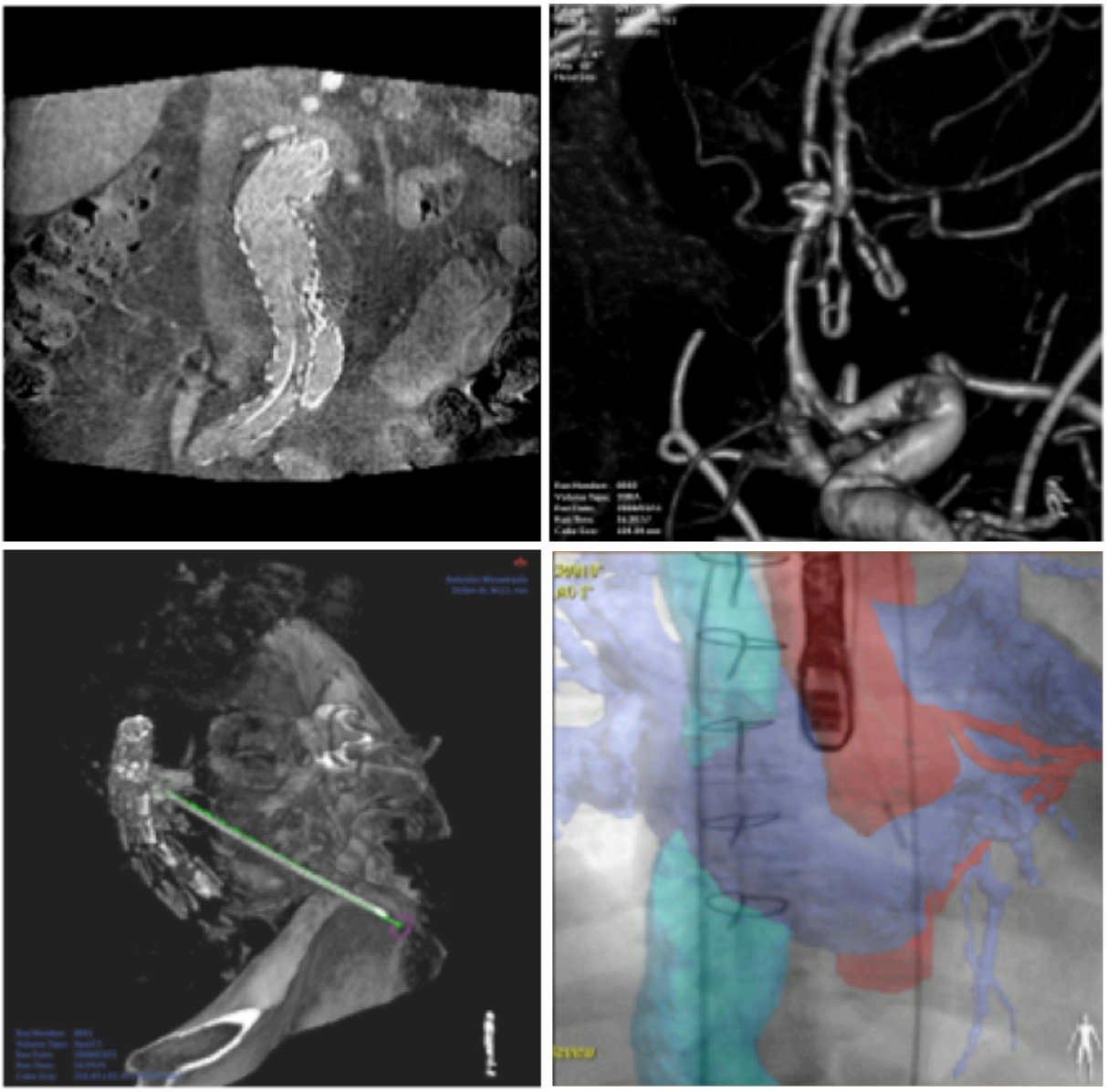


Illustration 32: Change quality of the pictures
The picture points like different phases of the picture look. finally, originates colored 3D-picture which contributes substantially to the orientation and improvement of the medical achievement. (Philips, in 2010).

For example, are for endovascular aorta aneurysma repair the following people are to be included in the plan.

- cardiologist interventional
- medical assistant cardiologist interventional
- heart surgeon
- preparatory doctor
- anesthetist
- medical assistant anesthesia

- jumper
- OR sister
- 1-2 people of the controlling room

The operation team prepares the operation room for the intervention. According to intervention the C-curve is aimed and the table is positioned, so that the best possible accessibility is given to the patient. See storage standards 6.2.2. The other equipment is aimed on the adjustment of the C-curve. It must be seen furthermore, e.g., to whether the surgeon is left or right hander.

The other operation equipment becomes removes introduced or opposed. Different carriages like anesthesia, surgery tools, organ, technical accessories, liquid care, heart lungs-machine, cutlery carriage are The required flaps, Stents are held ready etc. according to the measurement in suitable size. (extra productions should arrive on time and be early enough in the house, that with a breakdown which can be called off intervention still on time)

The transport and with it the transfer in the surgery shows juridical the handing over of the responsibility for a patient of a department to the next. Because the interventions are mostly minimum-invasive the patients from come at home.

Part of the takeover is to make available all data and facts of the patient with or to request and to examine. If the patient fulfilled all default for the release to the operation, the operation takes place.

OR intervention - Hybrid OR

Approx.30 min before the planned operation appointment is informed the get and Bring-service. The patient is already in the hospital and is sober (with patients which come from home)

Identification by information of the surname, given name (if available) of the patients / patients, room number (if available), kind of the intervention and the surgeon (or in exceptional cases after arrangement with anesthetist and surgeon).

Transport

The transport of the patient occurs as a rule in his own bed, or, however, through a transporter. The transporter is an object similar to bed, smaller and agile. New models are adaptive with the operation table and show a real working relief.

The takeover is carried out the takeover and the infiltration of the patient in the operation area. From this moment the surgery is responsible for the patient and his welfare.

The patient reaches first with other patients in a preparatory room, this room is heard to the operation area and waits here for his operation He is sober, wears an operation shirt and is cleaned.

Putting into another bed cannot be avoided for hygiene and sterility reasons completely. Also a transporter does not prevent this expenditure, however, makes easier the expiry and reduces the expenditure. In emergency situations if the hygiene is neglected a little the transporter can show his true use.

Then the patient is brought by his bed to a sluice and there on an operation transporter transfers with this he is led to the operation table and is transferred next time and now is ready for the intervention on the operation table.

Primarily preparatory measures

- Preparation of the OR table and the patient's sluice
- So that everything runs without problems, must be concluded before the patient it is transferred, all preparations. These are in the essentials:
- Lay stretched out patient's cloth on the patient's sluice
- Choice of the OR table
- Warmed up optical editions like Esemtan3 heating mat, to 1x optical varnish, patient's cloths and alternatively max. 10 min. red light lamp – body temperature
- Headrests, cover, OR table accessories (arm bowls, head clips, leg roles etc.)
- Patient's seat belt

Secondarily measures

- Allow to pleasant surroundings for the patient
- Provide rest
- Give constantly information about expiry and activities
- Protect intimate sphere of the patients
- Individual needs / wishes consider

Takeover of the patient of the sluice

- (impure area IMC)
- The escort (get and Bring service) announces the patients / female patients by the arrival in the patient's sluice in the operation department.
- Greeting by the responsible nursing person of the IMC.
- Put in to the headgear, filing of the operation shirt.
- Control of the ATS or bandages on correct seat free of fold
- (With absence of the ATS a bandage is put on as an alternative).
- Removing dentures, hearing aids, glasses, hairpieces, rings, Piercing
- (can be removed at special wish only shortly before anesthesia introduction)
- Removing hairpieces and wigs
- (can be left at special wish and after arrangement with the anesthetists / female anesthetists, provided that no metal parts are integrated)
- Handing over of the patient's documents to the operation assistant.

Written information to the operation staff on the form „sheet of information for the nursing operation team“ if jewelry, to substitute, prosthesis, hairpieces were not filed on the station.

3 Esemtan is an electrically heat able base, heating mat and protects the patients during the operation against under cooling. This lies on the OP table under the infertile optical varnish and covers from the OP table him urged stream. The heat able base is warmed at most on body temperature, because the OP room for hygienic reasons has no usual ambient temperature. (Wikipedia 2010)

Greeting

- Personal image of the operation assistant with name and function.
- Check of the identity of the patients / patients
- Gender, given name and surname and date of birth of the patients / female patients.
- Open question after the name is put:
- What is your name? When are you born?
- Information with ID tape is compared.
- Checked identity of the patients / patients is compared to the topical OP program. The array should be considered.

Check of the following documents by the operation assistant

- Patient's etiquettes, Cardex and X-ray picture bag is controlled on identity.
- Missing documents request.
- Forwarding important information existing nursing diagnoses to the instruments.
- (Form: Sheet of information for the nursing operation team, as well as nursing overview)

Realization of the operation documentation

- Open patient's file in the computer or anew put in.
- Nursing protocol OR, when required implant light,
- Settlement sheet and anesthesia-achievement sheet, preparation light,
- Release note for OR report,
- Medical arrangement protocol OR

Sluice

- Temperature control before transferring the patients / female patients on the OR table, the temperature control of the optical edition (Esemtan1) is carried out with the hand (body temperature).
- Follow from possible reactions with pre-medical patients.
- (temporal, spatial disorientate)
- Explain of the sluice process.

- Follow on possible impediments and movement restrictions.
- Consideration of individual needs.
- At wishes come: additional storage aid (e.g., knee role, cover)
- Open questions allow to clear and clear by surgeons and anesthetists'.
- Avoid from incriminating sights
- (e.g.: how blood, freshly operated patients etc.)
- Transfer of the patient in the introduction room operation with invested patient
- Seat belt in the thigh and cover.

Introduction room, OR

- Offer of the storage aid (knee role).
- Realization of preparatory measures for the anesthesia)
- (e.g., ECG electrodes attach)
- Clarification with surgeon whether a skin preparation is necessary.
- If necessary, see standard „pre-surgical preparation of the skin".
- Connection of the splints at the operation table.
- Prepare of the bag, yellow „esteem of denture" (marked with patients Label), if dentures, hearing aids, glasses, hairpieces, rings, Piercing were not yet stored. This is delivered intra-operative by the operation assistant in the IMC.
- Greeting of the patient by the surgeon and anesthetist

The available check lists and Guide-Lines have the disadvantage that they describe a linear expiry. This reflects the organizational structure of the hospital in single parallel departments again. This structure has the disadvantage which gets lost extremely a lot of time for transport and transfer achievements, because this method is structured not process-oriented and patients always by a department to the next must be transported and are transferred.

INTRA SURGICAL PHASE

The intra surgical phase describes the period from beginning of the anesthesia up to waking the patient. During this phase the real intervention takes place in the essentials, it concerns according to operation and complexity of the intervention, around a standard operation Procedure (SOP). It gives other concepts to describe this Procedure.

With a Hybrid OR intervention describes of the SOP also till detail the sequences and achievements, as well as the necessary aid of an OR. To the difference of a conventional OR the intervention is minimum-invasive and for the controls with the C-curve the intervention is briefly interrupted over and over again. Every intervention is still an individual event, patients are different. During the operations different people are in the operation room, they behave in exactly defined roles, her action and the expiries follow defined paths. There is a strictly hierarchical decisive structure and this includes an instruction right. Also in the Hybrid OR nothing has changed in this structure. All partners follow the word of the responsible surgeon who has to bear, in the end, the whole responsibility for the success or failure of the operation.

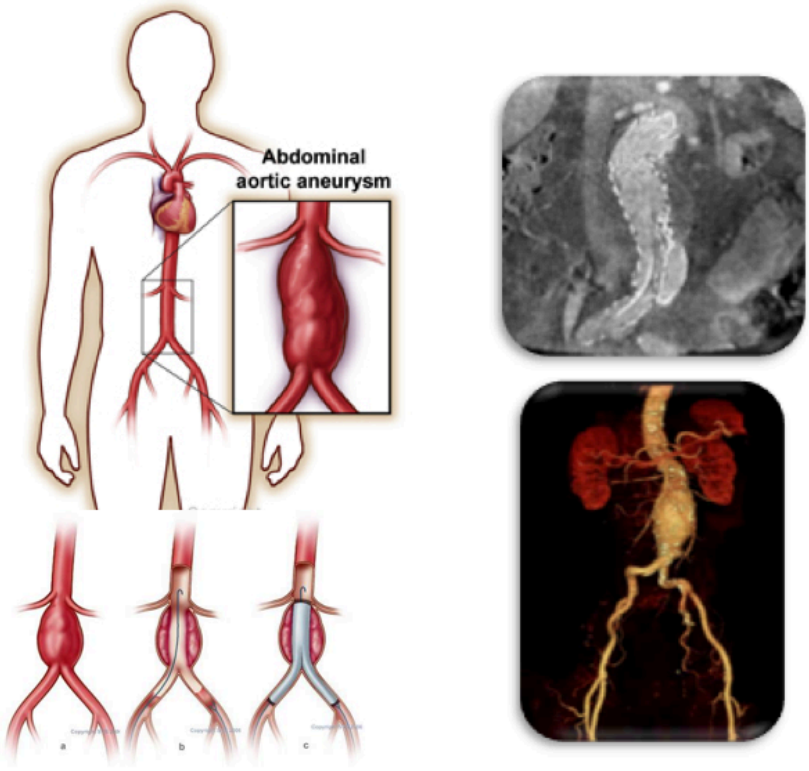


Illustration 33: Example of an endovascular aneurysm repair EVAR
The picture shows a serious expansion of the aorta (AAA) to fabric wrapping up Stents (Stents grafts) are led about the strip to the aorta and form a new vascular wall Stents there is in different dimensions, lengths, implementation and qualities, surfaces as well as qualities. (Spring: Philips, Sence and Simplicity, 7. Medizintechnik-Tagung, Inselspital Bern, Thema Hybrid-OP, paper, Swiss, page 12, 2010)

Another main focus originates from the cooperation of the surgeons and the employee among other things of the controlling room. The employees lead and support the surgeon by at the possession exhibit of the picture operation data from the outside, from the screen. This cooperation is new and substantially for the exactness and orientation of the surgeon at the operation table. By the transfer of a Stents endovascular aorta aneurysma repair nothing will leave to the chance. The patient is exactly measured and navigating there and then in the body of the patient happens precisely. Only so exact filing of a flap, a Stents, is generally possible.

POST SURGICAL PHASE

The operation assistant waits in the intervention room to the final control by the scrub nurse is finished and leaves the operation room when his question „Is the patients / female patients was answered to the out sluice released“ by the scrub nurse positively. The operation was minimum-invasive and, hence, a little incriminating for the patient.

To the security and a pleasant atmosphere is to be respected

- Provide rest (raised noise delicacy of the patient in the awaking phase)
- Protect intimate sphere of the patient.
- Constantly information about expiry and activities gives.
- Securing of perhaps invested drainages, rinses and drips.

Prepare of the out sluice

- Inform of the get and Bring service (HBD) by the operation assistant with information
- Names of the patient and the surgeon.
- Remove knee role etc.
- ATS or bandages check for correct seat free of fold
- Put on body belt
- Avoid warm loss
- (Patient's cover, bairhuggerfilm give in IMC)
- Patient's documents and prepare X ray pictures for transport
- Check ID tape
- (the ID tape intra-operative should have been taken, it must be renewed)

Out sluice

- The takeover of the patient occurs (IMC sided) through the DGKS of the IMC and the HBD.
- Explain sluice process to the patient.
- The out sluice of the patient occurs through the operation assistant in presence of the anesthetist.
- When required the second operation assistant or an operation sister is necessary.
- An operation assistant is not allowed do out sluice alone
- On movement restrictions, drainages, associations and drips pay attention.
- Drainage systems and drips lay during the sluice process on the patient (pleura drainage are clamped during the sluice process with two clips in each case)

Handing over to the DGKS of the IMC and the HBD

- Handing over of the patient's documentation and x-ray pictures by means of info pocket
- Medical information relevant for care is transmitted by the OP-DGKS or the surgeon to the DGKS of the IMC.
- Dismiss of the patient.
- Sluice windows / close door.
- After an intervention, after the out sluice and finishing the awaking phase the patient will keep by means of the Hybrid-operation room few days to the observation.

(Spring: Anderwald Gabriela, Interview, OR-Nurse Goldenes Kreuz, Vienna, 2010)

4.3. Hybrid-OR Advantages and Disadvantages

The high acquisition costs and production costs of the Hybrid-operation room are first the biggest hurdles, the running costs and those of the additional expenditure, by the management, should not be neglected also. The high costs of the installation of a Hybrid Operation room cause that it makes sense, the different professional disciplines must co-operate. In times of the economic crisis the hospital operators search possibilities to hold the costs low, and to create a maximum in use. This has the advantage that old confirmed barriers are diminished between the medical departments. The communication rises, the knowledge exchange increases and the patient profited. Costs are lowered.

Not only the costs are responsible for the fact that the otherwise so hostile professional disciplines go with each other common ways, but also because it simply makes sense. The pre sur-

gical phase creates new insights and possibilities by which it will be necessary to include his colleagues before the operation and to clarify questions.

The Hybrid Operation room makes several interventions at the same time possible which is a reason for the fact that only by opening the body exact information is not available to the surgeon. Thus it is suitable, e.g. that a heart surgeon and an angelology (vascular surgeon) stand together at the OR table, operate together and with it lower the number of the interventions by cooperation. Diagnoses earlier 2-3 interventions would have meant today can happen by the Hybrid OR in 1 step. By an exact preliminary planning the surgeon div is able. Problem formulations in rest study and discuss the forthcoming OR with colleagues various professional disciplines and plan. An exact planning contributes not least to the fact that more problem formulations are made visible. The pictures produced by the C-curve are evaluated by different teams and are processed (Spring: Stehr A., Heidrich M., Erfahrungen mit bodengestützter Angiolanlage im OP, (Artis Zee dFA) , Dissertation: “Perspektiven für den Hybrid-OP“, Forum Gefässmedizin, Regensburg FRG, page 11, 2010)

The costs of the arrangement are high, this is a big disadvantage. The procedure needs several staff, the building cost are higher, the demands for the statics of the house high. As a rule the arrangement can be seldom moved in an existing structure of an existing hospital. What entails that a new Hybrid Operation situation must become tilled or fixed. All this are add-on costs which raise the price of the production of the arrangement. This investment can be justified only economically if enough patients are available. If the hospital management is also so structured around the operation room that the company can be functioned smoothly and a maximum extent of utilization be guaranteed.

By huge shortening of the intervention times and nursing times, as well as by a strong lowering of the load by the intervention for the patient, can be operated not only highly old patients who were not treatable before any more, but it also spares the costs of the health insurance scheme. For example, after a heart operation, via the strip, patients need partly hardly more care, because the chest was not opened. The patients can leave the hospital in few days, 1-2 days. A customary heart-operation with the need the chest has to open, to the result that the patients need afterwards 3-4 weeks of care and need partly a huge number of heavy drugs. A customary intervention with opening the chest is for the whole body an immense intervention and load to which old patients have not mostly grown any more. The physical load by the intervention is too high. The next medication load continues weeks. (Spring: Walther T., Herz-

chirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 26, 2010)

The costs of both operation models, those of the construction, the equipment, the staff, the interventions and the accompanying costs and consequential costs are towards block. Also the costs are for the following care, as well as drug consumption, as well as the economical losses tax-is cancelled by salary loss (buying power loss), insurance achievement and.

Should the patient not be yet in pension, he can resume by the intervention by means of a Hybrid Operation within one week his work. The costs of the area health insurance schemes, by low sick person's states are to be included also. Towards him stands higher personnel expenditure and cost. Without new models of the health insurance schemes for the financing of the interventions by means of a Hybrid Operation room these operations will be financeable only seldom. I.e. the costs and food savings must be checked analyzed, statically and be confronted. The health insurance schemes must transmit the food savings by lower sick person's states and lower costs by new models and promote the construction of a Hybrid-operation room. The whole system, from the politics up to financing, is demanded to leave from old structures and to break new ground.

4.4. Hybrid-OR, Technology and Function

Example of the C-curve of the Company Siemens becomes here the technology Described. C arm CT. (syngo DynaCT) and 2 D/3D

The C-curve exists of a foot, an arm with a number in joints and a C-curve which has the job to lead the detector to the patient. The foot has to hold the job the arrangement and to deliver the appearing forces to the construction body, which is why a sufficient statics of the building is necessary. The foot must be oscillation-decoupled, because, otherwise, the oscillation transference of the apparatus would concern the whole building and could have these static results. The appearing forces are because of the mass of the apparatus, in combination with the discharge of the arm and the movement speed, terrifically. Hence, Siemens offers different models, ground, and wound, cover-mounted. Depending on how the given architectural situation is (Spring: Steinbauer M., Implementierung von neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 4, 2010) The ZEEGO is a robot arm which has the advantage to be very highly competitive. Accordingly largely become by the movements the discharge, and thereby the originating forces. The C-curve is virtually same with all manufacturers, these are stones which are bought more and the design comes from the "manufacturer". Differences concerning the question, as the C-curve comes to the OR table, are given by the philosophy of the manufacturer (Spring: Joch A., Interview, medical technical Manager Siemens, Vienna, 2010)

There are the C-curves in different dimensions, construction depths and with different achievements. There are mobile, semi-mobile, covers, ground-mounted and wall-mounted arrangements. All C-curves are equipped with sensors which should prevent collisions. The big differences between both manufacturers are the control and the mechanics. While Siemens offers a huge number of products, for all conceivable situations, the company Philips concentrates upon the cover system developed by them, and offers only this system (Spring: Thomann G, Interview, Hybrid-OR-Manager Philips, Vienna, 2010)

The difference is a question of the expenditure of the investment, the place need, the control where is the C-curve is placed and how the movements are in the OR room are. It is a question whether cultivation or new building. A question of the philosophy whether the ground should remain free what eases certainly of the cleaning and the observance of the hygiene or one tries to get by with a rather more slender solution and saves costs and expenditure.

From it the question results according to the image as the work routine should be in the operation room. The C-curve is driven constantly there and is taken away. An arm like the ZEEGO needs own position and "moving street" to be able to work. Other devices are less demanding and admit more room of interaction for the team. The movements are a very essential criterion, because in the extreme case, numerous people work under pressure and the health of a person stands at stake. The movements of the C-curve are partially very quick and jerky, so that the team must be put on it. This meets above all to the anesthetist, not only him. The necessary freedom of movement of the C-curve determines the installation location in connection with the cable lengths and room proportions (Spring: Steinbauer M., Implementierung von neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 9, 2010)

Level Detector Technology

It has asserted itself, in the meantime, the level detector technology. That is the fact that the detector is especially level and at the same time wide. This has the advantage, that a big detector surface which is better applicable extremely level and in order to save room, for the doctor. In spite of the fact that the OR rooms are big accordingly it is narrow around the patient and a scrum rules. Furthermore it simply saves with the diameter of the C-curve and with it by the room height, so that one becomes more adaptable in the continuance. The projections are free of distortion and distinguish themselves by high pixel depth. The technology is produced by the company Trixcell, proficient Philips and Siemens are additional buyer and use the knowledge. (Spring: Strobel N., C-Arm CT (synco DynaCT) und 2D/3D Überlagerungen zur Überlagerung von Abdominellen Aortenaneurysmen Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 4, 2010)

Size	30 x 40 cm
Szintillator	CsI
Detector matrix	1920 x 2480
Pixel size	154myM
2D extended difinition	3,25 lp/mm
Pixel depth	14 bit

Illustration 34: Technical specifications of the standard detector IR
Technical data of the C-curve heads. The data are valid for Siemens as well as for Philips, both insert the technology of the company Trixcell. (Spring: Homepage Trixcell)

Illustration 35: Level detector C-curve head
The picture shows a level detector with the technology of the fa Trixcell. Is to be seen clearly are the control keys in the detector. These are again on the table or on a mobile unity. This serves the control of the C-curve. (Siemens Medical Solutions Angiography, in 2010).

A standard detector for the C-curve, as he finds in Hybrid Operation Room exists of two components

- from a Scintillator.
- and a detector matrix.

The scintillator exists of cesium iodide, this are very fine, very close packed micro fibre ø 2-3 myM, and have the job to steer the x-ray radiation vertically on the matrix. Coming in the matrix, the rays are point-exactly registered and passed on.

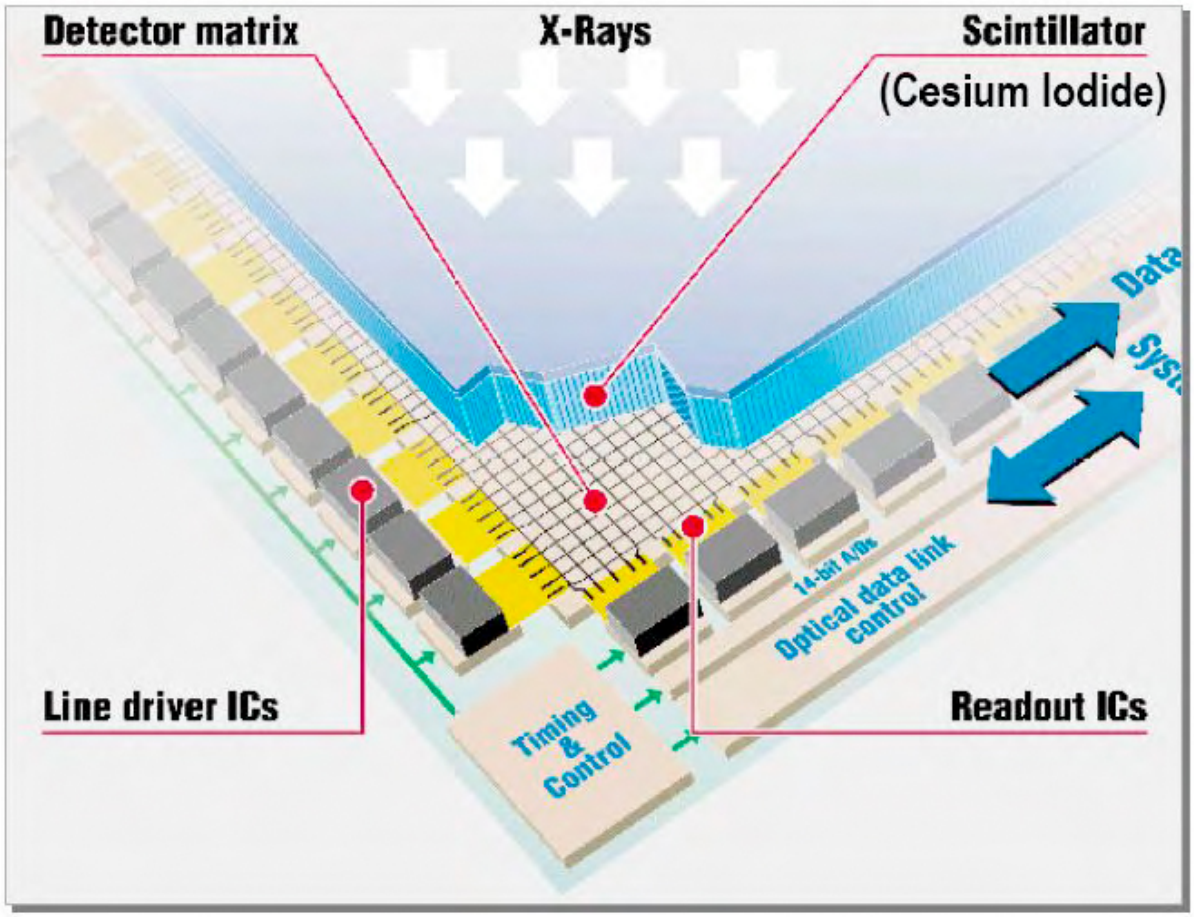


Illustration 36: Construction of the detector, Trixcell
The picture shows the construction of the detector of the company Trixcell. The application of these electronic stones means digital x-ray examination. (Homepage Trixcell, in 2008)

The high density of the microfiber is vital for the resolution of the pictures. The information is thereby steered on the matrix, without the rays mix and the information overlaps. This is the condition for the achievement of the EDP to generate 3D-pictures from this information and to allow an around look of the organ on a real-time basis. Then the information must be passed on as a result of by the matrix accordingly to the ICs (processors). High capacity calculators generate 3-dimensional pictures, these dye according to surface and create thus for the surgeon and his team of exact 3-dimensional models of the patient. The models are movable in the screen by which the doctor can consider himself, for example, the heart of all sides without moving the patient and opening the breast room.

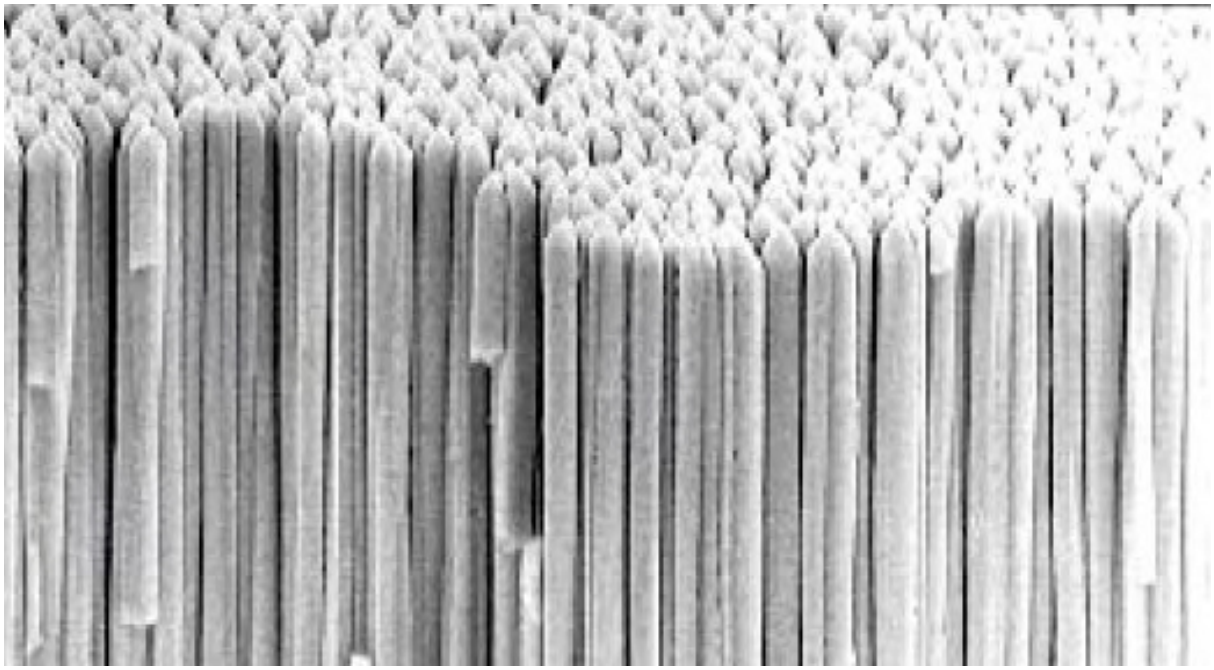


Illustration 37: Representation scintilator
The picture points, with ø from 2-3 myM to big Microfiber which are responsible for the steering system of the rays vertically on the matrix. (Homepage Trixcell, in 2008)

C-curve CT

The expiry exists of data admission. 2 x 300 projections in 5 or 10 seconds. This information more typically 2D X-ray pictures, is generated and reworked. (A volume reconstruction) The result is sharp, clear 3D pictures which appear to the doctor on the screen. There originates visualization. The movement curve of the C-curve, There is to two eccentric rotations, from 220 ° around the patient. One calls this Trajectories and has the sense to avoid own shade by overlapping. The C-curve forward and backward driven, both paints the patient is analyzed, both paints the projection corner is another, this also serves to be able to lighten in every "hole" and to have at disposal a huge number of projection corner.

Trajectory of Portrait Dyna CT Artis ZEEGO

The C-curve is got from his park situation and approaches the patient, the OR-table. They’re coming, the C-curve carries out curve 2 eccentric rotations around the patient. Once in clock-wise and once against clockwise. He makes this around the so-called. To hold radiation shade low or to switch off. The single projections are combined for 3D picture and are generated. A

bigger room cover is also achieved by this procedure in comparison to the traditional DynaCT detector roads. The representation of the volume height amounts to 25 cm, e.g., a good cover of the abdominally aorta is thereby given to the order of the Stents. A detailed representation is given by the high resolution to the control of the Stents.

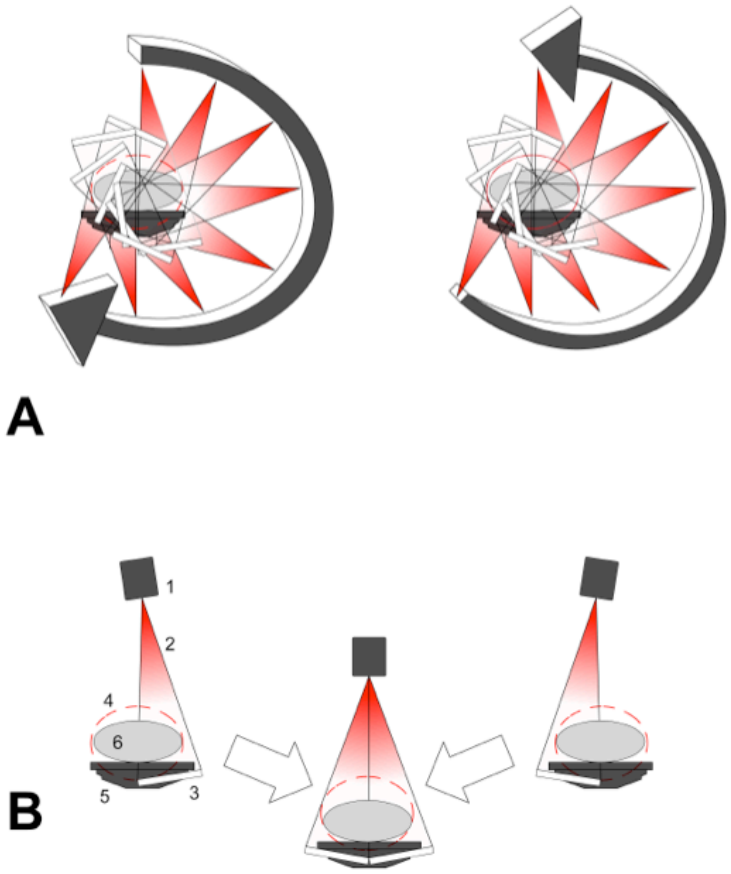


Illustration 38: Motion path of the C-curve
The picture shows the motion path of the C-curve which corresponds a parable - Trajectorie. The patient is circled irregularly. Representation A. The information from before and return is brought together and formed to 3D picture. Representation B. X-ray head 1, ray funnel 2, level detector 3, 4-area of the maximum radiation density, 5-OP table, 6-patient (spring: own representation)

[8] The Trajectorie (also: Trajectory, local curve, flight path, flight curve and throw parable, flight parable, road parable, local parable as well as way) calls a local room curve along which a point-shaped body or the main focus of a stiff body at a certain speed V moves. The pure description of the movement is called kinematics. In physics she mostly has the symbol see (from lat.: spatium = "way", "room"). (Wikipedia 2010)

Picture Correction

From the C-curve taken up pictures must be corrected, as in the classical photograph. The correction exists of different procedures which are automatically carried out, so that the employees must not stay in the controlling room with it as a rule (Spring: Strobel N., C-Arm CT (synco DynaCT) und 2D/3D Überlagerungen zur Überlagerung von Abdominellen Aortenaneurysmen Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 7, 2010)

- The commonly necessary corrections are:
- Litter ray correction
- Ring correction (like the Newton's rings)
- Projection correction the cut-off projections are corrected here.

All corrections in sum devotedly clear and sharp pictures, how well this shows functioned the confrontation.

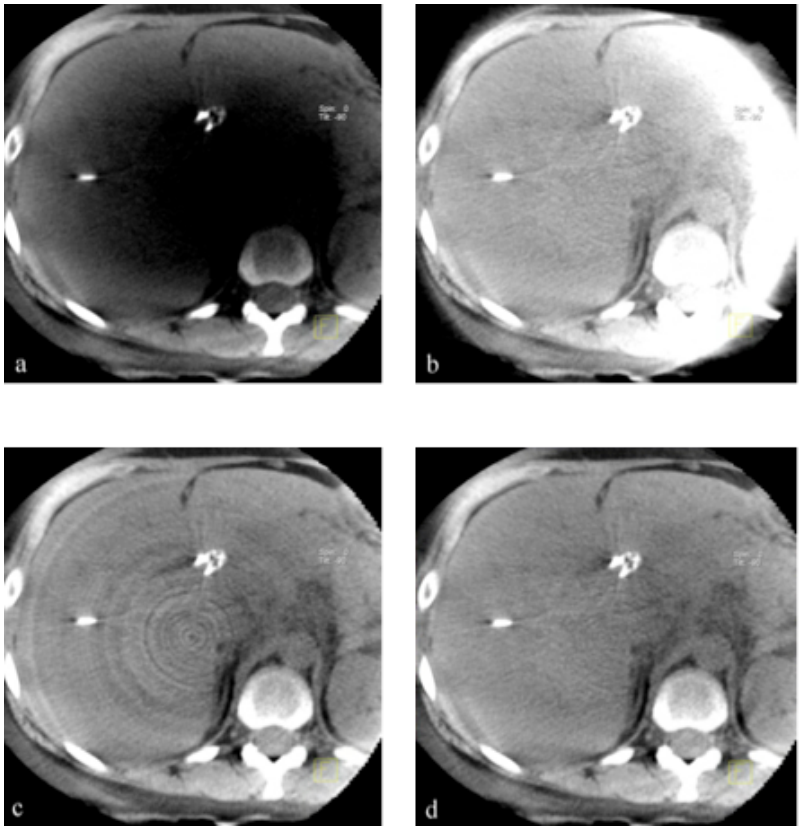


Illustration 39: Picture of projection correction
The picture shows on the left the necessary and automatic corrections. a) Admission without litter ray correction. b) admission without correction of cut-off projections. c) Admission without ring correction. d) admission with all corrections. (Spring: Strobel N., C-Arm CT (synco DynaCT) und 2D/3D Überlagerungen zur Überlagerung von Abdominellen Aortenaneurysmen Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 7, 2010)

5. Hybrid-OR Arrangement

A Hybrid-Operation-unity exists of a technic room, an operation or intervention room and a control room. Furthermore sluices and camps are in close vicinity to the operation room and must be well accessible. Additional there is the initiating room, the washing room as well as the disposal room.

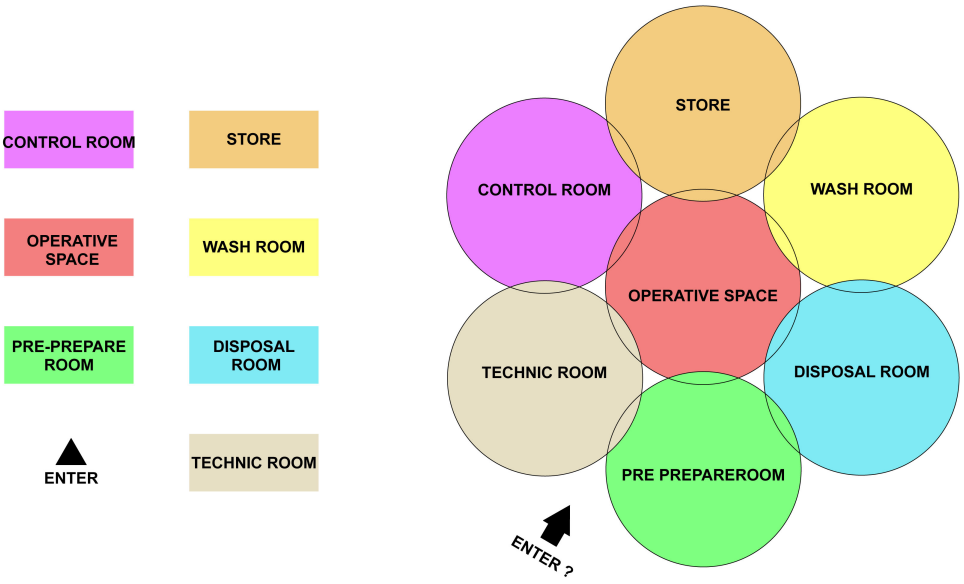


Illustration 40: Hybrid operation room, bubble functional model arranged
The bubbles-functional model puts the necessary rooms in relation to each other to take without taking into consideration the actual size. (Spring: own representation, Masterthesis MBA 2010)

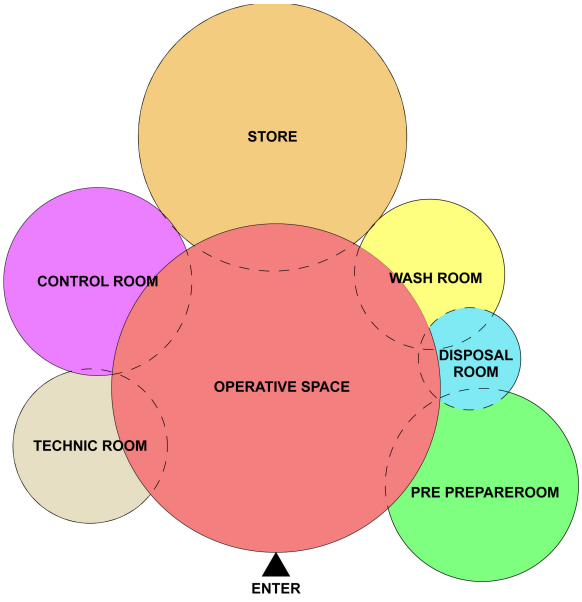


Illustration 41: Hybrid operation room, bubble functional model after function weights
(Spring: own representation, Masterthesis MBA 2010)

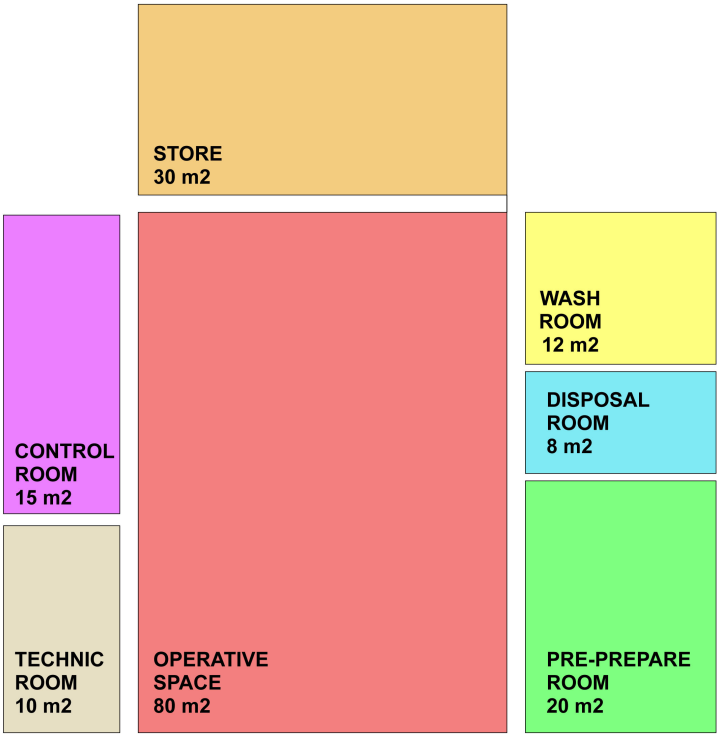


Illustration 42: Room functional model draught Hybrid Operation room
The room-functional model arranges the possible situation of the rooms. and if a basis for discussion explains for a preliminary draught. Proportions, surface and arrangement already correspond partly what is demanded. (Spring: own representation, Masterthesis MBA 2010)

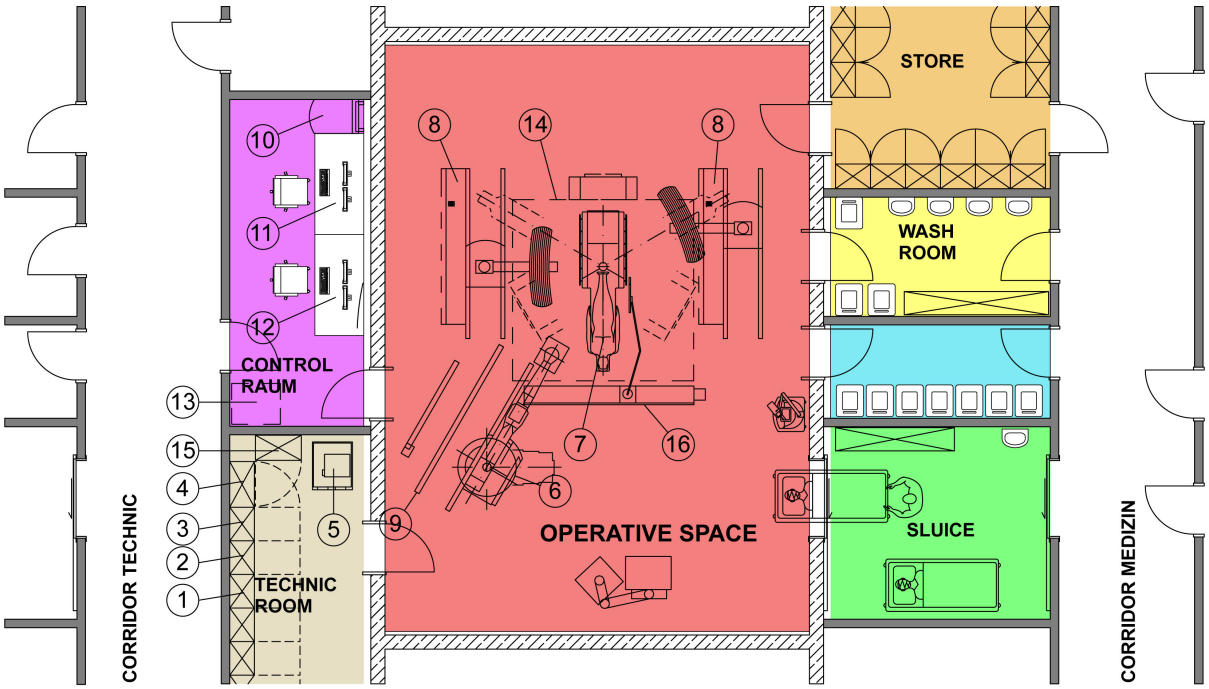


Illustration 43: Plan Hybrid Operation room
From the preliminary draught, a plan originates flat in the graduation 1:100. With the representation of the pieces of furniture expiries can be illustrated and be discussed. (Spring: own representation, Masterthesis MBA 2010)

5.1. Intervention Room

The intervention room or operation room, corresponds in his architectural implementation to the legal ones or the suitable to norm to climate-technical demands, as well as the hygiene and sterility regulations of the house. A Hybrid operation room is at least twice as big on account of the devices like C-curve, screens and for the suitable interventions to necessary people. (I.e. instead of 40m2 at least 80m2). The intervention room has certain proportions in the ideal case. The ready room height should amount to 3.2 m and must be corrected according to equipment upwards. In the room available statically props and wall discs are to be avoided. The C-curve in the Hybrid operation room generates X-rays, which is why a suitable wall construction is to be followed to the next rooms (Spring: Gahlen J., Wie plane ich ein Hybrid OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 17, 2010) The wall construction corresponds the German Institute for Standardization DIN 6812 in which the demands are regulated for architectural radiation screening. The thickness of the necessary protective coating is depending on the tube tension of the used device typ. With concrete or massive construction the mass of the building material reaches as a rule even as a protection. With non-weight-bearing inner walls, hollow hole brick or walls in dry construction method an additional screening must be achieved. Here there are system solutions, consisting of tilted metal elements which are composed on site and are screwed together or foils of lead or substitutes are used. The value of lead of a material brags, which thickness of lead in mm which is equivalent screening effect of the material

Information about different values of lead of different building materials is included, e.g., in the German Institute for Standardization DIN 6812 tab. 16. The industry has numerous products on offer the solutions ready for every detailed connection offer. The arrangement is able according to manufacturer, cover be wall-mounted ground, or and be movable according to achievement simply or several times. The room size and the necessary room proportions are directed after the size of the device, as well as the necessary freedom of movement. (Spring: Strobel N., C-Arm CT (synco DynaCT) und 2D/3D Überlagerungen zur Überlagerung von Abdominellen Aortenaneurysmen Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 11, 2010)

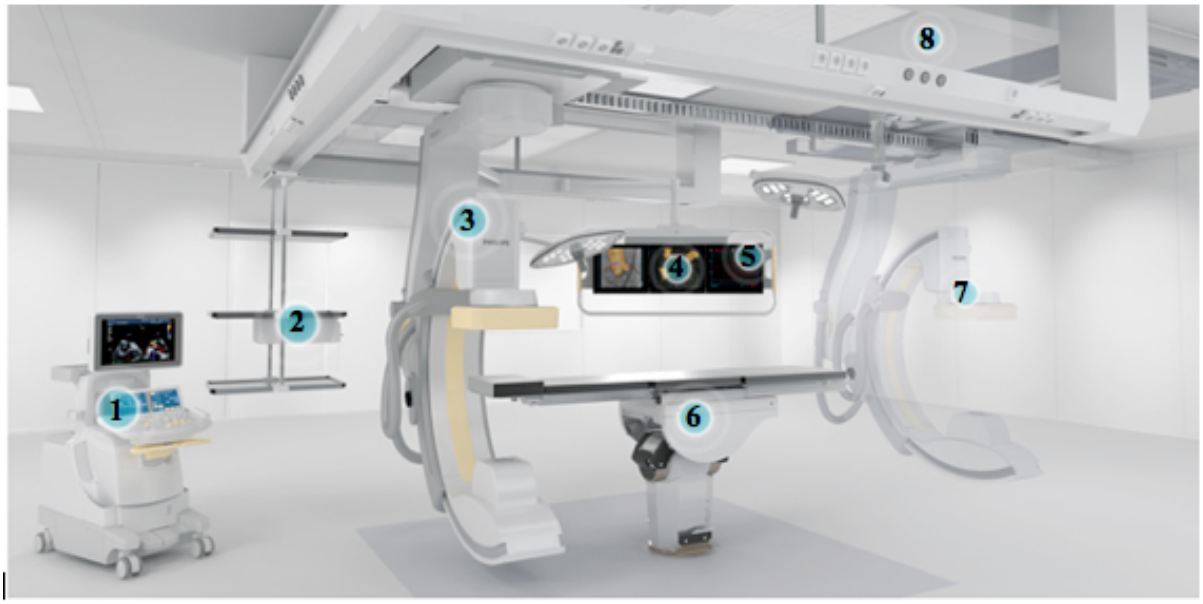


Illustration 44: Hybrid-Operation room, media bridge system solution Philips
The picture shows, the system solution of the fa Philips, the so-called media bridge. This rail bridge mounted in the cover (8), is patented and corresponds to the hygienic requirement room class 1A in accordance with. German Institute for Standardization 1946-4 for Cardio Vascular surgery and neurosurgery. At the same time become in this bridge for the installation div. Gases, stream and other technical lines uses. The rails are multi receptive. That is all modules, like screens (4), shelves (2), OP lights (5), can be led by the rail. The C-curve is led also in the park position by means of the rail (7) (1) side tables OP with control (6) Operating table, fa Maquett (homepage Philips, http:// www.healthcare.philips.com/main/shared/assets /images/about/events/2010/Gold_Hybrid_Standard_OP_560.jpg, in 2010)

The screens are mounted on movable and tilt able arms or Rack, and should be positioned in such a way that they cannot collide with the C-curve. In a Hybrid-operation room two tilt able arms with screens (on the left and to the right of the OR table) exist as a rule.

This is also the reason, why the fa bundles up Philips the support shafts for the various devices on the so-called media care bridge. With it more order is created in the OR and collisions is avoided. The bridge creates that the ground remains free and it can come for no impediments (Spring: Thomann G, Interview, Hybrid-OR-Manager Philips, Vienna, 2010)

There is if the position of the C-curve and the position of the anesthetist passed away solution attempts with regard to the adjustment and positioning of the operation table.. In principle the anesthetist must find a new position in the OR room, because him the C-curve takes away place. This is not always light and must be well planned.

5.2. Technic Room

The technic room must show the necessary size of approx. 10-12 m² and be obvious possibly the operation and controlling room. The technology room serves the admission of technical devices which are needed for the company and the care of the C-curve. Furthermore this room is used around perhaps required equipment which should not be in the OR to accommodate such as USV, generator chill unity, etc. (Spring: Gahlen J., Wie plane ich ein Hybrid OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 13, 2010)

It is, so to speak, the engine room of the C-curve and by the restrictions for technical reasons of the cables and inlet lengths; the technology room should not be further removed than 4-5 m from the C-curve. With increasing distance the quality of the pictures decreases by overrun. The situation of the room is to be aimed in such a way that the C-curves is not limited in his movement.

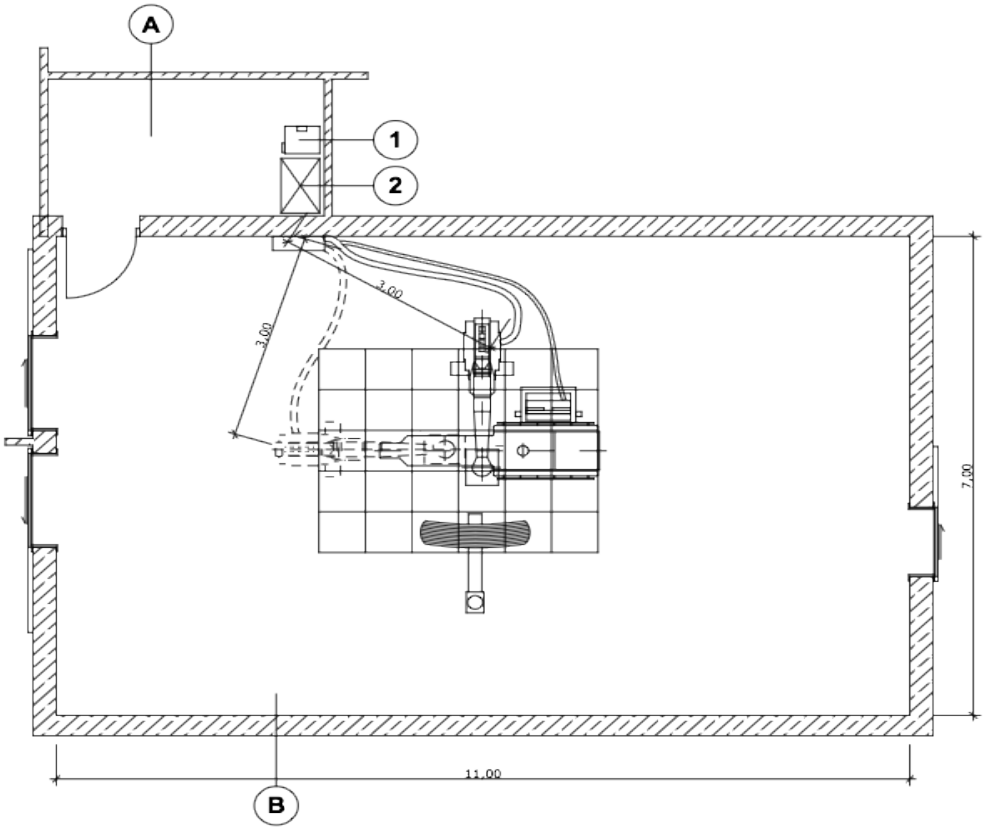


Illustration 45: Technic room of Hybrid Operation room
The picture shows the situation and position of the technic room, (A), and the intervention room, (B). The OR-room has 77m2, the table OR is arranged centrally. The care cables should be no longer as 4 m. The C-curve can freely move around the OR-Table. The image quality is guaranteed with it (spring: own representation)

5.3. Control Room

The connected control room, serves the employees by means of a view contact window with look to the OR table, to support the surgeons. The eye contact window is impervious X-rays; it is communicated by means of a speech arrangement. In the control room the pictures generated by the C-curve, are selected, worked on and modified. The pictures were matched with the planning. The selection is necessary because the C-curve generates a flood in pictures. The worked on pictures are provided to the surgeon during the OR. The pictures during the intervention are generated, were matched with the pre-surgical phase by which an optimum is guaranteed in control and planning.

Illustration 46: View window control room

The picture clearly shows the view connection between the technology room and the intervention room, the operation room. The employees in the technology room support to the surgeon in whom they work off the pictures created by the C-curve and balance with the admissions of the pre-surgical phase, the planning phase and matches. The coordination and communication between surgeon and employees is especially important. (Philips, Sence and Simplisity, in 2010)

Furthermore the data are fed for the other processing into the EDP system of the house and serve the administration of the patient. The narrow communication between the operation room and the control room is essential. These are as a rule from two to four jobs for an operation room enough. The size of the room amounts on an average approx. 20-24m2 (Spring: Gahlen J., Wie plane ich ein Hybrid OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 21, 2010)

5.4. Store Room

The store room or the infertile good camp, serves the storage of medical materials which are used during the operations. It is to be assigned an infertile good camp and according to the intervention room. One time devices, but also Stents, heart flaps and other medicine technical products are stored. A direct access of the operation room to the camp is necessary compelling, the camp cupboards and safekeeping systems should be observable by glass doors etc. from the outside without an opening of the cupboard is necessary, that the searches make in stressful situations during the intervention lighter. Store rooms are consignment stores that is also that should not be really saved with the place. Bigger supplies are thereby possible, the education of the employees is given by the communication among the employees what lowers the costs and lifts the quality (Spring: Steinbauer M., Implementierung von neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 15, 2010)

Illustration 47: Hybrid OR store room
A small camp with well closing doors shows the picture, however, with glass fronts. With it the right thing can be searched without having to open the door. Thus employees the night services are able also perform or helping out to grasp better, the continuance. (Spring: Steinbauer M., Implementierung von neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 15, 2010)

5.5. Sluice

The sluice, the room where the patient for the operation is prepared, must be formed greater than with a conventional operation room, with it is guaranteed that is prepared during the next patient, the patient who is already operated, easily goes past to the new patients. Ideally two possibilities for the positioning should be created by beds. Furthermore is to be paid attention to the fact that a free from problems bringing into play of the beds is guaranteed.

5.6. Wash Room

The wash room, that room in itself the team before the intervention washes and moves is in the essentials like the customary washing room of an ORs. The washing room should have a sluice effect and be positioned thus that enter all staff, as well as visitor by the washing room the operation room and must leave. At least three wash basins, refuse bins and spinte are necessary. The necessary size amounts approx. 12-15m2.

5.7. Disposal Room

The disposal room must dispose of a wash basin and a basin of rinsing and should enter on very direct way from the intervention room and can be left. He serves decontaminating of human fabric which results with the operation, as well as other medical rubbish.

It is essential, that the disposal room without disturbing the operation can be cleaned and be looked. This entails that this room also, as a sluice is to be equipped with two doors. The cleansing staff is to be entered not authorized the operation room.

6. Hybrid OR Equipment

Various medical devices and pieces of furniture which allow a Hybrid Operation to company are called equipment elements of an operation room. The principal item is the C-curve and the operation table. Besides, it concerns as a rule modules and components which are offered by various suppliers. As an example the table can be called here. Tables are offered in the essentials by three famous companies, the Hybrid Operation interior decorator, Siemens, Philips are functional intermediary. The elements are produced by specialists; Philips and Siemens assemble this and expel this. It is advisable to limit the assignment order to a partner, because, otherwise, a huge number are to be used by interfaces. Thus this is the subject matter of the contract of the contractor (Spring: Joch A., Interview, medical technical Manager Siemens, Vienna, 2010)

6.1. C-Curves

The C-curve is common with the operation table the heart of the Hybrid Operation room. There are different suppliers who represent different solutions. Today this are cover-mounted and ground-complained devices in the essentials, the wall assembly could not assert itself really, just a little the C-curves which exist of two C-curves. (a curve for the horizontal one and one for the vertical measurement)

The mobile devices which are in the market are low-performance devices, they create approx. 2 kW, this does not make sense for a Hybrid OR and, hence, no real alternative. These are mobile units which resemble the X-ray devices from the 60s very much; they play with a real Hybrid-operation room on account of the low achievement, but no role. Since by the low achievement the brightness of the pictures is too low, the resolution does not reach for the image quality is not satisfactory for a Hybrid Operation room.

The brightness is a measure of the energy of the X-ray radiation which is available. The body must be virtually analyzed, so that enough information comes with the matrix. If this is not the case, the pictures are inexact, blurred and contain not enough information around a detailed Rendering to allow. Pictures without detail as well as blurred would be the result.

Hence, the mobile devices cover niche areas in the operation room and are for professional Hybrid Operation equipment no final solution. These are solutions which are purchased, in addition to be integrated when required with to remain adaptable.

In the European room Siemens and Philips are the mostly represented suppliers of system solutions for Hybrid Operations. Asian companies press, in the meantime, for the European market.

6.1.1. Siemens

The company Siemens virtually offers all possible semi mobile units. The high product is of the ZEEGO which is comparable with an industry robot arm and approaches when required from his ground-mounted park position the operation table to return afterwards again back in the park position. The company Siemens prefers generally the ground mounted system, because it can come with her cover-complained system to problems with the hygiene.

In the operation area no open joints and constructional areas are permitted. With the open rails it comes by wear of the rails to problems above the operation table by which the hygiene edict A13 is not guaranteed. Furthermore it comes to a collision with the Laminar Air Flow by which this must be interrupted. There can also be, according to room geometry, place problems with the other hung units, as screens and lamps etc. The ground-mounted system of the company Siemens, ZEE or ZEEGO has these problems not and is if the operation room is big accordingly, a well thought-out solution.

6.1.2. Philips

The company Philips offers exclusively a cover-mounted system. There is of a running around frame, an apron which releases the area above the operation table. The problems with the hygiene which can originate from wear etc. were solved in which the construction method, the media care bridge, a running around was chosen so largely that the operation table remains free. All operation equipment elements, like the C-curve which can be accommodated screen arms, the lights, gases and stream in this bridge.

The rails are always closed in spite of mobility of the C-curve, so that it comes to no hygiene problems and the operation class A1 is guaranteed. These architectural aprons which are mounted running around the operation area guarantee a ground clearance; the C-curve can reach every point.

Illustration 48: Mobile C-curve Siemens
The picture shows a C-curve, with a small detector he is relatively low-performance. This C-curve sees the same way the C-curve of 60.th even today very much and is no C-curve for the Hybrid-Operation room. (Homepag Siemens Medical Solutions, Angiography, in 2010)

Below with this rather outdated model the emitter is clearly to be recognized by the C-curve and the detector. While the emitter is so big even today, as shown, the detector is not any more in the state of the technology. In the meantime, very level detectors are available, this has the advantage that the surgeon substantially better in the patient comes come on in other respects the handling is much easier.

Illustration 49: Mobile C-curve Philips
The picture shows a C-curve with a level detector which makes easier the access to the patient and produces a bigger screen window. The ray head became increasingly around the achievement to rise. (Homepage Philips Operating theatre in 2009)

Semi mobile arrangements are able wound, cover as well as be ground-complained. However, these arrangements have not asserted themselves really and are offered even by a company. The handling is complicated and not is suitable during an operation.

They cover and ground mounted arrangement is the most frequent, because these arrangements of the handling are the easiest ones and also the freedom of movement remains given for the staff in spite of restrictions.

The company Siemens offers devices with different achievements in different dimensions. Thereby it is rather possible to reach the installation of the C-curve in existing hospitals. However, in addition compromises are necessary, because as a rule the smaller C-curves are too weak and the achievement-strongest device of the company Siemens is similarly big, how of the company Philips. The management strong devices need a lot of place, movement room and above all a suitable room height which exists in the continuance seldom.

By a cover complained arrangement, as illustrated (Siemens), a problem with the hygiene appears. Because the guide rails lie with the model of the company Siemens very closely together and exactly above the operation table. The originating wear of the rails puts an essential interference of the hygiene there in an OR. Because this rails, with the model of the com-

pany Siemens are mounted directly above the operation table and with it about the patient this model is not really suitable.

Furthermore Siemens is hardly sensibly possible with the system of the company for the bringing into play of the Laminar Airflows what is another essential disadvantage. Therefore, the company Siemens goes more and more away from this model and concentrates upon the ground-mounted C-curve in different achievement areas. The company Philips offers exclusively a cover-complained arrangement with an achievement. The company Philips solves the problem with the rails by the fact that the rails are closed and are mounted not directly above the operation table, but take a distance of 3.2 m to each other. Hence, the rail system poses no problem, but offers the possibilities of the assembly to numerous operation equipment to elements.

Illustration 50: Ceiling mounted C-curve Siemens
The picture shows, a cover-mounted, at rails of movable C-curves of the company Siemens. Clear are to be seen the problems that the rails are precisely above the operation table. This solution does not correspond to the hygiene standards of an operation room (Homepage Siemens Medical Solutions, Angiography, in 2010)

These arrangements are more efficient than the so-called mobile arrangements, however, show still a compromise. The curve is small; the achievement does not reach yet desired 100 KW. For it these semi mobile arrangements still build in soonest in existing rooms.

Illustration 51: Ground mounted C-curve Siemens
A ground-mounted C-curve shows the picture which relatively near the operation table fixed on the ground is anchored. This model is not already an achievement-stronger type with four joints. (Homepage Siemens Medical Solutions, Angiography, in 2010)

The state of the technology is achievements of 80-120 KW. 30 high-contrast pictures per second of the inside of the body are thereby possible. According to manufacturer the C-arm units are mounted passed away and steered. This achievement creates without problems the model Artis ZEEGO of the company Siemens as well as the product of the company Philips.

Both models, from Siemens and Philips, need an accordingly big Hybrid Operation room with at least 80m2 (the greater the better), with suitable room height of at least light height 3.0 m. The height of the false ceiling as well as the assembly possibility is to be considered for the C-curve.

The statics of the house must be able, e.g. to take up the huge forces of the Artis ZEEGO of foot. Because the movements are quick and strong, the demand is big to the statics of the house accordingly.

The required movement room of the ZEEGO is huge. Is to be considered that OP rooms are never cleared up in such a way as this is shown on the pictures. The firebreak which is required the ZEEGO substantially this increases the operation room substantially. Hence, the ZEEGO is mostly mounted in a corner of the room and needs a free access to the operation table. Numerous additional ventures and equipment elements restrict the room, so that only that's why the room belongs accordingly largely planned.

Constructional this means that the construction body has huge point loads with across tensions for taking up, which is why this model is not mountable in the continuance mostly. Another problem is the dimensions of this arrangement, as well as the speed at which she approaches the table.

Illustration 52: Ground mounted C-curve ZEEGO Siemens
The picture shows a Hybrid-operation room to C-curve which is led by means of a robot industry arm. The mobility is reached by seven joints. Clear is to be seen the place need, the free room before the OP table where ordinarily the anesthetist is positioned. The big interpretation, overhang generates ernormously forces which must be delivered in the construction body by decoupling of the oscillations. (Homepage Siemens Medical Solutions, Angiography, in 2010)

The company Philips goes quite different ways. She forms around the operation table a centre, consisting of a rail system, distance 3.2 m which circumscribes the operation table. Thereby it comes not only constructional for a better distribution of the forces in the cover there this better be delivered to the construction body, but there also originates another room geometry. Because the rails run not through the operation table, but with a distance from approx. 3,2m are mounted, no more danger exists for the patient. Of the Laminar Airflow is to be introduced without problems. The ground remains free and shows a substantially more hygienic solution. The company Philips has perfected the draught of the cover rails so far in which it all operation accessories, screen Rack, lights, filing etc. on this rail can mount.

The room use is substantially more central and optimized, the operation table is the centre. The required ready room height is and about the hung cover an installation room is necessary. The achievement of the C-curve of the company Philips and of the company Siemens ZEEGO is the same. The stones are covered by the same manufacturer and are packed in another system. However, the company solutions are very different in the result. While the company offers to Philips a very well-balanced solution with the patented rails, it seems in such a way; as if the company has Siemens still problems to manage the service and the everyday Handling.

Illustration 53: Ceiling mounted media bridge Philips
The picture shows a Hybrid-operation room with C-curve as a system representation. The C-curve is led on this rail bridge to the desired position. All operation units, as for example screens, can be fastened to this system. (Homepage Philips Operating Theatre in 2009)

6.2. Operation Table

The demands for the Hybrid Operation room more differently of medical departments, like casualty surgery, orthopedics, cardiology or neurosurgery or angio-surgery differ substantially each other. The different demands for the operation table are directed after position of the intervention, head, and breast belly, the size of the team and to the kind of the planned interventions. Thus the OP table for an angio arrangement needs substantially less place than the operation table for the heart surgery on which every now and then 16 people work. (Spring: Steinbauer M., Implementierung von neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 6, 2010)

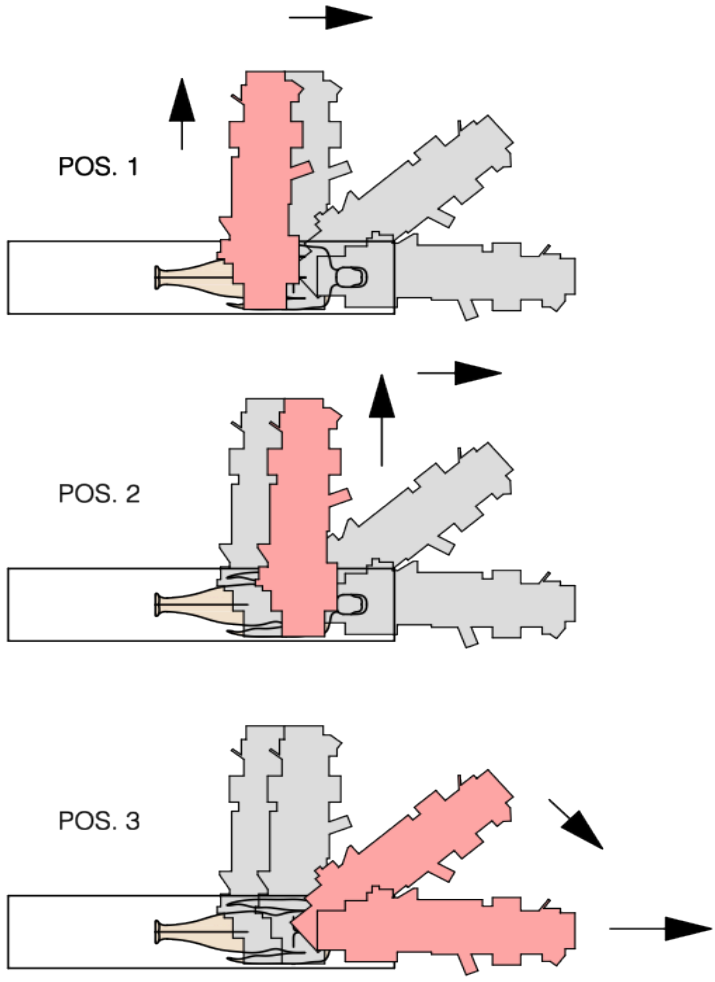


Illustration 54: Table position of the C-curve
The picture shows the different orders of the C-curve around the operation table. According to intervention the C-curve takes another position at the operation table. The conventional position of the anesthetist is endangered and must be solved anew. Pos1 vascular position, Pos2 cardio logical position, Pos3 neutral position. The arrows show the movement rooms those of the C-curves needs around in the park situation to reach and to release the patient. (Spring: Own representation)

Accordingly the spatial situation is to be tuned, because the treatments require different positions and accesses to the table. Technically different solutions exist for different operation tables, around the problems of the various professional disciplines solve. It is as a rule a spatial problem, because the different operation equipment elements must be considered. Therefore, a variable table is important by which everything can be ordered according to expenditure. The C-curve is moved during the intervention to and from or to be consulted again by the operation table by hand pushed away around then later to the control of the measure. Hence, the C-curve is driven rather seldom during the operation in the park situation. At the moment the available table solution is not satisfactory in a Hybrid Operation room. The Handling is not satisfactory and with overweight patients (trend rising), it comes to problems with the load-carrying capacity of the table (Spring: Steinbauer M., Implementierung von neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid OP“, Forum Hybrid-OP, Regensburg FRG, page 6, 2010) Because it is hardly possible, operation rooms in the continuance in accordance to textbook to plan and to realize (the reasons lie with the local circumstances), it will always come to compromises. Numerous concatenations of problems originates from it. Some of it are the arrangement of the lights and the screens, the geometry of the room, the place need of the tables, the Ergonometrie of the job of the surgeon, the room proportions generally, the room sequence and usability to call only some. This is the most frequent sources of error for the functioning of a Hybrid-operation room. As the last limb of the chain the surgeon notices that the Handling with the patient at the table not always claps (Spring: Gahlen J., Wie plane ich ein Hybrid OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 12, 2010)

6.2.1. Operation Table Types

An operation table exists of an operation column and a tabletop. The records are changeable and which is why is recommended to equip the Hybrid Operation room also with a conventional record. Thereby is applicable of the Hybrid Operation room also for a conventional intervention, this raises the added value.

There exist different operation tables

- conventional operation table
- swimming-disposed permanently operation table
- Hybrid Operation table

The conventional table, as well as the swimming stored table, are not suited Hybrid Operation because they are not free of metal and the C-curve a bad one or to low access has.

The Hybrid Operation room suited table is free of metal and accessible completely freely. It is typical that the column does not stand any more in the middle, but in the serving and the tabletop terrifically is overhanging.

The C-curve thereby better comes to the patient. Instead of metal, coach voucher was used with this table by which the table is able of X-ray examination, because the X-rays penetrate unhindered the table. The second tabletop, for a conventional operation, is as a rule an object of the equipment and should find in the operation room on the wall place. The application of coach voucher has of course in spite of high firmness of the coach voucher, an effect on the load-carrying capacity of the table. The overhang contributes to the fact that it can come every now and then with treacle weighty patients to distortions.

Also the C-curve bumps with very weighty patients with his achievement to the borders. Here will have to be reacted in future by sides of the industry. There are given the studies which report exactly these problems with the tables and overweight patients.

Around specifically for patient is to be able to react the table many-sided adjustable and by means of arm, head, leg bowls in the given circumstances adaptable. Striking is the huge overhang of the table which allows that the C-curve can grasp the large part of the body without problems. (Spring: Steinbauer M., Implementierung von neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 5, 2010)

At the moment the ergonometric of the table explains, one more problem for the surgeon. There is numerous discomforts upon the bad terms of employment and bad position in the job, because in spite of many set possibilities of the table, it is no rarity that the patient's accessibility is putting dissatisfied. The Hybrid operation table is not developed so far like the conventional operation table. Technical problems by the size and the overhang indicate the limit

In the Hybrid-operation room the conventional position of the anesthetist in the head of the table poses a problem because the classical position is limited by the C-curve mostly strongly or is also absolutely impossible. Because the table can fast move, the difficulty comes that the tubes and lines must be longer than in a conventional operation. The anesthetist must react to quick movements and get by with a limited field of work or position himself absolutely anew (Spring: Kettenbach J., Interview, radiologist, Vienna, 2010)

By the mobility it is guaranteed that a maximum is reached in flexibility. Table and C-curve are by control units at the table and in the C-curve maneuver cash. The surgeon can steer the devices without foreign help through the easiest service, as well as by the installation of the sensors which avoid a collision. Infertile covers and a change storage record belong to the basic equipment.

Illustration 55: Conventional OR table, Maquet Magnus
The picture shows a conventional operation table of the company Maquet. This table distinguishes itself by a lot of set possibilities, however, is not suited for a Hybrid-Operation room. (Homepage Philips, http://www.healthcare.philips.Com/pwc_hc/de_de/products/interventional_xray/Demos/Hybrid-OP/app/img/content/op-tisch-2.jpg, in 2010)

Illustration 56: Swimming OR table, Philips
The picture shows a operation table of the company Philips. The table swims and hands over at the side tip what helps the surgeon, better to the patient come on. (Homepage Philips, http:// www.healthcare.philips.com / pwc_hc/de_de/products/interventional_xray/Demos/Hybrid-OP/app/img/content/op-tisch-1.jpg, in 2010)

Illustration 57: Hybrid OR table Marquet
The picture shows a Hybrid operation table of the company Maquet. To see clearly the huge discharge and the possibility of the C-curve the body is to be grasped almost totally. Furthermore the tabletop is made without metal and thereby able of X-ray examination. (Homepage Philips, http:// www.healthcare.philips. com / pwc_hc / de_de/products/interventional_xray/Demos/Hybrid-OP/app/img/content/op-tisch-2.jpg, in 2010)

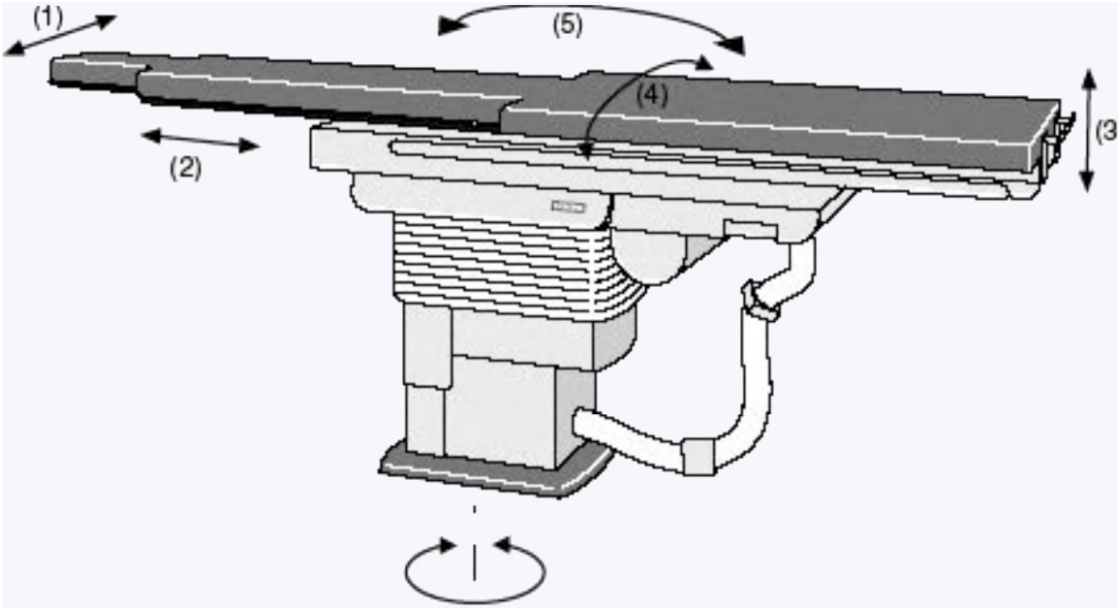


Illustration 58: Hybrid OR table, graphic 1

The picture shows a Hybrid Operation table of the company Maquet. The set possibilities are explained. 1-lateral movement, 2-Längsverschiebung, 3-vertical adjustment, 4-springs along the Längsachse, 5-incline along the transverse axis. (Homepage Philips, http:// www.healthcare.philips. com / pwc_hc / de_de/products/interventional_xray/Demos/Hybrid-OP/app/img/content/op-tisch-2.jpg, in 2010)

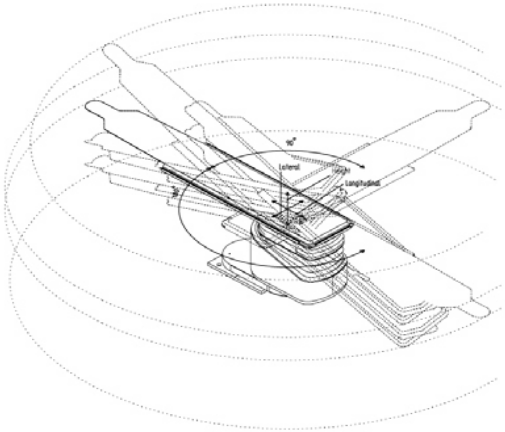


Illustration 59: Hybrid OR table, graphic 2

The picture shows the movement and setting possibilities of a Hybrid Operation table of the company Maquet. Essential is the mobility of the table which must be also guaranteed if weighty patients are operated. (Homepage Philips, http://www.healthcare.philips. com / pwc_hc / de_de / products/interventional_xray/Demos/Hybrid-OP/app/img/content/op-tisch-2.jpg, in 2010

Storage Standards

The storage standards are the positions of the C-curve to the patient. Two storage standards are essential for the planning of the Hybrid Operation room. These are the storage standards with central interventions with peripheral interventions. They differ in the geometry of the installation; this has a big influence on the geometry and size of the intervention room and with it on the expiries.

Before one a Hybrid Operation room plans, hence, should be clear which interventions should take place in which room. Accordingly the table and the C-curve is positioned in the room. It is distinguished between central, not central and peripheral interventions (Gahlen J., in 2010).

Storage Standards of Central Interventions

For these both orders the service console is fastened to the Hybrid-operation table and these are 1-2 an Orchestrating serves provided. The patient lies in both cases with his head to the C-curve turned.

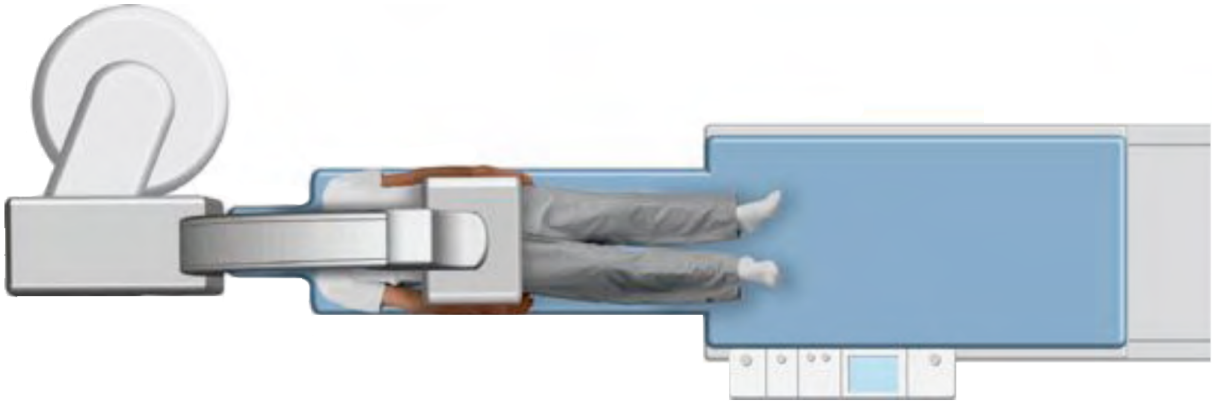


Illustration 60: Arrangement of the C-Curve from the front
This arrangement does not allow that the anesthetist keeps his position. Spatially this arrangement saves place. The positioning must be discussed before the treatment. (Spring: Steinbauer M., Implementierung von neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 6, 2010)

Head-sided position of the C-curve, with patient's access on the left side and on the right. The C-curve shown here corresponds to a usual C-curve with an easy arm, cover, or ground-mounted. This arrangement poses of course a problem for the anesthesia, because the usual position is not possible, or the anesthesia very little place leaves for.

This arrangement of the table and C-curve is suited for

- Supra aorta interventions
- Shunt interventions
- Periphere interventions

This arrangement is more room-saving and, hence, comes preferentially to operation rooms to the use, even if for the anesthetist a new place must be found. This arrangement finds use when on account of the rebuilding terms enough room depth does not exist. Hence, this arrangement is suited for smaller, narrower operation rooms. (Spring: Steinbauer M., Implementierung von neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 6, 2010)

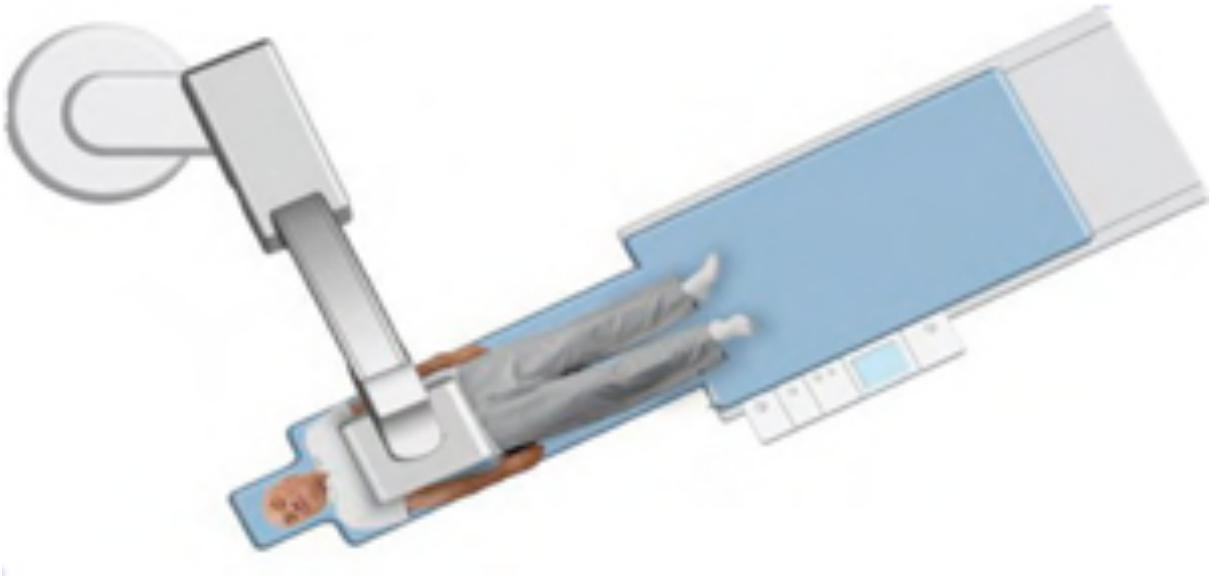


Illustration 61: Arrangement C-Curve of the side
The picture shows the most frequent arrangement for the operation table and position of the curve. however, this arrangement demands a certain spatial generosity and proportion. (Spring: Steinbauer M., Implementierung von neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 6, 2010)

Position on the left side of the C-curve with legal-sided patient's access. The C-curve shown here corresponds to a usual C-curve with an easy arm, cover, or ground-mounted. This arrangement offers more places for surgeon and anesthesia. This arrangement is also the most frequent case of the operation creation. She offers more places for surgeons and anesthetists.

This arrangement of the table and C-curve is suited for

- Central interventions
- Hybrid operations
- Bypass operations

Storage Standards of Peripheral Interventions

For both orders is the service console in the side car and it 1-2 orchestrated broads are provided. The patient lies in both cases with his legs to the C-curve turned.

These are as a rule vascular intervention in legs and arms of the patient. The Angelology does not need such big intervention rooms, these are essential for it the arm and leg bowls and the connection possibilities. The operation table owns own rails around equipment like this to mount.

6.3. Laminar Air Flow and Laminar Cross Flow

Pure room technology system to the pure position or creation of purity of the air in sensitive surroundings like this, for example, in hospitals, while manufacturing sensitive goods, how more optical glasses or in the solid-state technology (how this in the EDP the case is) to call only some examples. In the most a Laminar air Flow is used: This element is central above the table, cover-sided mounted. One speaks of Laminar cross Flow if the elements are complained on the wall; furthermore it is possible to provide with overpressure to aerial exchange systems of the cleanness of the air. The air exhaust field Laminar air Flow is optimally above the OR table and provides for the best conditions to the germ freedom in the operation table area. The system misses 3.2 x 3.2 m; these have to go, also with a cover-complained unity, are not affected and are interrupted.

OR Air Systems

- Laminar Air flow
- Laminar Cross Flow
- Overpressure Elements

The C-curve is a sturgeon factor for the air suck off. The cover-complained C-curve of the company Siemens makes an assembly of the Laminar Air Flow `see impossible, because the rails of the C-curve would cross the field. In this case alternatives must be searched for the aerial cleaning in the optical area or be renounced this. Because there are at the moment no obliging legal regulations for the airing in the operation area, norms are recommendations and no laws, may form hospitals the kind of the aerial cleaning them.

The Laminar Air Flow is in the cover, accommodated without interruption. Because no additional cover arms are able to be mounted in this area it is important that the cover rails lie accordingly far apart. The airing element lies centrally above the OR table and has the magnitude to DIN1946-4 of 3.2 x 3.2 m. It sucks off the air above the OR table and generates such a sub pressure above the operation table. With it the risk of the contamination is substantially reduced. (Spring: Philips, Sence and Simplicity, 7. Medizintechnik-Tagung, Inselspital Bern, Thema Hybrid-OP, paper, Swiss, page 31, 2010)

Illustration 62: Laminar Air Flow ceiling mounted
The picture shows a Laminar air Flow to element surrounded from rails for the C-curve of the company Philips. The cover solution of the company Siemens admits nobody Laminar air Flow, because this interferes with by the rails. (Homepage Philips Operating theatre in 2009)

6.4. Operation Monitors

For the surgical measures numerous monitors in the operation room are necessary. Here as a rule it concerns covers, rail-mounted units, so called Rack with 4-6 monitors. The solution with the rails offers a very high flexibility. In spite of the high costs this monitor it is essential not to save with the number. Hence, on both sides of the operation table Rack with 4-6 monitors must exist. Only to guarantee that the intervention of surgeons the left handed and right handed is to guarantee, it is to be had installed urgently on both sides of the operation table screens.

According to complexity of the intervention the other people need doctors, also to monitor in the operation room, anesthetists, and assistants to be able to pursue the events. As with the lights, is to be paid attention to the fact that it comes to no collision with the C-curve and the screens. (Spring: Philips, Sence and Simplicity, 7. Medizintechnik-Tagung, Inselspital Bern, Thema Hybrid-OP, paper, Swiss, page 39, 2010)

Illustration 63: Hybrid OR monitor racks
The picture shows different Rack existing operation rooms in Cologne, Leipzig and Hamburg. (Homepage Philips, http:// www.healthcare.philips.)

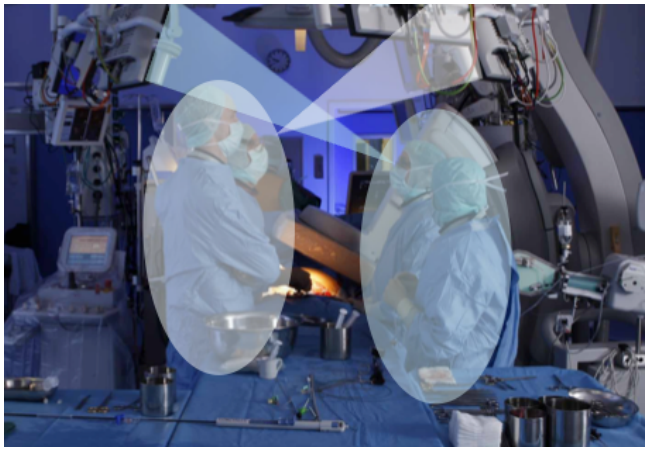


Illustration 64: Hybrid OR screen positions
The picture shows the assembly of the screens of a Hybrid-operation room during an intervention, cardiologist and heart surgeon stand on the left and on the right from the operation table and examine cross the results of the operation. (Philips Operating theatre in 2009)

The costs of the screens are very high, because they are extremely high-resolution and strongly shine. Still it comes to discomfort that the shine is not sufficient in some cases and the screens dazzle. In conventional operations windows often are included in the plan, to the production of a better atmosphere and not least to fulfill the regulations pertaining to labor law. This does not make sense in a Hybrid Operation room, because the work on the screens is thereby substantially affected. (Spring: Philips, Sence and Simplicity, 7. Medizintechnik-Tagung, Inselspital Bern, Thema Hybrid-OP, paper, Swiss, page 40, 2010)

6.5. Operation Lights

The operation lights are cover-mounted like the screens and the equipment or are fastened to the cover rails. It is not to be aimed by the arrangement of the screens which claims the place around the C-curve every now and then easily the lights in such a way that the surgeons throw no shade on the patient. See plans. The lights of the new generation are LED and, hence, produce no more warmth. Furthermore the lights have become lighter and smaller. The already difficult situation of the arrangement of the operation lights makes these advantages easier.

Illustration 65: Hybrid OR arrangement
The picture shows the movement and setting possibilities of a Hybrid Operation table of the company Maquet. Essential is the mobility of the table which must be also guaranteed if weighty patients are operated. (Homepage Philips,http://www.healthcare.philips.com/pwc_hc/de_de/products/interventional_xray/Demos/Hybrid-OP/app/img/content/op-tisch-2.jpg, in 2010)

6.6. Operation Equipment

In an operation different aid is required. These can be put down on the ground be fastened, however, also to the cover. So called cover care units (CCU) hang on joint arms of the cover and or are fastened, in addition, in rails. This is a good solution because with it the contamination of the ground is reduced by roles and the like. The disadvantage is that more expenditure while preparing and arrangement of an operation originates from the rails. Minimum-invasive operations have a substantially more diminished expenditure, the Hybrid Operation room is tidy and less filing is used. In addition, the very long operation table serves as a rule as a filing. A Hybrid Operation room must be still laid out in such a way that all equipment can be taken up and place has all interventions to carry out also conventional ones. Hence, the Hybrid Operation room should also be able to be used conventionally.

According to intervention different demands for the operation are made. The number of the present people, the required monitor and filing surfaces, as well as the lights can strongly vary. Also whether pure air is required or whether the C-curve goes to park position. The equipment of an operation room must be prepared for all these variables. (Spring: Philips, Sence and Simplicity, 7. Medizintechnik-Tagung, Inselspital Bern, Thema Hybrid-OP, paper, Swiss, page 41, 2010)

Illustration 66: OR equipment

The picture shows the different operation equipment parts. Every now and then some of these filing tables and liquid stands are lying round above all with conventional interventions in the operation room. Also of the Hybrid-operation room must consider these parts. (Homepage Philips in 2010)

7. Hybrid OR Models

Today there is already a huge number of medical centers, beside the already known natal medical centers, it will pursue casualty hospitals, rehabilitation centers, beauty, children, women, alcohol and drugs medical centers, radiation medical centers and university hospitals in future other like cancer, vessel, epidemics (like AIDS), hormone, transplant, metabolism as well as basic care medical centers or age medical centers etc. medical centers are mostly structurally separate parts of existing hospitals, put them own location and main focuses. They are organizational and administratively independent hospitals with certain main focuses.

The future of the hospital lies in it to itself on main focuses to concentrate and to differ thereby from the competition. Other as well as sensible combinations of existing medical centers will originate. The installation of certain technical equipment, like the Hybrid OP, or a particle accelerator, MedAustron entails that exclusively certain medical achievements can be offered. For example, minimum-invasive interventions in the heart (Hybrid Operation) or the destruction free of intervention of the tumor (MedAustron) (Spring: Debus J., Wannenmacher, Mit schweren Ionen gegen Krebs, paper, 1999)

Hospitals are to be concentrated in future constrainedly upon certain achievements and to realize her core competence and to develop this competence. Merely in the big areas of concentration hospitals will continue who offer all medical achievements, as we know this today. Basic care medical centers, medical centers will originate to themselves for research and apprenticeship. The medical centers who dispose of all technical possibilities will be probably left merely to the university hospitals. The competition of the hospitals takes place in future in two fronts:

- Competition of the strategically Excellency by multiple positioning, by a competition of the medical top achievements and a Supply Chain management (SCM) as well as

- Competition of the surgical Excellency along multiple differentiation parameter (e.g.: Costs, quality, time, service, flexibility, Convenience) by the use of the Lean principles in static environments and by the realization of an Agility management in dynamic environments.(Spring: Braun von Reinersdorff, Andrea, Strategische Krankenhausführung, Von Lean Management zum Balanced Hospital Management, Hans Huber publishing company, 2 circulation 2007, page 24)

A specialization takes place because this is the only chance to lower the costs and enough patients to gain, on the other hand, originates from the concentration on the core competence, a specialization, and a reduction on the core competence. The diversification of the hospital as a Hybrid-Operation hospital model would entail that certain fields would lead under circumstances to a union.

A Hybrid Operation room is not suitable for all medical fields, it is particularly for the intervention ulna radiology, the intervention ulna a neuro-radiology, the intervention ulna cardiology, the intervention ulna oncology, the vascular surgery, the cardio thorax surgery, the neurosurgery and the casualty surgery of meaning. Hospitals with main focuses like Hybrid Operations will originate from the development into the specialist. The costs and the missing specialists put, in any case, "natural" barriers there, which are why it will come for a diversification in the health market. Hence, Hybrid Operation rooms shall be found rather in areas of concentration with a separate order.

To defuse the high cost pressure it should be possible to form sensible synergies between single disciplines. This lowers not only the installation costs and operating expenses, but also creates an added value (Spring: Gahlen J., Wie plane ich ein Hybrid OP, Dissertation: "Perspektiven für den Hybrid-OP", Forum Hybrid-OP, Regensburg FRG, page 8, 2010)

Sensible Hybrid operation synergies arise, for example, by the combination from

- cardiology - angelology
- casualty surgery - orthopedics
- neurosurgery – surgery

The equipment as well as the equipment of the single operation rooms are similar or well can be complemented. The requirement profile coincides partially and the doctors come from related departments or have partly the same patients. (These patients are operated in a conventional operation one after each other)

[8]With the concept Clinic it was reacted to the fact that the concept Hospital and Hospital has already become outdated and the concept Clinic, even if is used partly in a wrong connection. Hence, with clinic hospital is meant.

The arrangement and the arrangement of the operation room differ according to intervention. Hence, before every operation it is respected to the specific features of the forthcoming operation, and all needs is considered. Arrangement of the C-curve, the equipment, the accessibility, the participating people as well as the position of the anesthesia. By a change of the surgeon of a left-hander on a right-hander and by changes of the demands can mean these changes engraving every now and then. Every intervention in the operation must be prepared in such a way that even if something unplanned happens, everything is required what, exists. Accordingly certainly a measure is prepared and equipped the operation room. The possible operation equipment determines the geometry and size of the room in the planning. The arrangement and above all the freedom of movement of the C-curve, this is removed during the intervention over and over again from the operation table, as well as the position of the operation lamps, the screens and the position of the anesthetist determines the operation planning in the essentials.

Three essential plans are introduced by Hybrid-operation rooms, and according to surgical measure the equipment and arrangement of the intervention room is different. The freedom of movement of the involved doctors must be guaranteed. According to intervention another accessibility must be given for the C-curve and motion path to the table be guaranteed.

It must exist for all partners a clear view on the screens. The key players need furthermore eye contact with the staff of the controlling room. Lights must be arranged in such a way that the measure is well illuminated and throws no shades. According to intervention other supervision devices stand in the room which should remain freely accessibly and kept an eye. The infiltration of the patient poses mostly already a problem and only thereby succeeds in which after the infiltration the arrangement of the operation room is finished. To the out sluice the arrangement must be dissolved again.

By a change of the surgeon of a left-hander on a right-hander and by changes of the demands can mean these changes engraving every now and then. Every intervention in the operation room must be prepared in such a way that even if something unplanned happens, everything is required, exists. Accordingly certainly a measure is prepared and equipped the operation. The possible operation equipment determines the geometry and size of the room in the planning. The arrangement and above all the freedom of movement of the C-curve, this is removed during the intervention over and over again from the operation table, as well as the position of the

Operation lamps, the screens and the position of the anesthetist determines the operation planning in the essentials.

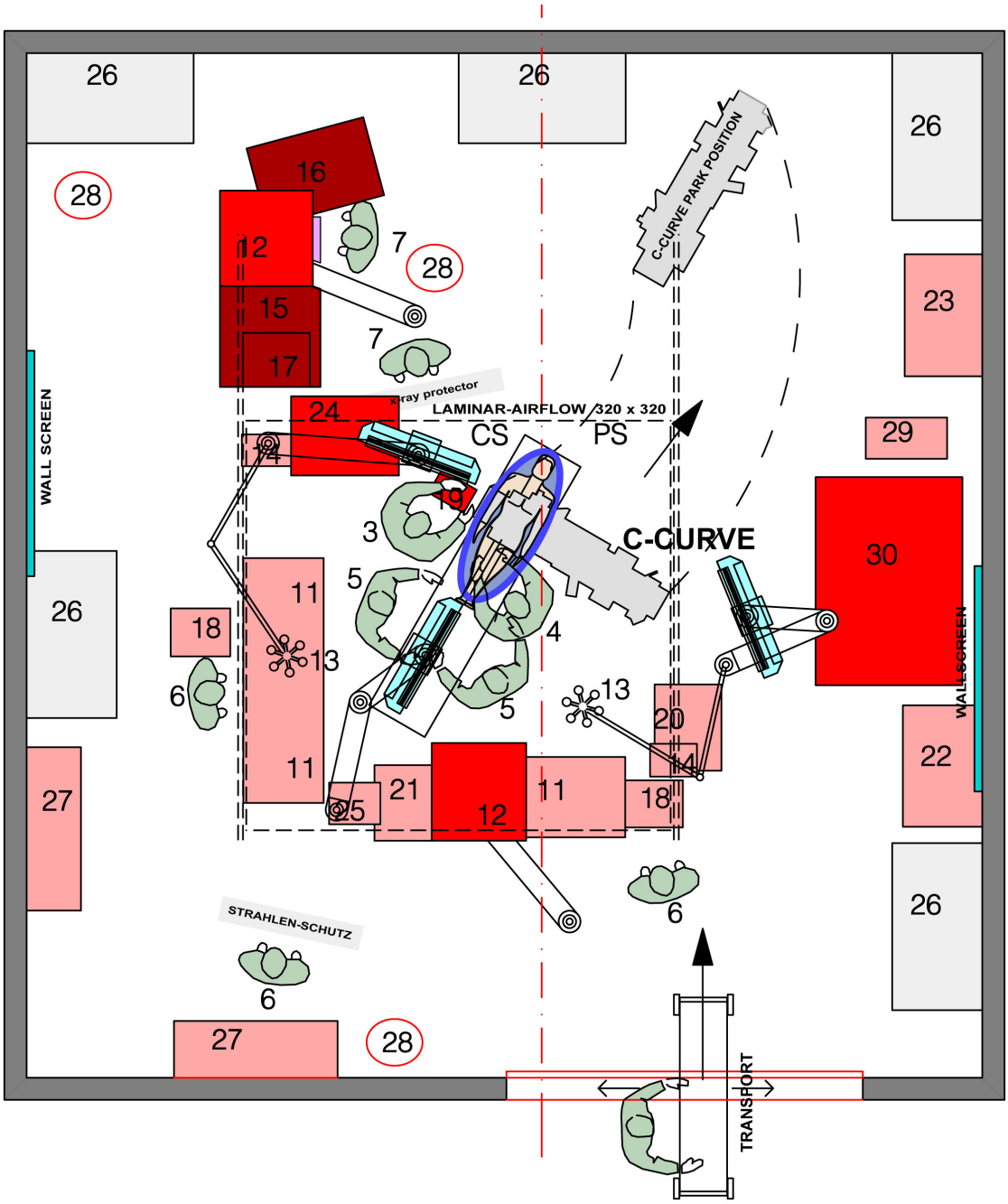


Illustration 67: Arrangement Hybrid-OR of a minimal invasive cardiology

The picture shows the arrangement of the equipment of a minimum-invasive cardiology, 105m2, as well as the positions of the people in the Hybrid-operation room. Grey is the C-curve, at the table and in park position. The positions 1-7 are the co-operating medical people. 3 chief surgeons in the switch writing desk, 4 second surgeons, 5 operation assistants, 6 OP sisters, 7 anesthetists, 11 equipments tables, 12 equipments tree, 13 OP lights, 14 flat panel display Rack, 15 anesthesia's delivery unity, 16 anesthesia's carriage, 18 rubbish, 20 suction car, 21 elektrocautery, 22 ultrasonic carriages, 23 resuscitation carriages, 24 contrasts projector, 26 traffic jam boxes, 27 desks, 28 stools, 29 coagulation machines ACT, 30 heart lungs machine, 31 EEGs, 32 navigations, 33 microscopes. Lights and screen Rack are fastened to the cover rails. The area of the Laminar Airflow amounts 3,2 x3,2m and is above the OP table. Immediately around the patient there is the infertile zone, blue. CS=Side of the surgery, PS=Side of the care (Own representation in 2011)

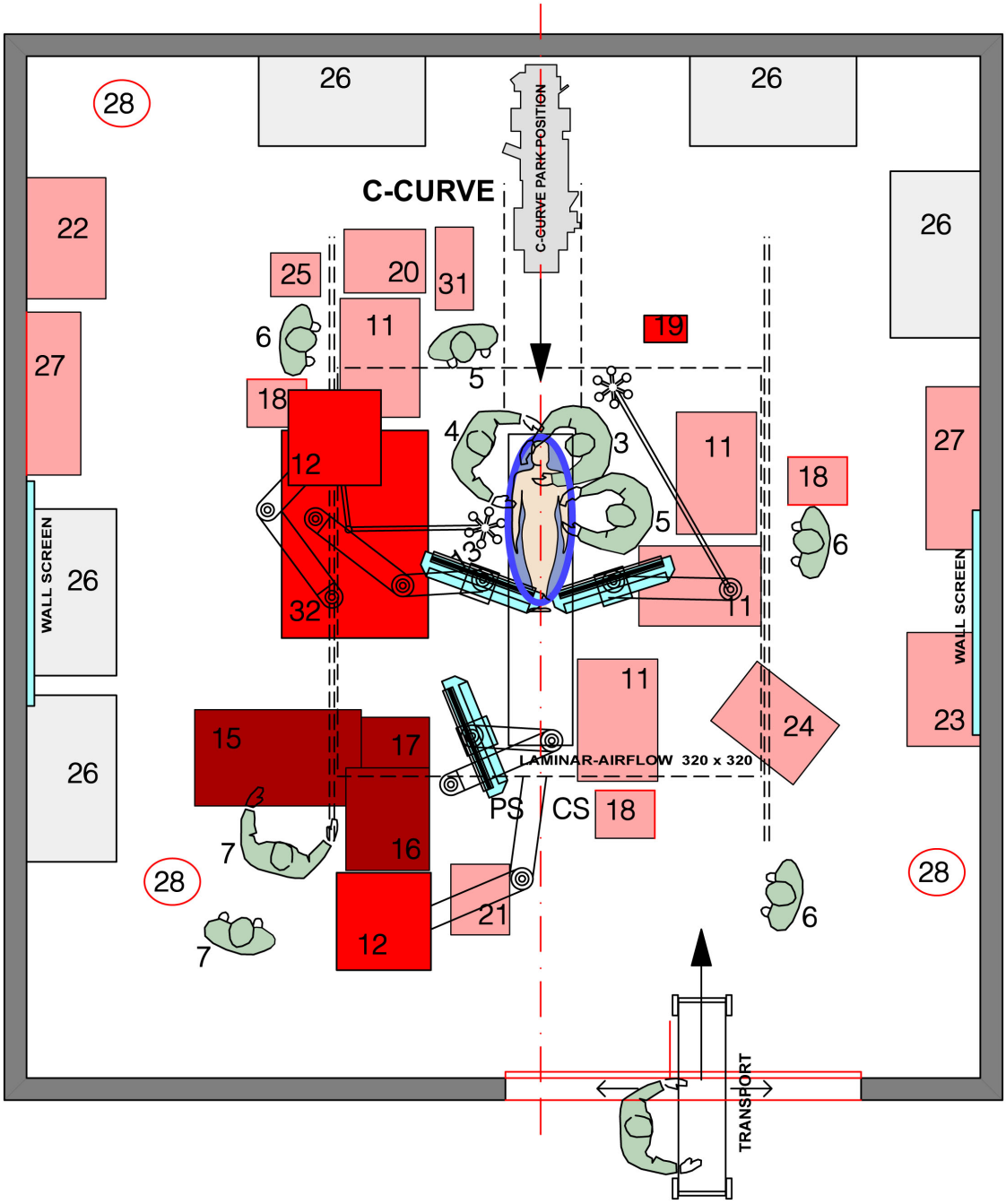


Illustration 68: Arrangement Hybrid-OR of a minimal invasive neurosurgery

The picture shows the arrangement of the equipment of a minimum-invasive neuro surgery, this intervention room has approx. 105m2, the positions of the people, as well as the position of the C-curve, at the table and in park position is shown. The positions 1-7 are the co-operating medical people. 3 chief surgeons without switch writing desk, 4 second surgeons, 5 operation assistants, 6 OP sisters, 7 anesthetists, 11 equipments tables, 12 equipments tree, 13 OP lights, 14 flat panel display Rack, 15 anesthesia's delivery unity, 16 anesthesia's carriage, 18 rubbish, 20 suction car, 21 electrocautery, 22 ultrasonic carriages, 23 resuscitation carriages, 24 contrasts projector, 26 traffic jam boxes, 27 desks, 28 stools, 29 coagulation machines ACT, 32 navigations, lights and screen Rack are fastened to the cover rails. The area of the Laminar Airflow amounts 3,2 x3,2m and is above the OP table. Immediately around the patient there is the infertile zone, blue. CS=Side of the surgery, PS=Side of the care (Own representation)

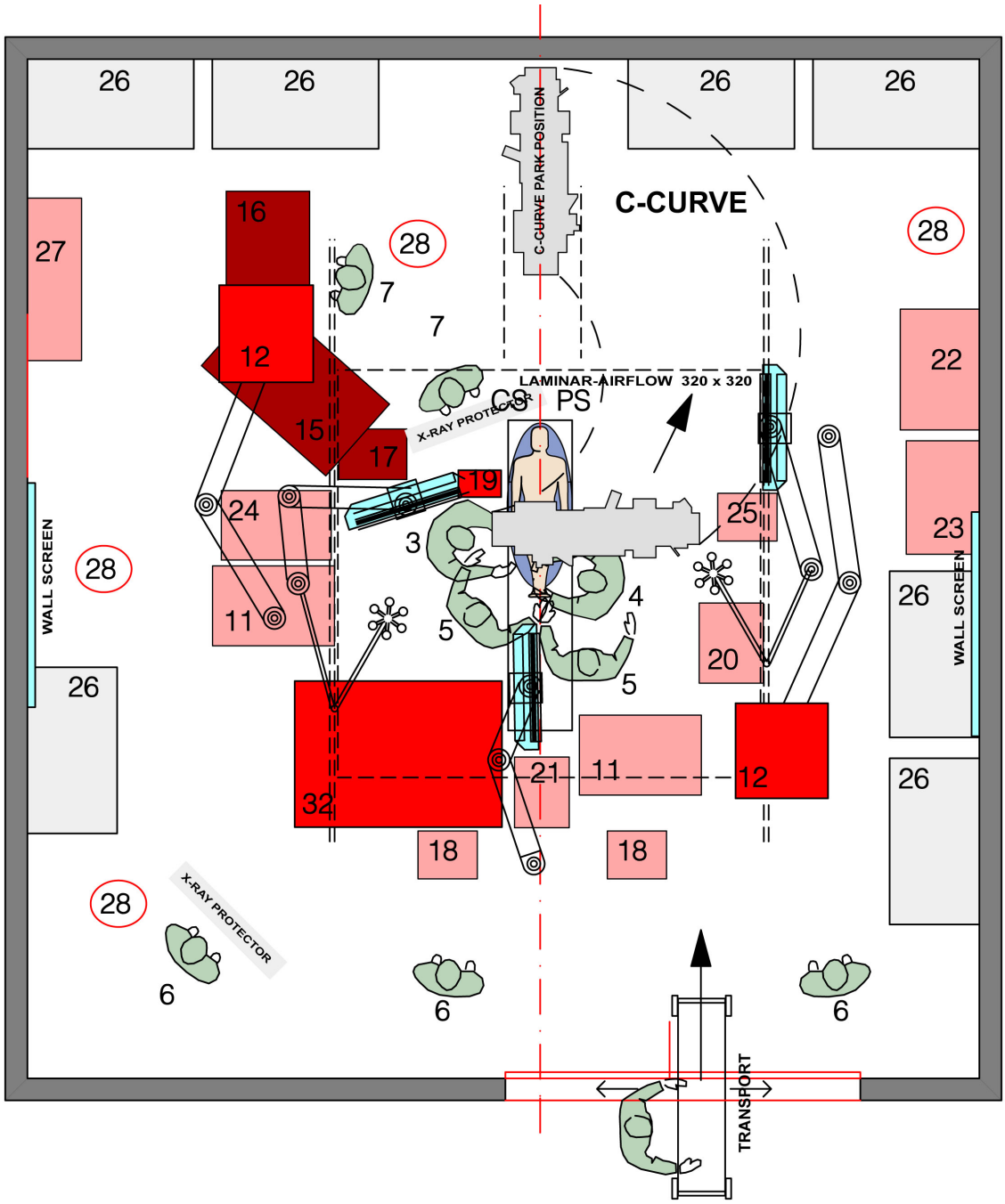


Illustration 69: Hybrid OR of a minimal invasive orthopedic casualty surgery

The picture shows the arrangement of the equipment of a minimum-invasive cardiology, 105m2, as well as the positions of the people in the Hybrid-Operation room. Grey is the C-curve, at the table and in park position. The positions 1-7 are the co-operating medical people. 3 chief surgeons in the switch writing desk, 4 second surgeons, 5 operation assistants, 6 OP sisters, 7 anesthetists, 11 equipments tables, 12 equipments tree, 13 operation lights, 14 flat panel display Rack, 15 anesthesia's delivery unity, 16 anesthesia's carriage, 18 rubbish, 20 suction car, 21 elektrocautery, 22 ultrasonic carriages, 23 resuscitation carriages, 24 contrasts projector, 26 traffic jam boxes, 27 desks, 28 stools, 29 coagulation machines ACT, 32 navigations. Lights and screen Rack are fastened to the cover rails. The area of the Laminar Airflow amounts 3,2 x 3,2m and is above the operation table. Immediately around the patient there is the infertile zone, blue. CS=Side of the surgery, PS=Side of the care (Own representation)

The highest complexity shows the arrangement of the intervention room for the casualty surgery. A lot is unplanned, it must be able to be entered on everything, furthermore a maximum accessibility is necessary, because can be planned not precisely how much staff is involved and is no time, by the bringing into play of the patient to arrange the operation anew. The patient needs a generous free possibility for the operation table, this show a difficulty with the contact of the C-curve. The demands of the hygiene are screwed off in an emergency and the main attention lies on the life-saving measures and the first care.

With synergies of Hybrid Operations of different fields must be entered at the different demands. To form in the operation area of synergies indicates to enter compromises. Medical professional disciplines together a Hybrid Operation room must plan and form renounce either functions, or, however, plan a maximum variation. With it the saving potential is mostly lost. The room function programs of different operation rooms are formed differently and the motion sequences are not same. Partly different units and apparatuses are available in the operation room. Thus the cardiology needs heart lungs machine which has a suitable place need and needs a suitable accessibility. The neurosurgery examines again the patient from the front and not from the side; as usual commonly the operation room must be thereby arranged completely anew.

The synergy between the cardiology and the Angelology makes sense because both medical disciplines work on the vessel and navigate themselves about the vessels to the surgical place. Hence, the work on vessels and heart flaps gets by with a Hybrid Operation room of similar equipment and for the interventions in the heart, a C-curve with a maximum achievement is necessary. However, for the interventions in vessels of the limbs reaches an easy C-curve with a substantially lower achievement. These considerations have influence on the place need of the intervention room and, finally, on the planning of an operation room.

With the pool of a casualty surgery and orthopedics the conditions are probably still easier produce able. Without having to consider much too big differences. Indeed, positions itself here the problem that a casual-operation, can be hardly completely booked up for the orthopedics, because an casual-operation room should be always kept. One could use the operation room only if there is no need and accidents. However, this seems to plan ahead impossibly. With the synergy between the neuro surgery and the surgery will have to be entered at the demands of the neurosurgery, because these demands are substantially higher and more complicated. The neurosurgery differently requires than the other interventions a main attention to

the free access in the head. This is quite difficult in itself, because not the length of the body of the patient is available, but everything is to be arranged to itself around the head of the patient. Also the C-curve needs a free access.

8. Hybrid Operation Advantage and Disadvantage

The Hybrid-operation room can be used by different medical professional disciplines like orthopedics, cardiology, neurosurgery, casualty surgery, angiology, etc. sensibly together (Spring: Philips, Sence and Simplicity, 7. Medizintechnik-Tagung, Inselspital Bern, Thema Hybrid-OP, paper, Swiss, page 8, 2010) The classical room use means a spatial and above all technical separation of the conventional surgery and endovascular intervention. By emergency transportations and with a percutaneous coronary bypass operation it already comes to a cooperation of both professional groups. With a trans apical flap substitute comes to a common room use. This is an essential progress, because Interdisciplinary creates by communication as well as exchange of views more quality and security what is an essential profit. (Spring: Grützner P.A., Erfahrungen mit dem Schulungskonzept. Intraoperative 3D Bildgebung, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Gefässmedizin, Regensburg FRG, page 24, 2010). A Hybrid OR no operation room is alone for a certain discipline, it will become an operation room with certain demands for all disciplines (Spring: Strobel N., C-Arm CT (syn-co DynaCT) und 2D/3D Überlagerungen zur Überlagerung von Abdominellen Aortenaneurysmen Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 18, 2010). At the moment a Hybrid Operation room makes sense on account of the integration of a Hybrid Operation room offers not only advantages. Thus human aspects are to be considered, but also technical aspects as well as changes of the work routines (Spring: Grützner P.A., Erfahrungen mit dem Schulungskonzept. Intraoperative 3D Bildgebung, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Gefässmedizin, Regensburg FRG, page 23, 2010) A Hybrid Operation room requires another medical access and control by the management. The complexity for the hospital management increases. Hence, the Hybrid Operation room extends the possibilities and offers to the doctors the platform of all kinds of interventions from minimum invasis to invasis. The technical progress only for certain departments.The clinical trend for endovascular treatments by the intervention ulna radiology, neuro-radiology, cardiology and oncology become at time more complicated and costlier, at the same time are carried out the surgical treatments the vessel, cardio-thorax as well as by the neurosurgery and casualty surgery more and more minimum-invasive. These medical fields profit from the development of the Hybrid Operation room. (Spring: Thomann G, Interview, Hybrid-OR-Manager Philips, Vienna, 2010) The technical possibilities of a C-curve create new medical possibilities and administrative, technical problems. The process of the Hybrid Operation room is managed only by a team to employee what entails that the commu-

nication, rises verbally and non-verbally, immensely. The success of an operation does not hang with it any more of the surgeon separate from the team and technology. Thus the employees are better to be tuned to each other.

- Organizationally the integration of the Hybrid Operation room is to be mastered in the management of the house. The persons responsible must be better tuned on each other. There is the danger, a bad communication. A hospital is a hoard of the single fighters. The organization of a Hybrid Operation room needs a separate treatment by the management because the expiries need another process structure.

- The C-curve moves fast and makes big movements; the contact with the C-curve must be coached. The acting people must learn to handle to take with the movements and on it consideration. The anesthesia is differently positioned than in a conventional operation room. Because the table movements often occur unexpectedly and fast, the danger of collisions exists. However, this entails that to plan the cables and tubes longer. Hence, it is unavoidable to include the anesthesia as early as possible in the planning.

- There are problems still with the hygiene, because the suitable covers for the C-curve etc. at the moment still in the market are absent, hence must be improvised. The similar is valid for the huge number of hung operation elements, like lights, screen arms or care consoles. Also for these elements suitable covers are absent.

- The use of the C-curve wants to be learnt, and also then it not always functions in such a way as she has to go. It comes partly to collisions with the rotary C-curve. Partly the control is still too comfortable and it comes in spite of sensors to collision. The service should occur through the doctor itself. Not seldom the C-curve is led away because of the problems with the hand to the table and again.

- The table with a length of 2.3 m is huge what is also problematic partly. The excessive length originates from the need of the accessibility of the C-curve and is used as a rule as a filing. Also this is an advantage not only.

- For certain medical professional disciplines it is to be worked together sensibly, synergies can originate between orthopedics and casualty surgery or just of the cardiology and the angiology. These synergies help not only the specialists about the field to get to know going out more and to extend cut borders and to be able to operate thereby all

together, it reduces the costs, contributes to the mistake avoidance and Helping the patients with the load of the interventions.

- Sensible alliances in the medicine offer chances which must be helped carry, however, by the hospital bearer and, finally, by the health insurance schemes. Hence, the installation of a Hybrid Operation room concerns the whole health service, up to the politics. Fears that a new section takes away from the old established surgeons operations must be diminished. The entire integration must be planned and be prepared. It must be understood as a chance for the whole company; patients were even better or were not treatable patients to be able to help. It would mean, that the old structures which would be diminished of the fields and their borders. An all together access would enter. New processes change the expiries by which the costs could be reduced.

- The completely rigid organizational structure in the hospitals would open, this shows at the same time a possibility to diminish the barriers between the doctors and the care as well as the borders under the medical fields.

- The real aim to help patient to her health would move more in the middle reason. The recovery process would be marked more aim-oriented and not from problems who excise everyday.

- At the moment the processes in existing Hybrid Operation rooms do not run partly yet really sensibly. Thus it comes by the difficulties to longer Operations than with a routine conventional operation. Trainings and educations in the Hybrid Operation room should improve this situation.

For certain medical professional disciplines it is to be worked together sensibly, synergies can originate between orthopedics and casualty surgery or just of the cardiology and the angiology. These synergies help not only the specialists to get to know about the field going out more, to extend her knowledge and to be able to operate thereby all together, it reduces the costs, contributes to the mistake avoidance. There originate more sparing interventions what supports the patient with the recovery very much. The design of products and their use is based on their application possibilities. (Hekkert P, Neue Krankenhausbauten Deutschland, Band 1 Allgemeiner Krankenhäuser und gesundheitszentren, Dom Verlag 2008, Philip Meuser & Christoph Schirmer, page 40, 1997)

The difficulties existing at the moment with the Hybrid-Operation room are apparently based on the fact that the technology has not still totally matured anew, and, hence, yet. Difficulties with the tables and the C-curve stand in the agenda. Furthermore the contact with the technology is unusual in such situations of the strain and concentration absolutely. Old-introduced orders and expiries of an operation are changed, acting people must come to an agreement anew, and the cooperation of the doctors in an operation wants to be practiced. Sensible alliances of the medicine offer chances to form interventions careful and more actually. The hospital management should see such chances and support, because costs can be saved by the right guidance, and be achieved more quality. (Spring: Gebhard F., Hybrid-OP in der Unfallmedizin, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 32, 2010) The installation of a Hybrid OR concerns the whole health service, up to the politics, because the installation is manageable only by a change of the finance structure of the health service. A reorganization of the finance streams and the payment of achievements would be the result.Also personnel barriers must be overcome. Fears that a new section, the old established surgeon takes away operations must be diminished. The entire integration must be planned and be prepared if this system should be seriously moved. It must be understood as a chance for the whole company, patients even better or patients were not to be able to help any more treatable. To lower the costs of the interventions and to increase the quality of the interventions. It would mean that old structures, the fields and their borders would be diminished. An all together access would receive move. New processes change the expiries by which the costs are reduced. All this unnerves and cannot run off from the outset smoothly. Such difficulties are normal and master able. At the same time the problems with the technology of the users must be taken seriously by the manufacturers and be accepted. Improvements of the reliability of the C-curve are certainly necessary; also the difficulties with the Hybrid Operation table should be eradicated. However, the installation of a Hybrid Operation room also brings organizationally fresh wind in the completely rigid organizational structure of the hospital. The installation shows a possibility to diminish the barriers between the doctors and the care, as well as the borders under the medical fields and to see the medicine all together. The real aim to help patient to her health would come to the fore more. The recovery process would be marked more aim-oriented and not from the everyday Hick minced meat of the hospital. Another result would be that the hierarchy would be diminished among the operating people. The Hybrid Operation room demands Team-Work and is not master able with a strict hierarchical order of conventional operation.

9. Hybrid Operation Disciplines

The number of the disciplines to those of the Hybrid Operation room is of interest, is limited. At the moment, on this occasion, it concerns in the essentials the angiology, cardiology, neurosurgery, orthopedics and casualty surgery.

These fields usually have different processes and operation room standards what affects the size and equipment. Furthermore it can mean that the processes take up different periods. While the casualty surgery must be always free ready and the OR, the cardiologist usually plans from long hand. Big differences with the demands make difficult to combine the Hybrid Operation room sensibly.

While the next rooms hardly change, nevertheless, it can mean that the technology room should catch more employees with EDP access for a cardiology.

The cardiology and the neurosurgery make the highest demands in an operation room, to the room, as well as in the achievement of the C-curve. These are the most complicated OR which are carried out seldom also to clearly older patient. This shows a raised risk what means furthermore expenditure.

That is the fact that more auxiliaries are involved in the intervention and more information must be compiled for the intervention. This entails that the ORs are stronger booked time wise for a patient. Patients more differently medical fields claim the Hybrid OR in different Intension. These factors affect the planning of a Hybrid Operation room and have influence on the choice of the C-curve.

At the moment the medical disciplines introduced here are the most essential disciplines being possible for a Hybrid Operation room. They are looked at first separately; synergies take place in the connection.

9.1. Neuro Surgery

The neurosurgery was the forerunner of the development which has led to the education of a Hybrid-Operation room. This lay above all with the fact that the highly complicated and sensitive interventions, step by step a control have used. In addition it was necessary that the patient was illustrated with the help of a ct. arrangement. In the beginning the patient was transferred during the intervention, with open skull, straight through the house and to be operated afterwards back to the operation around further. Partially this happened during an operation several times. These not answerable states were put down as a result of in which one put a taken out of service CT in a next room of the operations, this saved time and lowered the risk for patient and surgeon (Spring: Wirtz C.R., Neurochirurgische Anwendungen im Hybrid-OP/ Artis Zeego, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Gefässmedizin, Regensburg FRG, page 5, 2010) There lay on the hand this development to continue and the CT walked visibly more and more in the nearness of the operation table. Thus the arrangement was optimized and the operation table was changed. There has originated the thought to develop a Hybrid Operation room, a “simplistic CT procedure“ with the patient any more must not be transferred. Therefore, the neurosurgeons were also involved decisively in the development of the Hybrid-Operation room. The neurosurgery is beside the cardiology one of the medical central areas which forced the application of the Hybrid Operation room massively (Spring: Strobel N., C-Arm CT (synco DynaCT) und 2D/3D Überlagerungen zur Überlagerung von Abdominellen Aortenaneurysmen Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 8, 2010) On the 05th of Dec., 1995 one began the attempt in Heidelberg, by establishment of a room in the operation room, the combination of a CT of the company Siemens, Magnetom Open, with an achievement of 0.2 Tesla. This was a C-shaped magnet and had 270° opening, with a NCH-OR. The patient did not have to leave the room any more, however, table (Wirtz C had to be still transferred by the OR table on the CT., in 2010). On 30th September 2008 a CT of the company Siemens became in castle Günz in the NCH-OR Siemens, Magnetom Espree with an achievement of already 1.5 Tesla installed. This arrangement distinguished itself by an already shorter magnet and a bigger opening. Openings are at the end of the ct. arrangement by which the contact became substantially easier (Spring: Strobel N., C-Arm CT (synco DynaCT) und 2D/3D Überlagerungen zur Überlagerung von Abdominellen Aortenaneurysmen Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 11, 2010)

Illustration 70: MR Open Heidelberg
The picture shows the NCH-OP in Heidelberg from 1995. The advantage of this operation room was the possibility of the control of the intervention without having to leave the operation. (Wirtz C., in 2010) The CT. arrangement was more efficient and better applicable; furthermore the arrangement was installable by the compactness in the nearness of the operation table by which the ways became substantially shorter (Wirtz C., in 2010). The patient had to be still transferred several times during an operation what was a huge load. One lost a lot of time by this Handling (Spring: Wirtz C.R., Neurochirurgische Anwendungen im Hybrid-OP/ Artis Zeego, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Gefässmedizin, Regensburg FRG, page 4, 2010)

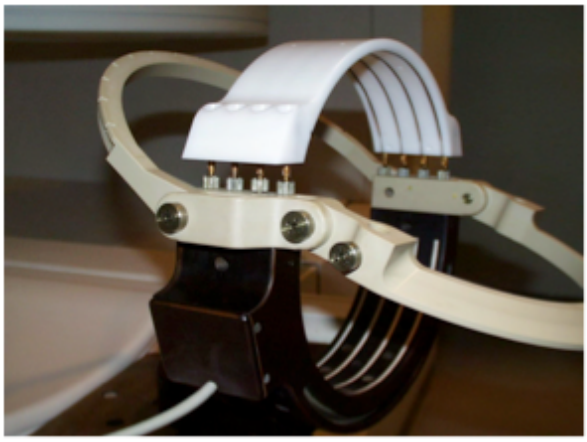
Today the picture is an everyday life in the neuro-surgical (NCH)-Operation room and exists in the essentials of a screening, an angio arrangement and an ultrasound scanner. (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 26, 2010)

In the beginning there were numerous problems with the compatibility of the technology, partly they are not solved till this day totally. This led to an integration and adaptation of the technology, as well as for modifications of the creation operation, furthermore the operation technology had to be adapted and the operation expiry be changed. One can compare this to the success with high risk patients in the cardiology.

Illustration 71: Brain suite castle Günz
The picture shows the NCH-OP in castle Günz from 2008. The whole arrangement was already substantially more compact and the ways are clearly shorter. (Spring: Wirtz C.R., Neurochirurgische Anwendungen im Hybrid-OP/ Artis Zeego, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Gefässmedizin, Regensburg FRG, page 4, 2010)

All operation table accessories, like the MR scanner which must be free of metal couch or the head clip and the reel and from alternative materials, as ceramics are produced. With the head fixation this condition led to an advancement with patented integration of a MR reel and head fixture (Spring: Wirtz C.R., Neurochirurgische Anwendungen im Hybrid-OP/ Artis Zeego, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Gefässmedizin, Regensburg FRG, page 19, 2010)

The Hybrid Operation room in the NCH-OR exists of an intra-operative CT. and MRT. The base equipment of the NCH-OR allows picture-supported interventions with intra operative picture and bound navigation. The navigation is inalienable just in the neurosurgery, because the interventions are risky extremely extravagantly and highly sensitive.



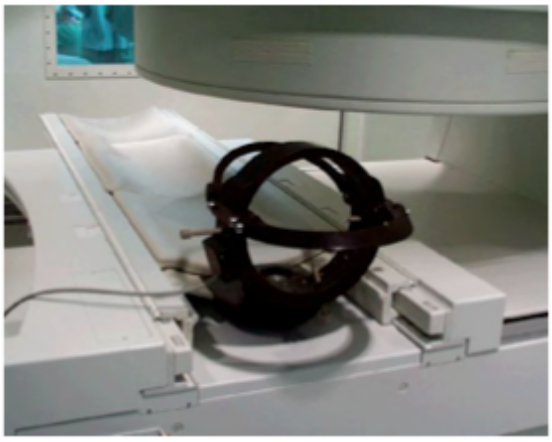


Illustration 72: Head fixation and MR reel
The picture shows a ceramic head fixation like she is used in NCH-OP. This fixation was developed specially for the Hybrid-Operation room by Prof. Wirtz. (Spring: Wirtz C.R., Neurochirurgische Anwendungen im Hybrid-OP/ Artis Zeego, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Gefässmedizin, Regensburg FRG, page 6, 2010)

In the neurosurgery one makes a distinction between:

- Imagery and intervention
- Micro surgery
- Navigation

The interventions taking place in the NCH Hybrid OR are complicated and very time-consuming. Numerous interventions need a good preparation and planning. Set pieces must be produced partly individually for the patient and be held ready. The interventions themselves are very time-consuming for everybody and force-robbing. It demands a good cooperation of the whole team and also the best possible terms of employment (Wirtz C., in 2010).

The interventions of the neurosurgery in the Hybrid-Operation room are in the essentials

- Neuro-vascular intervention
- Intervention in the backbone
- Neuro-lesion-percutan intervention
- traumatologic intervention

Not for every intervention in the neurosurgery a Hybrid Operation room is used. But just for the interventions to the nervous system a Hybrid Operation room has become, in the meantime, an essential tool. The risk can be reduced by the good picture and navigation for doctor and patient strongly. Today the neuro-vascular interventions (vascular operations of the nervous system) are very frequent interventions and take place in the essentials in the Hybrid-Operation room.

Count to it

- Emergency care of the subarachnoidal bleeding
- Aneurysmatherapy (incidental OR as SAB)
- Arteriovenöse intracranial malversation
- Durale AV-fistula
- Invasive apopletic stroke therapy

The neuro interventional workflow exists of overview, ROI, Decision, Guidance, Placement as well as the next control. Also here is clear that the picture of the inside of the patient has become inalienable. The intervention is observed intra operative and the security and necessary information is controlled and offers the surgeon.

The spinal interventions taking place in the neurosurgery in the Hybrid-OR are

- Decompression and instrumentation with degenerative spinal diseases
- Spinal trauma
- Spinal tumour surgery

Angiomexstirpation in the Hybrid OR

- Representation and localisation of feedern
- Intraoperative control
- If necessary other resection of restnidus

Also here is valid that the exact picture representation, to the surgeon has become an inalienable tool which is exceptionally important in this sphere. Only is thereby guaranteed that nobody takes damage. The complicated spinal instrumentations belong to the most difficult interventions generally, because the peripheral nervous system, a very sensitive one is and the

interventions take place on the narrowest room. Also here exact representations and measurements of the patient are inalienable (Wirtz C., in 2010).

Hybrid-OP: CT. Somatom emotion, Heidelberg

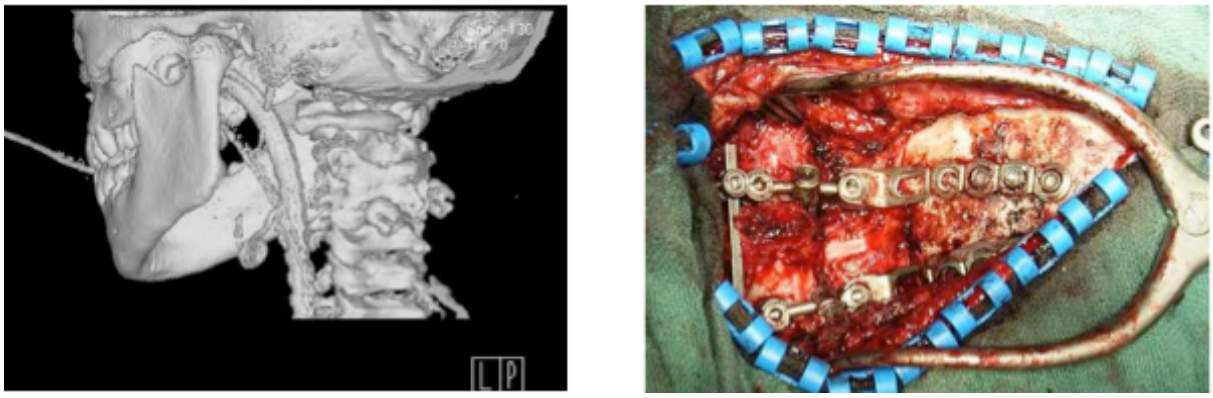


Illustration 73: Head and dorsal vertebra representation
The picture shows a neuro-surgical intervention in the backbone. After the pre-surgical measurement the tailor-made transfer of the implant occurs. (Spring: Wirtz C.R., Neurochirurgische Anwendungen im Hybrid-OP/ Artis Zeego, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Gefässmedizin, Regensburg FRG, page 18, 2010)

Complicated backbones operations are nothing unusual in the neurosurgery just as other interventions to the headquarters, peripheral nervous system. In addition it is necessary to ascertain the generation of a navigation record intra operative control of the decompression and/or screw situation (Wirtz C., in 2010).

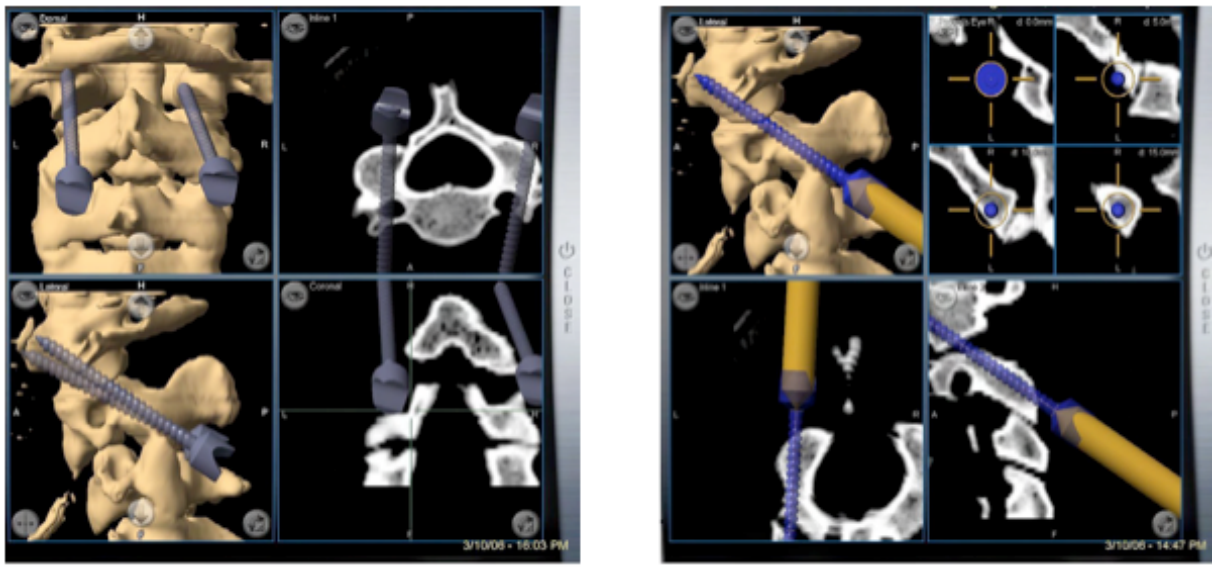


Illustration 74: Dorsal vertebra representation
The picture shows the intervention in the backbone. Fixation of dorsal vertebra by means of screws and pencils. Sensitive interventions like this make the Hybrid Operation room inalienable. The pictures point as precisely the neurosurgeon must work to cause no other damage. (Spring: Wirtz C.R., Neurochirurgische Anwendungen im Hybrid-OP/ Artis Zeego, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Gefässmedizin, Regensburg FRG, page 19, 2010)

The spinal injuries belong to the traumatology interventions such as

- Acute stabilisation
- Micro vaskuläre decompression

Removing div. hematoma in the headquarters nervous system, skull-brain traumas, such as

- On both sides subdural hematoma
- Epidural hematoma with contusions bleeding

Control of the not primarily operated findings before the OR end with Dyna ct.

Interventions and laesionly interventions such as

- Guidance fashion for difficult punctures
- Thermo-coagulation with the trigeminusneuralgy
- Neuro modulator broad procedure (RM stimulation) Dyna ct.

The advantages of the interdisciplinary use of the Hybrid Operation room are obvious also in the NCH

- A better extent of utilisation of the Hybrid-ORs takes place.
- Time-optimised expiries by installation of an OR manager, e.g.: OPERA
- Improved cooperation among the acting people
- Better patient's care and better results
- Lowering of the costs of the care

The capital costs are thereby lowered in relation to the use and the economic efficiency of the company is strengthened. The number NCH interventions increase very strongly.

(Pfeiffer, Wirtz C. In 2010), therefore, it will become in future from meaning to use the available resources better. The Hybrid-OR has changed the work of the neurosurgeon and has improved. For the patient as well as for the surgeon sinks the risk because the relocations and the time delay linked with it are lost (Spring: Wirtz C.R., Neurochirurgische Anwendungen im Hybrid-OP/ Artis Zeego, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Gefässmedizin, Regensburg FRG, page 22, 2010)

9.2. Cardiology

The Hybrid Operation room opens absolutely new possibilities of treatment for the heart surgery, the cardiology. Cardio surgical emergencies can be diagnosed in the Hybrid-OR without every time delay simultaneous and be treated, without additional risky transports or relocations become necessary. The spectrum of treatment reaches from the catheter-supported therapy of narrowed Aorta flaps up to the care of acute aortic illnesses which can be treated now surgically, endovascular or in a combination of both procedures (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 2, 2010)

At the moment different possibilities of interventions exist for the Hybrid-OR, in the cardiovaskular sphere. It has appeared by the experience, the last years in Leipzig that the following interventions very make sense by the support of a C-curve:

- Transcatheter valve implantation (AV, MV)
- Congenital: PV, ASD, VSD, coarctation
- Hybrid coronal intervention
- Thoracic aortic interventions
- Heart failure: Pacer, ICD, Afib, biopsies
- Others: Fulminant pulmonary embolism

Demands Hybrid OR to Cardiovascular Room

The operation room of a cardiology, should be so largely as possible, at least however, 80 to 100 m². The arrangement, a highly efficient fixed arrangement must be, so no mobile or semi mobiles device. Hence, only the achievement-strongest devices of the industry come sensibly to the use. The suitable place need of the C-curve defines the size of the room. There comes that just in the cardiology the teams are big in the OR, so that is to be provided for suitable movement rooms (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 3, 2010)

The Hybrid Operation room has changed the cardiology; with the bringing in and place from Stents 3D-pictures are very helpful. The doctor assumes a good mobility of the apparatus, however, she should claim little room need. An easy introduction and an intuitive control and

service, is the condition for an easy use (Spring: Gahlen J., Wie plane ich ein Hybrid OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 15, 2010)

It is important to reach a high resolution of the pictures. This means that the achievement of the C-curve can be well illustrated with it a suitable brightness and the patient, accordingly must be big. The achievement of a C-curve is comparable with the resolution of one picture. Then information the absence cannot be added as a result of by the EDP. Hence, with the exposure a maximum must be created in information. 3D contrast resolution 2D is preferred generally, because she offers essential advantages. The pictures become more sculptural and lighter readable, individual signs are better interpretable. To receive the information of the reconstruction of 3D pictures the C-curve must be laid out accordingly strongly, however, it needs a high number in Screens, the information is joined by means of the EDP to 3D picture. Furthermore it is essential that the screens have a suitable resolution and exist in sufficient number 5-6 pieces on the left and to the right of the table, as well as multimodal couplings (Spring: Strobel N., C-Arm CT (synco DynaCT) und 2D/3D Überlagerungen zur Überlagerung von Abdominellen Aortenaneurysmen Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 18, 2010).

This is an essential expense factor, because the screens are still very upscale at the moment. However, the surgeon as well as the assistance should be able, on the left as well as on the right the pictures, data and representations, without themselves after the screen around turn off to grasp.

12 Vaskuläre interventions refer to the vascular medicine

	nummer of patients	motility %
elected	855	1,5 %
during OR	69	10,2 %
total	924	2,1 %

TA vs AVI [X]

[X] TA = Transapical, X TF = Transfemoral, AVI = Angio-Vaskuläre Intervention, CoreValve + Edwards SAPIEN (Siemens Website, 2010)

Illustration 75: Mortality rate of the first 30 days

The table shows to pass away the mortality rate of the patients within the first 30 days after the narrow reef. Additional the patients who do not survive the operation. 1.5% die of 855 patients within the first 30 days. During the operation 10.2% pass away. Aim this relatively high percentage is to be reduced. (Walther T., in 2010)

The main attention lies in the cardiology on the training and education of all Hybrid Operation room employees, because 5-8% of the patients must be given artificial respiration artificially. Accordingly sensitively the contact with the patient is to be formed. The success of a Hybrid-OR hangs in the essentials, how in a conventional OR from the good cooperation of the team. A marker with a heart OR, are the first 30 days after the intervention. The first 30 days are relevant for the judgement of the positive exit of the intervention and this time the patient stands under observation. Run the first days after the intervention positively the success is guaranteed. (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 16, 2010) The number of the partners during the operation in the operation room to located people is huge partly with a cardiology and exceeds the number with other interventions by far. Also the need in operation devices is substantially bigger than with a less costly operation. If the C-curve comes very much achievement must be strong and accordingly largely is laid out. The movement rooms as well as parking bays for the C-curve, as well as the possibility enough OR equipment for a cardiology as well as the need that the auxiliaries must move around the operation table freely entail that the Hybrid Operation room of the cardiology amounts between 90-100m2. In the comparison a conventional operation room is between 30-40m2. By the size of the operation room and their auxiliary, also there grows the requirement of the technology room, so that also in this room is to be calculated on more employees.

Patients with Raised Risk Profile

Very old patients mostly suffer from furred vessels; this complicates the intervention in the vessels substantially, because these so-called porcelain vessels are hard and friable. They admit no intervention and break as soon as the surgeon tries the vessels for opening. A conventional intervention thereby is hard to impossibly. By the application of the Hybrid Operation room more sparing interventions are possible, the vessels must be thereby worked on not at immediate place, but the intervention can occur in a substantially more favourable position. The vessels are spared, the chest can remain closed and the patient needs less anaesthetic. The intervention in the heart occurs, e.g., about the strip of the patient. The patient can be dismissed by the substantially lower expenditure and load for the patient, then few days later after the intervention. E.g., the number of the operations could be increased by the introduction of the Hybrid Operation room at the university clinic of Leipzig with patients with raised risk

clearly and lay with it clearly about the EU average. Studies proved that because the intervention showed a lower load for the patient, the lifetime after the intervention, with higher quality of life, could be clearly extended. at the same time the expenditures and with it the costs were clearly lowered postal-surgically.

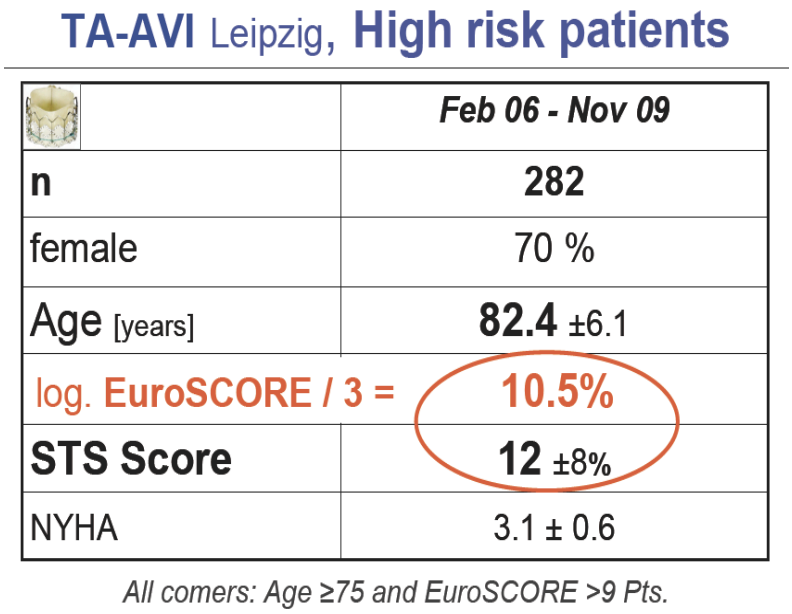


Illustration 76: Increase of the number of the interventions with high-level risk patients
The picture shows the increase of the interventions with high-level risk to patients with the average age of 82.4 years. The university clinic of Leipzig lies with 12±8% about the EU average with 10.5% (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 15, 2010)

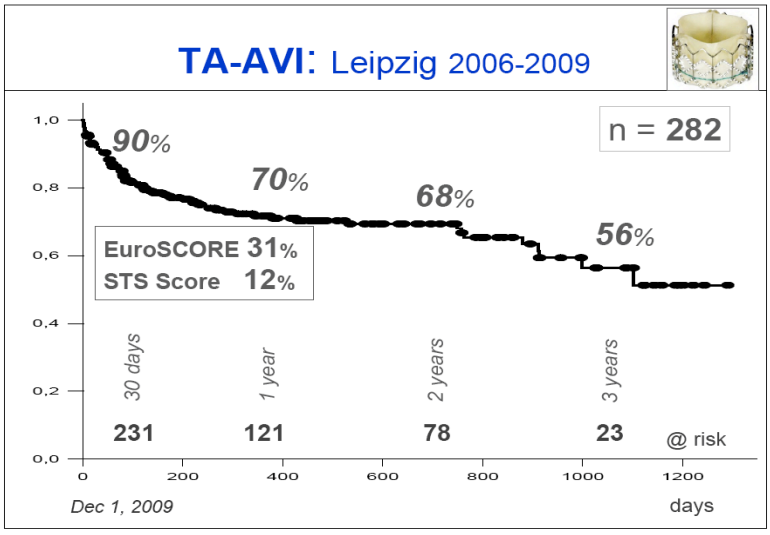


Illustration 77: Course of the lifetime after conventional intervention method
The high-level risk patients show the lifetime the picture after a conventional intervention methodology. After 30 days the situation stabilizes. Marker of 30 days is significant. (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 16, 2010)

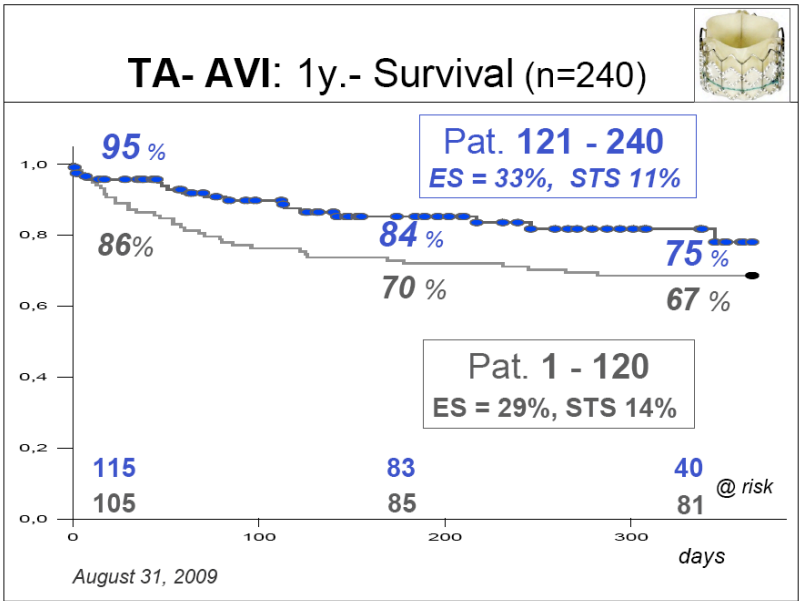


Illustration 78: Course of the lifetime after intervention Hybrid OR

The high-level risk the patients who get over the intervention well shows the change of the course the picture. Degeneration of the curve. Besides, an improvement of the methodology entered, so that can be distinguished between the first 120 and the last 120 patients again. (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 17, 2010)

9.3. Orthopedy

The orthopedics has already recognized the advantage of a Hybrid Operation room. Numerous interventions by means of the Hybrid Operation room are meanwhile, in the agenda. This also lies with the trend that always more minimally invasive interventions take place.

The accident and emergency Hybrid OR does not exist yet, besides, just these both disciplines would have to be interested in the education of a Hybrid Operation room, because the Hybrid-OR would be very well suitably just in cases with which time an essential role plays to be handy. As in the neurosurgery relocations are still usual in the casualty surgery, besides, a Hybrid-Operation room can solve this deficiency. (Spring: Gebhard F., Hybrid-OP in der Unfallmedizin, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 3, 2010)

Minimally invasive interventions in the casualty surgery and orthopedics need

- modified treatments and sequences
- diminished tools
- a good intra operative picture representation
- a lot of experience
- computer-controlled assistance

By the possibility of a computer-controlled assistance, it comes to never been quality of treatment. The surgeon can measure the situation of the bones in the fabric precisely and determine. Thereby, the transferring of technical aid is like nails, pencils possibly, even if the wall strength of the bone is thicker only slightly than the nail itself. With patients after accidents would be this one huge increase of the operation quality, the surgeon can determine the strength of the bone during the operation and move the right nails etc. in the right corner and depth without interruption. This would entail that the quality could be increased with emergency and accident-operation. (Spring: Gebhard F., Hybrid-OP in der Unfallmedizin, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 13, 2010)

That is a measurement of the skeleton takes place by creation of mess score, the putting of marker and auxiliary lines. Thereby it is possible to orientate itself at a later time by these

points. The navigation is thereby at a later time regardless of the situation of the body of the patient. With it is possible to orientate itself with the help of the C-curve in the patient and to navigate, to determine dimensions and distances precisely and to look at the body zones three Dimensional. With it is able regardless of the situation of the patient, the intervention occurs and implants precisely, after plan are produced and are moved in the right situation.

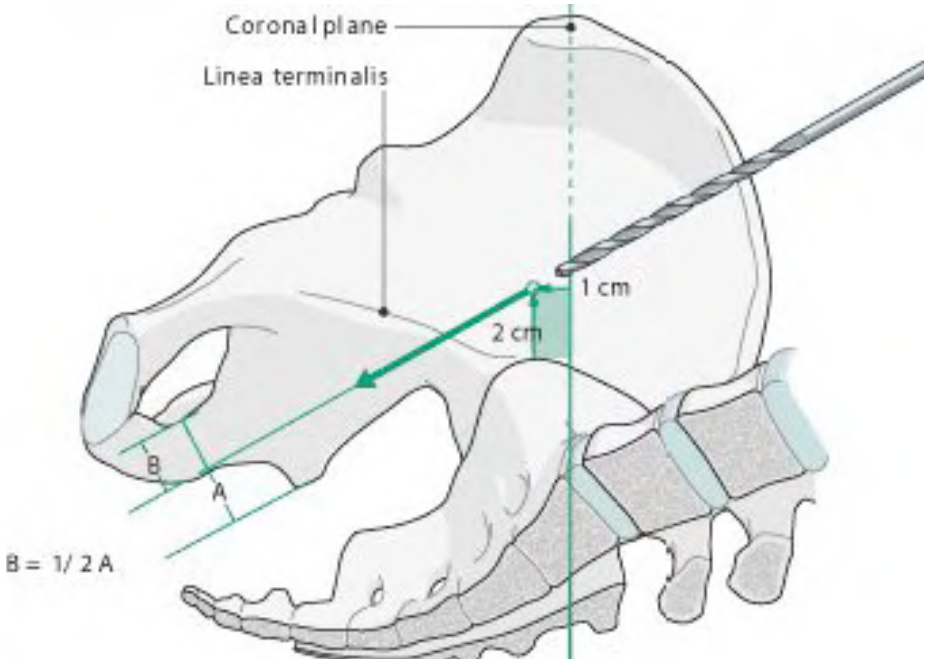


Illustration 79: Pelvic representation of a woman
Representation of a washbasin with of the corners of the drilling will measure. A thin record bone of the washbasin, an exact entry corner of the drilling demands, because the pencil would resign, otherwise, again from the washbasin. (Spring: Gebhard F., Hybrid-OP in der Unfallmedizin, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 8, 2010)

Since from the outside the record bone of the washbasin is hardly noticeable with free eye, the exact situation and the corner. So that it can be necessary with a fractured pelvis that this shovel-like intestinal leg with pencils must be fixed. To be able to put precisely the pencil, the corner must be determined first for the drilling . (Spring: Gebhard F., Hybrid-OP in der Unfallmedizin, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 14, 2010) This intervention is extremely difficult and needs a lot of experience. The danger is that if this happens not precisely, then the pencil resigns at unintentional place, again from the washbasin. Movement restrictions and a bad healing as well as discomfort would be the results.

This is only one example of a successful and sensible application of a Hybrid-operation room. Hence, the support by picture-giving technology, is time-saving and makes a spontaneously necessary operation, e.g., after an accident, only possibly. The intra surgical control, as well as the representation of the situation of the breaks and damages, by a C-curve, are indispensable just in the case of an accident (Gebhard F., 2010).

Illustration 80: Surgeons in the OR - patient with fractured pelvis

The picture shows surgeons with the measurement of the right corner to the treatment of the break of the hip. (Spring: Gebhard F., Hybrid-OP in der Unfallmedizin, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 13, 2010)

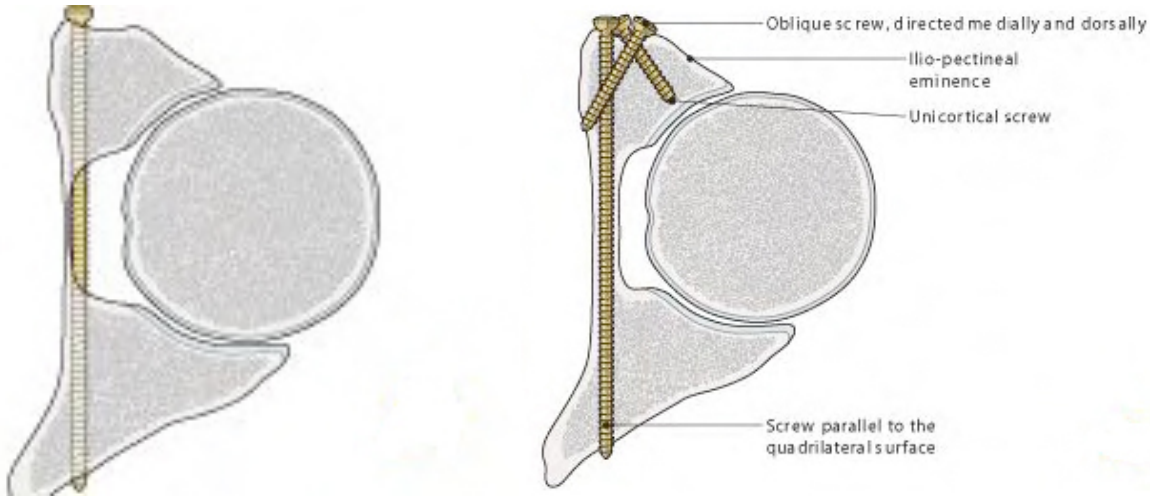


Illustration 81: Representation of the screw connection of the washbasin

The picture shows a screw connection of a washbasin, on the left it comes, in spite of an exact situation of the screw to the escape of the screw. The example shows as exactly at this point the screws must be moved. (Spring: Gebhard F., Hybrid-OP in der Unfallmedizin, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 9, 2010)

The connecting means, pencil, screw, are roughly equally thick like the ilium, the flat-shaped bone of the washbasin. The washbasin is at this point in which often breaks seem, very thinly. This place has approx. one strength from 6-8mm and the pencil has ø from 6 mm. earlier one has tried by numerous X-ray examination and marks in the patient to determine the situation of the washbasin to begin with. Indeed, these functions only partly, because externally in the patient right measuring points can be never exact. By an exact measurement and control during the intervention by means of C-curve the situation is precisely determinable and is possible for an exact work (Spring: Gebhard F., Hybrid-OP in der Unfallmedizin, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 12, 2010)

This example shows how important the availability of around pictures of the inside of the patient is. It shows furthermore that sometimes the time does not exist to make an advance planning. So that when the patient is available must be operated and be reacted. This is above all in the casualty surgery and emergency surgery the case.

Heart-operations and neuro-surgical interventions have as a rule long preterm. The application of a Hybrid Operation room in a emergency-operation reflects quite different conditions again (Spring: Gebhard F., Hybrid-OR in der Unfallmedizin, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid OR, Regensburg FRG, page 15, 2010)

9.4. Trauma and Reconstructive Surgery

The investment of a Hybrid Operation room is a strategically investment, it is about the question to which main focus the hospital wants to develop. The examples have shown that it sense makes for the most different professional disciplines Hybrid OR's to train. Thus there could be Hybrid ORs see for the cardiology, neurosurgery, orthopedics, casualty surgery. (Spring: Schuhmacher H., Was erwarte ich von einer Angio Suite?: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 4, 2010)

The casualty surgery shows a special form of a Hybrid-OR see. With the casualty surgery the time plays an essential role. The main attention lies on it quickly to be able to react and to use them to the C-curves to receive information quickly on the operation table which injuries are given with the accident victim.

Without the victim must leave the operation table, information can be collected thus and be evaluated; at the same time the patient can be treated by multiple injuries during he becomes examined, already at other place.

Hence, with the casualty surgery no pre surgical phase also exists, but the surgeon begins all of a sudden with the intra surgical phase. The more importantly it is to be documented for the casualty surgery, the steps and measures and to evaluate later in the postal-surgical phase and to evaluate for training purposes, also for liability reasons and insurance reasons.

Hence, the process of the casualty surgery requires differently formed operation rooms. A main attention shall be laid on the good accessibility to operation table with transporter with several people.

Because the accident victims are carried as a rule with the transporter of the rescue vehicle directly in the operation room and only suburb is transferred. All involved people emergency doctor as well as 1-2 assistants accompany the victim. Doctors and surgeons of the hospital them the victim take over arrive. The handing over of the victim happens at the operation table, so that also around the operation table inter Hence, the process of the casualty surgery requires differently formed operation rooms. A main attention shall be laid on the good accessibility to operation table with transporter with several people.

Because the accident victims are carried as a rule with the transporter of the rescue vehicle directly in the operation room and only suburb is transferred. All involved people emergency doctor as well as 1-2 assistants accompany the victim. Doctors and surgeons of the hospital them the victim take over arrive. The handing over of the victim happens at the operation table, so that also around the operation table internally several people stay.

Hence, the casualty surgery needs another process management. The accessibility of the C-curve must be guaranteed. It is to be considered whether C-curves not own for the casualty surgery belong to specialist qualified. After the accident victim was handed over and empties the operation room a little, while the first cleaning happens and the doctors get an overview which injuries are given seemingly, an employee could drive the C-curve from his park situation, an activity usually the surgeon makes. Causing the C-curve takes up 3-5 minutes, in a situation is every minute for the patient of importance, is these a lot of times. (Spring: Schuhmacher H., Was erwarte ich von einer Angio Suite?: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 9, 2010)

Hence, the casualty surgery must be differently led and be organized a special case, hence, shows than the other operation rooms Also the spatial organization of a Hybrid Operation room is a special case.

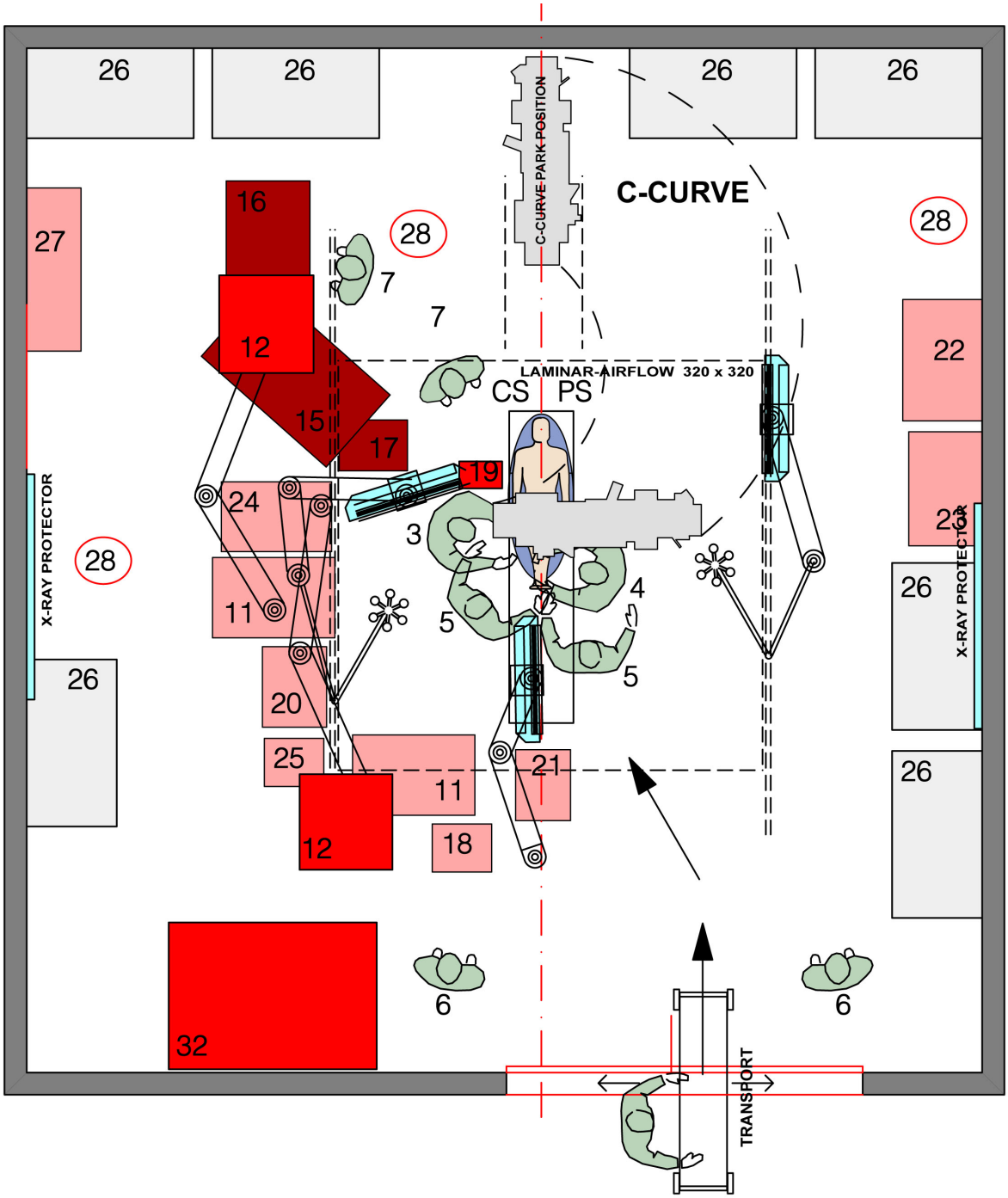


Illustration 82: Arrangement Hybrid OR of a minimal invasive emergency OR

The picture shows the arrangement of a Hybrid-Operation room of a casualty surgery. It is striking that the C-curve from the side as well as from the front can become driven up. Furthermore a lot of place exists for the rescue to bring had an accident to on the operation table. (Own representation in 2011).

10. Hybrid Operation Room Organization

Operation units are integrated components certain specialized divisions as well as independent departments, the patients other departments too shown get. Hence, general demands of the situation of the organization of the operation rooms can be formulated following.

The demands for the operation organization, conventional operations are short connections with intensive departments and a low distance to the general care surgical fields.

Functional binding in service centers in particular to the processing unity for medicine products which guarantees the care unity of the official training centre operation room.

A nearness to the exemption department (room for bearing) in case of emergency section as well as the accessibility of the emergency admission and endoscopy. A good accessibility for day patients. (Spring: Linzatti R., Professional MBA Health Care Management, Krankenhausmanagement und Krankenhausorganisation, Vienna 2008, page 48)

The Hybrid-Operation room makes partly other demands because the process structure is another. By the strong arrangement in pre-, intra-and postal-surgical phase and the possible Interdisciplinary it comes to a more intensive interaction between Doctor Patient, however, also between doctor doctor and doctor medical technical employee or between the different medical departments and fields.

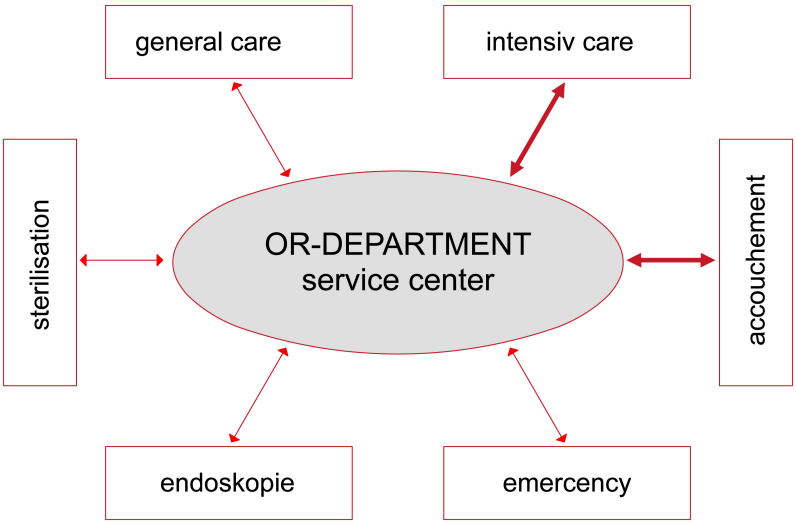


Illustration 83: Functional pattern OR organization

The picture shows the relations of a conventional operation room as an official training centre. The thin arrows show the good relations, the fat arrows the immediate binding of the training centre to other departments. (Spring: Linzatti R., Professional MBA Health Care Management, Krankenhausmanagement und Krankenhausorganisation, Vienna 2008, page 48)

Hence, the Hybrid Operation room virtually forms an interface; these new demands require a huge number of new solutions. The microcosm operation room is broken open and the existing functional respect of the official training centre Operation is broken open and changed.This concerns the administration and management of the hospital also, like the doctor and the patient, the OR process as well as the management. The Hybrid Operation room process is jointed in pre-, intra-, and postal-surgical phase. An essential component of the everyday contacts with the patient in the Hybrid Operation sphere is, that the contact and the respect between doctor and patient. This is intensified by the arrangement of the process and is changed in comparison to conventional ORs see strongly. The arrangement entails that the organization of the Hybrid-operation room differently develops, than the customary operation processes. The functional pattern Operation organization cannot be moved anymore and must be converted. A new position of the Operation originates see from anew formed processes and new functions in the organization of the hospital. By the arrangement in the phases, more interactive contacts exist before and after the intervention between doctor and patient. The doctor, surgeon, radiologist accompany the patient more intensely and come increasingly on the health problem of the patient. These votes and investigations must be able to take place spatially, in addition it needs investigation rooms, discussion rooms etc. under circumstances are own C-curves, exclusively for the investigations urgently not to load thereby the Operation rooms.

The expenditure for these achievements before and after the intervention increases for the hospital. The whole process of the Hybrid Operation room positions itself is differently there, than of a customary Operation room. At the same time the service duties must be produced in the hospital. Hence, it seems sensible that there is beside the Hybrid Operation room the second conventional structure which fulfills these duties. The Hybrid Operation room fulfills, so to speak, the function of a connection between a conventional Operation room and the new room draughts and functional draughts future Operation room. The new room models and functional models to the creation of Operation-organizational structures demand a logical conversion and support of parallel expiries. The peri surgical zones of treatment and the structuring of the Operation room in pre-, intra-and postal-surgical phases. The education and creation of a central anesthesia zone as well as the conversion multifunctional operation rooms and the reorganization and structuring adjusting and storerooms. (Spring: Linzatti R., Professional MBA Health Care Management, Krankenhausmanagement und Krankenhausorganisation, Vienna 2008, page 53)

A peri surgical zone of treatment is a holding company area. Preparatory zone and awaking room stand to each other in connection and form such an exchange zone for the patient. The Hybrid Operation room forces such an operation organization; because the interventions run off as rule minimally invasive and part processes are to be moved very well if parallel expiries are pulled together. Hence, of the installation of a Hybrid Operation room reorganization and imbedding demands in existing hospital structures. Partly these models exist at least travelled around on paper. Another organizational change by the installation of the Hybrid Operation room originates is the huge data flood and their contact with this problem. So that the Hybrid-Operation room not only process-surgical changes with itself brings, but also causes administrative changes. From the measures of the postal-surgical phase originate a lot of data which must be documented very well worked off, and be put into archives. The Hybrid Operation room has the disadvantage that new problems in the form of huge data amounts originate from the new technology. Now the hospital produces by the Hybrid Operation room a flood in images which are enormously big and which must be administered accordingly and be made accessible. At the moment politically this problem is not solved. Since e-card is not to be stored in the situation these data amounts. If one Austrian, European IT architecture comes for the memories such data and sick person's act totally at the moment is absent.

The Hybrid Operation room will anew define the medicine and make substantially more efficient. Interventions are formed easier and more actually. Patients will profit from it, because the quality becomes better and the load becomes lower. However, at the same time the administrative expenses will rise to protect these data of the patient. These problems are not solved yet. One argues at the moment at all levels about who the architecture of such a structure establishes what she must be able to do everything and who should administer them. It stands for the discussion where the data are stored and who, as access agrees. A new form e-cards is discussed, also a central data management. Other discussions go in the direction of that the patient is responsible for the protection of his data and should carry a memory with himself. A Hybrid Operation room needs to be able to function a new organizational structure around sensibly. This structure is of the existing operation organization absolutely alike and comparably. However, changes and renewals are necessary, because the expiries of a Hybrid-Operation room differently develop. The interdisciplinary teams must be composed and be led, hence, the operation organization is not to be assigned any more exclusively to a field and must be organized specialized covering and be structured.

10.1. Hybrid Operation Room Personal Demands

Hybrid Operations should exist of interdisciplinary teams what has to the result the professional borders are dissolved and hierarchy is broken open. These teams exist, hence, increasingly also not of doctors, but of medical-technical staff. The personnel structure and the requirement profile of the medical disciplines in the Hybrid Operation rooms are very different partly. See plans: Neurosurgery, cardiology, this is due to the fact in the essentials that the interventions are differently complicated and that the patient is treated by teams, doctors of different fields. And at the fact, that to carry out around the operation, different equipment is not least required what entails which rises the need in medical-technical staff which are a part of the team. Generally the intervention is carried out by the chief surgeon as well as the second surgeon. Then the second surgeon is one of a related field. e.g., heart surgery and angio surgery. (Spring: Vliek E., Philips, Operating Theater Room - Room Layout, page 9, 2010) Furthermore 2-3 operation assistants are available to them as a rule. This is already problematic by the limited access to the table. The anesthetist and his assistant are to be accommodated also in close vicinity to the patient. Furthermore another 2-3 operation sisters are available they help and assisting. The room is shifted by Rack for the monitor and accessories, filing lamps around the operation table quite strongly. The side separation, surgical and nursing side will usually maintain, however, at the same time the movement room of the C-curve calculation must be carried. The chief surgeon usually steers the C-curve which he gets over and over again during the intervention to the patient there (3-5 sometimes per operation). During the screening people must protect themselves in the room-located against the radiation. This happens with aprons as well as signs and walls. Moreover, the strong and quick rotation of the C-curve as well as the quick movements of the table is to be followed. The number of the employees in the controlling room amount 2-4 and they are indispensable part of the operation team and during the intervention. Their most essential job is to support the surgeon by means of the prepared pictures of the pre surgical phase and the topical pictures during the operation to matches. The surgeon depends on the employees in the controlling room and accordingly well the cooperation must be marked. Therefore the total number of the employees amounts with an operation constantly to present people up to 14 people. If colleagues come still under circumstances the intervention briefly accompany as well as training visits. (Spring: Grützner P.A., Erfahrungen mit dem Schulungskonzept. Intraoperative 3D Bildgebung, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Gefässmedizin, Regensburg FRG, page 35, 2010)

10.2. Hybrid Operation Room Structural Demands

Structurally a Hybrid Operation room requires quite different signs than the usual COR offer. This is due to the fact partly that the Hybrid Operation room exists of other rooms and shows other process sequences. The patient's streams are different to value, because the real intervention shows only one temporal phase of the interaction between doctor and patient. The pre-surgical and postal-surgical contain also patient's contacts. This change is to be considered structurally. A Hybrid Operation room needs structurally substantially more place than a conventional Operation room.

This has different reasons. The Hybrid Operation room needs next rooms, like a conventional operation room also, additional next rooms are controlling room, camp and technology room. The intervention room must be formed furthermore substantially greater. Because the C-curve and the organization of the ORs needs a lot of place, on the other hand, the C-curve must freely be able to move and limits the accessibility of the patient strongly, and this is the team greater than with a conventional operation room although. To walk towards him, must be planned of the Hybrid Operation room according to room generously.

If the Hybrid Operation room must fulfill, in addition, still different medical demands, it is necessary to intend enough place for the shutoff of operation carriage and equipment. That's why in the past the ways and the hall were mostly pulled up for the operation room for it. The company of a Hybrid Operation room shows a new, not available challenge, for the hospital management. The Hybrid Operation room company is not integrable simply thus in the hospital structure. Specific structures must be created to form the company smoothly. The Interdisciplinary of the Operation room is also noticeable in the management and creates additional interfaces and demands.

11. Hybrid Operation Room Workflow

The workflow of the Hybrid Operation room differs radically to that of a conventional operation room. According to intervention and field pass different workflow. A radiological surgical intervention develops, for example, differently than a percutan aorta flap implantation. Both the arrangement of the process is together by the possibility, one of pre-, intra-and postal-surgical representations (Spring: Linzatti R., Professional MBA Health Care Management, Krankenhausmanagement und Krankenhausorganisation, Vienna 2008, page 48)

In comparison to conventional interventions, the workflow of a Hybrid Operation room develops totally differently. The workflow of the Hybrid Operation room is divided in pre-, intra-and postal-surgical phase and also by the interaction to the patient the workflow of a Hybrid-Operation room differs from the conventional Operation room.

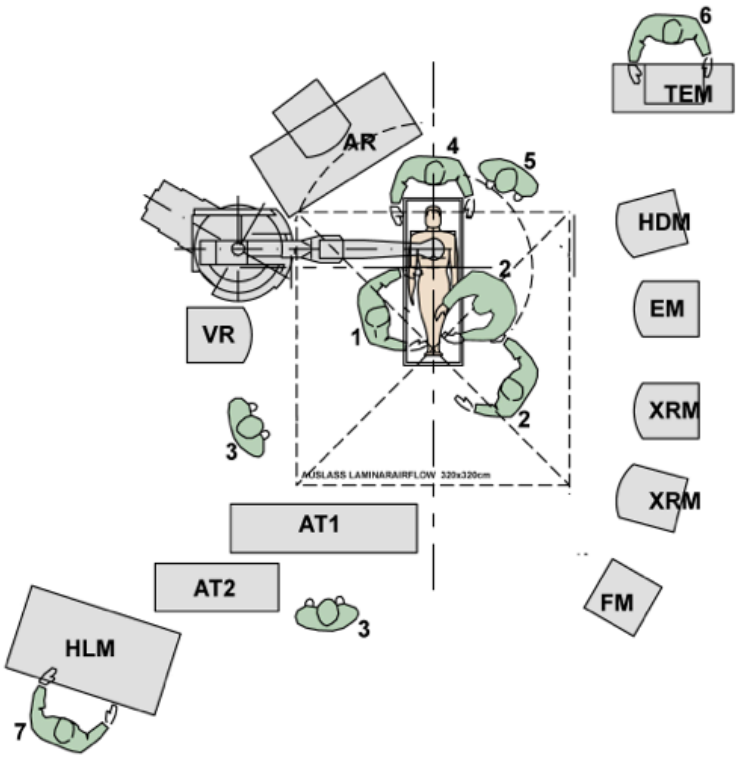


Illustration 84: Radiological intervention suite

The graphics show a schematic construction of a radiological surgery. These are striking the arrangement of the components as well as the spatial expansion. ARE of anesthesia Rack, AT assistance table, endoscopy monitor EM, FM of pressure gauge, HDM hemodynamic monitor, heart HLM lungs machine, TEM transoesophageal Echocardiogram, video VR scopic rack, monitor XRM x-rays, chief surgeon, 2 Assistance surgeon, 3 OP sisters, 4 anesthetists, 5 anesthesia sister assistance, 6 cardiologists, 7 cardiotechnical. (Own representation based on Barstad M et all, Intraoperative Angiography in Minimally Invasive Direct Coronary Artery Bypass Grafting, The Society of Thoracic Surgeons, Published by Elsevier Science Inc, page 1836, 1997)

While the surgeons with a conventional operation hardly have direct contact with the patient, the surgeon of a Hybrid Operation room has intervention a very narrow contact. By pre-and postal-surgical phase the measure develops for both sides totally differently. In a Hybrid Operation room conventional as well as minimum-invasive interventions are possible. Here merely the minimum-invasive intervention is discussed.

By pre-and postal-surgical phase the measure develops for both sides totally differently. In a Hybrid Operation room conventional as well as minimum-invasive interventions are possible. Here merely the minimum-invasive intervention is discussed.

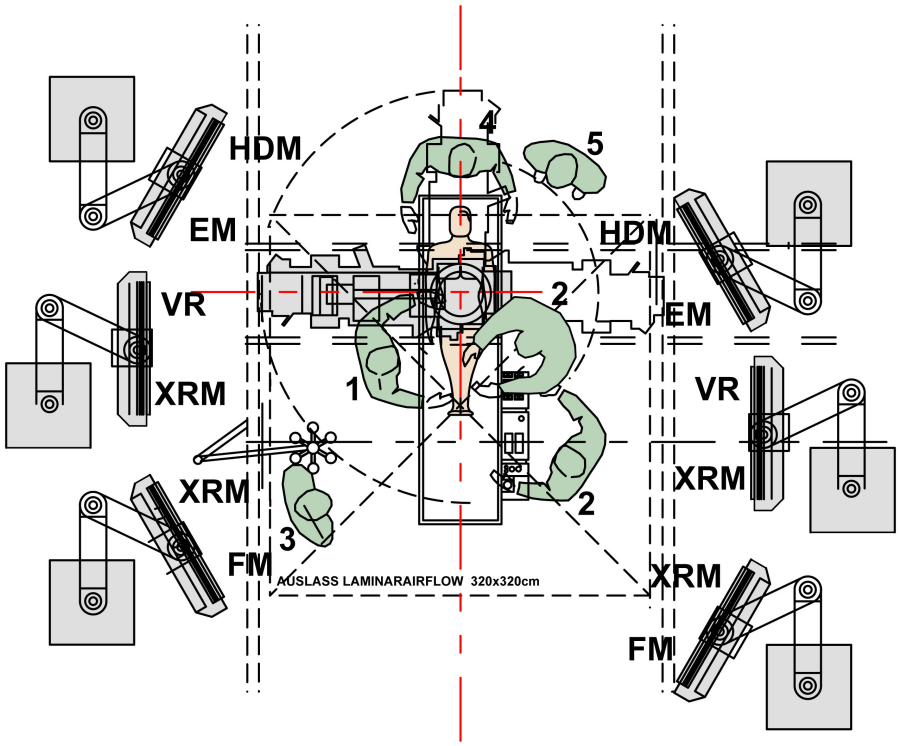


Illustration 85: Radiological intervention Hybrid OR suite
The graphics show a schematic construction of a radiological surgery as a Hybrid-OP suite. The difference between this suite and a conventional radiological interventional suite ist, that this needs less medical personal and room in the operation room and is much more economical. (Own representation)

PRE SURGICAL PAHSE

During the pre surgical phase an individual takes place, on the patients specifically coordinate planning and risk assessment of the intervention. By means of the C-curve pictures are provided by the inside of the body of the patient. The respective organ will measure this has the advantage that the patient can be measured precisely and be made as a result of re-

quired implants before the intervention. Furthermore can navigate by the measurement of the body, the surgeon in succession, during the OR itself by the body. The produced pictures are worked off for the intervention by the employees of the controlling room and are provided. With it colored pictures of the organ, the vessel or the organ are available for the operation. Furthermore it is possible to measure the body and to plan measuring points. The surgeon can reproduce thus regardless of the storage of the patient, the place in the body as well as their orientation during the intervention precisely. It can be put on by means of the EDP on the provided picture measuring points, these serve the surgeon to lead and to signal at the right moment that here at this point, eg. the new heart flap lies precisely properly and can be filed. The elaboration of the pictures of the pre surgical phase is an essential advantage of the Hybrid Operation room the picture it is generated colored and to 3D pictures. Not only well processed picture is thereby available for the intervention, but the picture is also used to plan the intervention. That is the doctor can prepare implants etc. for the intervention and produce. Furthermore the pictures can become further used later also for training purposes. The planning as well as recording the interventions shows the base of the training of medical forces. The simulations by the EDP, the pictures make clear plastically and form therefore the basis of good training examples. That is the surgeon stands in a direct narrow contact with the patient already before the intervention. The patient moves increasingly in the centre, this affects positively for both, doctor and patient.

INTRA SURGICAL PHASE

The intra surgical phase is that in that the intervention takes place. The C-curve comes to balance for the application around the intervention with the preliminary investigation and supply the navigation in the body by. During this phase the OR team has a narrow contact with the controlling team around the pictures of the pre surgical phase with those of the intervention to matches. Intra surgically the surgeon can make good the control of the Reposition and Fixation with bony joint surfaces, the screw situation as well as osseous defects as an example. Thereby it comes for the avoidance of check operations with often problematic soft part relations. There originates an improvement the process and result quality as well as the delay of postal-traumatic arthrosis.

The doctor has for the first time the control of the intervention and to him the sharp highly distraught pictures which were calculated in addition by the electronic treatment colored and 3-dimensional are available.

The possibility thereby exists

- a simultaneous intra operative diagnostics and therapy of emergencies (without time delay and transports).
- of a Matchings presurgical with the intra operative pictures, by transference of the planning data to the Situs and the intervention-accompanying modification.
- an immediate therapy control, by integration of all picture-giving procedures in the OR (profit of security and quality).
- an overcoming of field borders by cooperation of multidiscipline experts.
- from complicated interventions of different fields at the same time and also sequential.
- of all capacities of an OR with more multimodal state-of-the-art picture
- (angio, CT, endoscopy etc.).
- from intra operative simulation and navigation to the exact cooperation of all components.
- a visualization of the respect patient to instrument.
- the registration of the intra operative picture data.

The matches of the pictures are accompanied by the computer-supported systems. The surgeon finds out a real support. The system, the C-curve, also has influence on the accessibility to the patient. The usual accessibility is not given any more, working processes must be tuned to it. Strongest it meets the Anesthetist. His conventional position shall not be held.

POST SURGICAL PHASE

The postal-surgical control of the operation and backup of patient's data, as well as the documentation of the data and feed in the individual personal health act. Pictures pre-and the intra surgical phases become next time matched and are controlled. One works directly on the body of the patient and not with a choice in precast grey 2D-pictures. The navigation is an essential progress; the patient can be looked over and over again, all the same from which perspective, and be measured.

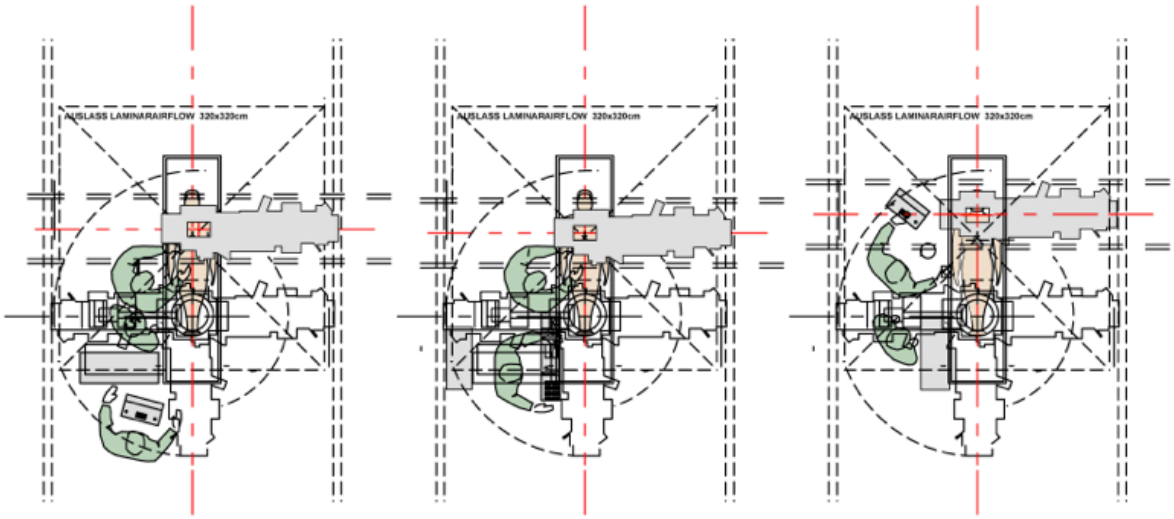


Illustration 86: Hybrid-OR positions
The graphics show that passed away to positions of the C-curve in the upper part of the body, heart, breast, larynx. The positions of the involved people, as well as those of the aid change according to movement room of the C-curve. Example with the help of a Hybrid-Operation room of the company Philips. (Own representation)

12. Hybrid OR Costs

The costs for the company of an operation are vital and consist of production costs and operating expenses. One count to the production costs all costs for the installation of a Hybrid-Operation room of company are necessary. This are to the costs of the acquisition of the devices, the planning costs, administrative costs, loan costs, building cost as well as the costs for the trial period and training an education. The costs, the trial period and training and education should not be underestimated, because the introduction and training time takes up several months and all involved people take part in it.

With under the trial period amounts some weeks to months. The installation of a Hybrid-Operation room and the suitable training of the involved people, doctors as well as not doctors want to be planned and be structured.

The acting people have to go in the best way possible is trained, be trained and be voted on each other to be able to act correctly under extreme conditions, like an operation. Hence, the advanced training costs show the biggest cost position, by far higher than the costs of the arrangement itself. With the education of the staff, however stands and falls the meaning of the installation of the Hybrid-Operation rooms. Nevertheless, unfortunately, these costs were not calculated properly. The result is that after completion the money is absent.

Today the installation of a Hybrid Operation room is financed as a rule by means of loans. If this cost position is absent in the calculation, the money is absent. A heightening of the loan changes the financial basic conditions substantially and a new economic efficiency check must be done. Expenditure originates and the economic efficiency of the arrangement must be judged anew.

Not seldom the possibilities of a Hybrid Operation room arrangement are not used and the potential is not exhausted, the possible economic profit is not taxed away. (Stone farmer M., 201) The calculation basis is pending from the extent of utilization of the operation room and from the kind of the carried out interventions. All three phases of the treatment also matter to the calculation.

In comparison to a conventional intervention which is hardly divided in phases the costs of a Hybrid-Operation room are characterized by the strong stamping of the phases by another process. The installation can still calculate itself, because the Hybrid OR creates substantially better results and this with a lower physical load for the patient. Hybrid ORs create see a huge number of possibilities of treatment and are many-sided applicable. By the reduction of the expenditure of the intervention, the nursing expenditure and the medical support also decreases. The convalescence phase is substantially shorter.

That means it comes for an improvement of the balance in favor of the Hybrid Operation room, an exact confrontation of the costs must be done and brings clarity.

The application of the C-curve lowers the costs of the assurances because the costs are lowered for the care, for the drugs and the insurance achievements, by reduction of the insurance times. In addition, it comes to a high-class increase, because the transferring of the stents, flaps and other implants occurs in an unprecedented exactness. (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 37, 2010)

The quality of the treatment leads to an added value, because the treatment must not be repeated and the capital costs were properly invested. The health of the patient can be produced more quickly again completely. At the same time the cut seam is lower. Merely the setting times are even costlier. At the moment by the absence suitable covers for the C-curve, it still comes to a considerable cleansing expenditure. (Spring: Torsello J., Erfahrungen nach 6 Jah-

ren Hybrid-OP(Axiom Artis) und Zukunftpersektiven, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 19, 2010)

COST EXAMPLE

Hospital German Heart Centre Berlin

With the help of the rebuilding of the operation rooms of the hospital German heart centre Berlin, Augustenburger Place 1, 13353 Berlin. It should be shown which expenditure is behind the rebuilding of an operation room to a Hybrid-Operation room. The rebuilding of the Operation units of the hospital to caused costs of 11 EUR of million and found in the period of 01. Sept. From 2007 to 31. Aug. In 2008 in two construction phases instead of. Three operating theaters were anew formed 1-3 (2nd AC) and halls 4-6 (1st AC) and were brought on the newest state of the technology.

55 professional companies were involved in the conversion of the rebuilding, of it 25 companies of the medicine technology, as well as 5 engineer offices, 1 project team DHZB and the employees of the hospital who have gone on working in spite of the rebuilding (Spring: Schmal J, P., Umbau des OPs des DHZB, Stiftung des Bürgerlichen Rechtsin, paper 2010)

The rebuilding measures were in the essentials

- To medical arrangements and devices
- Installation cardio-angiography system and a heart measuring place (Hybrid) as well as all the rebuilding all operation rooms.
- Interlinking of a modern medical video management with picture-giving procedures and high-resolution HD-, admission, memory and sound quality.
- Installation new technical care systems with raised technical safety standards and ease of use.
- Electric and distant registration installation
- Medical gas public utility uses
- Sanitary arrangements, sanitary installation
- Room air, Measuring, control, regulation-technical arrangement
- (RLT/MSR-technology)

- Cleansing machines and disinfection machines in the OR and on the intensive care unit.
- New qualities in the construction head trade:

  - Automatic door arrangements, OR doors.

  - Antistatic floor covering, OR window and doors

  - View protection arrangements, covers and wall panels among other things

The implementing of the new Hybrid-Operation room also indicates in the essentials to have to provide the personnel resource and the necessary operation management. It is by no means only another operation room which it is a matter to implant. The acting people are to be sent to school specifically, own rosters are to be developed. The extent of utilization of the Hybrid-Operation room is in the foreground on grounds of the high establishment costs and maintenance costs.

Another cost example is AKH Vienna, Währingergürtel 18-20, in 1090 Vienna

This project became for financial reasons in the end of 2007, not realized, the rebuilding costs were too high. Folding up two operations 5 and 6 of the level 9 was planned for the heart and thoraxchirurgy (Spring: Joch A., Interview, medical technical Manager Siemens, Vienna, 2010). The workflow and the room function program of the Hybrid-Operation room would have reworked and on the today's state must be lifted. It would have brought the education of new rooms, like technology room, controlling room as well as a storeroom with itself.

POS room	room number	floor cover	scale in m²
1 Hybrid-OR	09Hxxx	PVC/ conductible	114,00
2 control room	09Hxxx	PVC/ conductible	17,00
3 induce room	09Hxxx	PVC/conductible	21,00
4 accession room	09Hxxx	PVC	14,00
5 cleaning room	09Hxxx	PVC	9,00
6 dispose room	09Hxxx	PVC	7,00
7 technic room	09Hxxx	PVC	20,00

Illustration 87: Hybrid OR AKH Vienna room book
The graphics shows a cutting from the room book of the Hybrid-Operation room of AKH Vienna, room number and the quality of the ground are to be taken from the room book. (Spring: Joch A., Interview, medical technical Manager Siemens, Vienna, 2010)

The company Siemens served as an authoritative manufacturer of the AKH, the following units were planned

- Computer-tomography arrangement - sanatom sensation Open with sliding Gantry
- Injector - accutron
- Ultrasound scanner - acuson Sequoia Card
- Archive system

Angiography asset with robot tripod

- Variation A - biplane arrangement, Artis ZEE Biplane (wall device)
- Variation B - mono tarpaulin arrangement, Artis ZEE ceiling (ceiling device)

Ceiling care unity - company DRÄGER Medical, more integrated Laminar Air-flow cover, with OP lamps and integrated video cameras

- TAV - ceiling
- Operation light, STELLA, 2x 160,000 luxes incl. integrated camera with remote control and operating tablet.

(Spring: Schmal J, P., Umbau des OPs des DHZB, Stiftung des Bürgerlichen Rechtsin, paper 2010)

The estimated costs amounted for the rebuilding as such net to EUR 3.300.000,00 as well as to other EUR 3.040.000,00 for the investment for great devices and medicine technology. The costs are attached in Austria very high. This certainly lies with the relatively small market and in the huge interweaving of the politics and the health service.

Today numerous planning’s of Hybrid Operation rooms originate in the most different sick person's institutions. These are partial main hospitals who would like to develop her main focus further or want to form another main focus (Spring: Thomann G, Interview, Hybrid-OR-Manager Philips, Vienna, 2010)

The problem with the rebuilding cannot be fixed simply in few parameters. Generally it is to be realized very hard without compromises a rebuilding in the heart of the house because the architectural measures are very big and the new organization needs his place. The costs can become extremely high. Thus the examples of the costs of AKH Vienna of 32,250€/m2 shows

us. Thus it seems absolutely unrealistic to manage the rebuilding at running company, because the costs thereby rise further. The biggest hurdle is that do not mean available room height, so that the efficient devices are not used. While usual room heights amount to 2.8 m in the OP rooms, needs of the Hybrid OR 3.2 m there come, the inter heights, for accommodating of the technology, like climate, airing etc. To manage a free from problems expiry, the attention of the place need is essential. With a pool of two operations is to be calculated as a rule on many compromises. (Spring: Gahlen J., Wie plane ich ein Hybrid OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 10, 2010)

The next rooms, how the technology room and the camp are essential for the functioning of a Hybrid-Operation room, besides the camp may be planned by no means too small. The future development to be expected should also stand firm. It is to be expected that the development will put on the market numerous new medical implants, furthermore the existing products are developed and stronger differentiated. A well sorted assortment needs place, and then the implants can be also found in stress-conditioned situations (Spring: Steinbauer M., Implementierung von neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 15, 2010)

The best solution and, hence, in the long term the most favorable variation an additional building is certainly to be planned. With it many problems which originate with a rebuilding step not at all by days. A substantially better expiry is to be expected; so that the concentration can be laid increasingly on the c The costs for the rebuilding strongly vary. The device costs amount in accordance with. Information of the manufacturers around EUR 500-600.000,00.

If the costs of the rebuilding come, so that is to be calculated on approx. EUR 1.0 million per Hybrid OR. (Spring: Thomann G, Interview, Hybrid-OR-Manager Philips, Vienna, 2010)

One can arrange the costs in two main groups, in the architectural rebuilding measures, this all rebuilding’s are in the structural fabric including the house technology and the medicine-technical rebuilding measures. Moreover all apparatuses and medicine-technical devices count. The rebuilding measures keep as a rule to a certain extent because intensive rebuilding’s can be excluded. The adaptation of the airing and the air-conditioning, usually explains, the biggest position of the architectural rebuilding measures. The building cost amount as a rule only to one fraction of the total expenses. The medical devices often put out a multiple of the building cost competence centre

13. Hybrid OR Planning

The planning of the operation room should be structured see well and be given in professional hands. It must be defined first for which departments a Hybrid Operation room should be established. The project planning Hybrid Operation room starts with the check of the location factors. The hospital bearer must do an economic efficiency check and clear, which competitors in which catchment area exist? Which achievements have the existing arrangements? Which specifications have this? Which job, would the planned arrangement have? What is the source situation of the existing hospital? Where does the hospital want to go and what should be reached with establishing a Hybrid Operation room? How does the existing situation OP look? How can a Hybrid Operation room be integrated into the existing situation operation? Which user's groups, doctor's teams, should be demanded? Who are the patients? Where are the capacities? Do the patients exist in the catchment area, and if so, in which number? Where there lies the growth potential. Which care steps which are demanded surgical departments? Wants the house to grow? Where should the house grow? How can it market the achievement? (Spring: Schuhmacher H., Was erwarte ich von einer Angio Suite?: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 7, 2010)

The decision which system of which user's group whether a new building or a rebuilding should be created is complicated. The new building is to be preferred to the rebuilding certainly. The total expenses are higher, but the use is substantially bigger and it still allows rather that the coming developments can be still considered later. Many trouble during the construction phase by company maintenance are lost, no compromises are necessary by the planning. The efficiency rises, the use rises. Long-term cost-use- confrontations show that no compromises should be entered (Spring: Gahlen J., Wie plane ich ein Hybrid OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 6, 2010)

The advantage of the Hybrid-Operation room is recognized see meanwhile by all professional guilds in the hospital (Walther T., in 2010) a Hybrid-OR is a very high investment, however, the biggest investment, is the investment in the employees, so that the Hybrid Operation room is also integrated really economically. The definition and training of standards is indispensable. The training concerns not only the staff immediately with the C-curve deals, but all professional forces all around. Employee of the doctors, care, anesthesia, radiology, EDP, technology, physics, cleaning and management. (Spring: Steinbauer M., Implementierung von

neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 2, 2010)

The operation room extent of utilization is the same, with the same cut-seam times and shorter intervention times, as well as lower power and lower ray load. The maintenance costs lowered and effectiveness can be increased by the planning of common next rooms, as for example the consignment store ((Spring: Steinbauer M., Implementierung von neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 15, 2010)

Before the planning of a Hybrid Operation room is to be cleared

- Whether a sufficient extent of utilization is possible.
- Who the users of the Hybrid OR and whether they exist.
- As the equipment of the Hybrid-OR should be.
- Whether it synergies with div. med. Disciplines, Interdisciplinary are possible.
- As the optimum organizational implementing looks in the house.
- As the expiries and the planned interventions develop.
- As the definition are formed by standards and arrangements.
- As the need can be created for a higher interest in the ray protection.

13.1. Decision Maker Planning

The planning is the first step for the realization of the Hybrid Operation room and begins with the education of a planning group to the conversion of the construction of a Hybrid Operation room.The planning group has the job to make the need and the quality of a Hybrid Operation room visible. A basis of the planning are so-called need studies and feasibility studies, arise from the master plans to the conversion of a detailed planning (Spring: Steinbauer M., Implementierung von neuen Arbeitsabläufen im Hybrid-OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 12, 2010)

Planning Group

The planning group has to steer the planning process and to tact the planning expiry. The approach should be intensive and multidiscipline. The regular meetings which intensify the know-how are to be held. The duties must be distributed clearly and be kept. It is advisable to visit existing Hybrid-OR see of various hospitals and to search the contact with the different manufacturers and to evaluate like the teams are composed (Spring: Schuhmacher H., Was erwarte ich von einer Angio Suite?: "Perspektiven für den Hybrid-OP", Forum Hybrid-OP, Regensburg FRG, page 8, 2010)

Certain combinations would extremely make sense and lower not only the costs but create an added value (Spring: Vliek E., Philips, Operating Theater Room - Room Layout, page 8, 2010)

Such OR synergies arise, for example, by the combination of medical disciplines like they

- Cardiology, angiology
- Neurosurgery / surgery
- Casualty surgery / orthopedics

The planning group is, so to speak, the project team of the Hybrid Operation room and exists of representative of all areas. From people they are also seized decisions to hit and also accordingly operate.

So that the Operation room is planned also well the planning group exists of the following interest representatives

- Owner's representative, supervisory board representative
- Hospital manager
- Care: OR-assistant/vascular assistant / OTA/MTRA
- Hygiene: more responsibly for the hygiene
- Planning office: architect, structural engineer, TBE
- Planning team: Div. Surgeons, anesthetist and assistant, interventional person
- Engineer: TBE, mostly in-house engineers
- Medicine technology: Div. Professional forces
- Big device consultation: Manufacturer of the devices

The planning group compiles all relevant parameters, like costs, situation and the using of the operation room as a result of the house-internal parameters should be looked. It is matter statics, TBE (technical building equipment), spatial expiries, the binding in existing structures as well as the room-functional structures of the house to follow. (Spring: Schuhmacher H., Was erwarte ich von einer Angio Suite?: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 9, 2010)

Furthermore the expiries should be planned in the Hybrid Operation room, e.g., the anesthesia position, as well as the light which are cleared to monitor and the video system. (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 3, 2010) The equipment of the OR room must be clear, like operation tables, glass cabinets and Trollies. Finally, the company of the Hybrid Operation room must completely become be planned.

A project team with a project management, project structure as well as describing the projects, e.g., reorganization of the OR management must be formed. The realization of all needs, conditions, time and room plan and sequence plan lead to the spatial planning as well as the gadget office layout necessary for it. In the end the conversion plan occurs with participation of all persons responsible. This concerns not only the management, but also the care and the doctor's team. People can thereby visit trainings and seminars concerned, e.g., on time. Within introduction the solution is helped carry not only by all partners, but by suitable control all partners are also prepared accordingly (Spring: Grützner P.A., Erfahrungen mit dem Schulungskonzept. Intraoperative 3D Bildgebung, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Gefässmedizin, Regensburg FRG, page 25, 2010)

13.2. User Groups

The user's groups determine the number of the required operations as well as their equipment and size. However, by the combinations of user groups the complexity of the parameters of the operations increases according to the achievement picture of the medical professional group, and depending on which visions become followed changes the demands of the Hybrid-Operation rooms. Besides, these not always become easily his different achievement pictures of the different professional guilds under a roof to bring.

They passed away to medical professional disciplines very different views also live, consciously and unconsciously. Thus one must take note that the cardiology, neurology, neurosurgery, neuro-radiology, radiology, angiology make to emergency surgery, casualty surgery, orthopedics, gen. surgery as well as the operation care absolutely different demands for the job and also the expiries in the job, in the operation are completely different. Only from this point of view it is hardly conceivable to form combined operations they go on, as the on the page 43 introduced ones. Cluster models, Hybrid OR are multifunctional recordable, therefore, seem absolutely impossible. But it always depends on the acting people (Spring: Linzatti R., Professional MBA Health Care Management, Krankenhausmanagement und Krankenhausorganisation, Vienna 2008, page 50)

14. Hybrid OR Draughts

There are no generally valid Hybrid Operation room draughts. Depending on how the Hybrid-Operation room should be recorded which professional disciplines should work in it, the need is described. If then still different professional disciplines should co-operate, the demands increase, the state of affairs becomes more complicated. (Spring: Strobel N., C-Arm CT (synco DynaCT) und 2D/3D Überlagerungen zur Überlagerung von Abdominellen Aortenaneurysmen Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 8, 2010)

As a rule the hospital is not planned round the OR what entails that compromises are entered which become mostly apparent in practice, with the expiries. The huge number of next rooms is to be followed, like disposal room, technology room, controlling room, washing room, storeroom everybody needs her place and needs her place near the events, near the intervention room. Thus, For example, the technology room can be not far planned away because the inlets and the care are limited for the C-curve by approx. 4.0 m. (Spring: Gahlen J., Wie plane ich ein Hybrid OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 19, 2010)

The assisting people, in the controlling room to the doctor support need a clear view on the doctor, hence, they should also be in close vicinity to the operation table. Hence, it is hardly conceivable that it will come to a cluster education of Operation rooms. It will be too difficultly to co-ordinate the technical problems and the expiries. This would be called that it will

come to main focuses (Spring: ten Cate et al, Integrating surgery and radiology in one suite: A multicenter study, Journal of vascular surgery, volume 40, number 3, page 499, 2004)

Soonest will assert itself of the operation room in sufficient size 70-80m2. In this size he is already multifunctional recordable and has to take up enough room reserves around different doctor's teams. Pulling together of next rooms could function according to geometry of the house. As for example folding up of preparatory rooms, washing rooms or the camp for the infertile property (Spring: Gebhard F., Hybrid-OP in der Unfallmedizin, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 30, 2010)

14.1. Hybrid OR Integration

The architectural integration of a Hybrid-Operation room depends in the essentials, of it like the continuance procure is and how the existing operations are integrated structurally (Spring: Linzatti R., Professional MBA Health Care Management, Krankenhausmanagement und Krankenhausorganisation, Vienna 2008, page 52) The architectural substance, the constructional, static-constructive grid of the house is vital by the judgment whether additional loads can be expected of the house, and whether the house admits static changes. Furthermore it depends of the quality of the structural fabric of the house; it is a difference whether one attacks structurally a house from the last century, or a modern Ferro-concrete construction (Spring: Gebhard F., Hybrid-OP in der Unfallmedizin, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 31, 2010)

The loads and movements it introduces a Hybrid Operation room in the substance, may not be underestimated. A Hybrid Operation room also exists of many next rooms which are properly arranged to ideal manner, only so functions the company. It is problematic thus a complicated thing of a Hybrid Operation room, with the next rooms to integrate spatially with the structurally necessary magnitude. The logistic solution is not difficult less which is a result that as a rule numerous compromises are entered (Spring: Gahlen J., Wie plane ich ein Hybrid OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 3/19- 20, 2010)

The source situation in an existing hospital to install a Hybrid Operation room is likely, at all hospitals alike. The basic conditions are more or less always the same. The existing construction body ordinarily has to take up constructional no possibility the loads of a Hybrid-

Operation room. A Hybrid Operation room sprinkles as a rule the borders of the feasible; therefore, the rebuilding measures to be expected are massive. The statically necessary measures for the cover and the ground, for the pool of the rooms are not mostly sensible or do not become cost-defensible. The rebuilding is still often carried out, and is preferred the additional building, because apparently only the estimated building cost are seen. The building cost with a rebuilding amount to from approx. 25 to 30% of the total expenses, (cost incl. cost of the devices). If costs come by the implementing and installation as well as costs for the staff and training (Spring: Joch A., Interview, medical technical Manager Siemens, Vienna, 2010)

With a rebuilding too many compromises are entered as a rule. Instead of planning a solution on wide view, a Hybrid OR is virtually installed with the crowbar. This starts with the room height; this is not usually suitable for a big arrangement. The room height, 3.6 m is necessary, is only very hardly changeable and would become at older houses, two floors concern, which is why the smaller arrangements which are achievement-weaker and with which the screening is not so strong are used. A too weak C-curve retires as a heart arrangement of a competence centre. It is a compromise which is not remediable (Spring: Umscheid T., Erfahrungen mit einer deckenhängenden Anlage im OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 22, 2010) In Regensburg a Hybrid Operation room was built, one has made way here in the cellar and has therefore created an own area for the Hybrid Operation room. With it one has behaved statically and technically cleverly, indeed, this operation room, no binding has in the centrally operation room (COR) and has no nearness to the intensive care unit. The Hybrid OR lies far from the centre of the house and, hence, is bad. It is possible, sensibly to build additionally, according to geometry of the existing building. This was reached, for example, in Ludwig's castle. An existing COR from the 70.th had to become general-cleaned. One has to do this opportunity, finally, used and itself after the first inspection in addition decided a building. With form of a Hybrid ORs no compromises should be entered. The analysis numerous studies for the rebuilding of an ORs see to the Hybrid-OP has shown that the problems predominate with a rebuilding of an Operation room mostly, the building cost comparatively terrifically rise and the solution, nevertheless, is not satisfactory. The reason for the fact is that the compromises they must be entered are too big which are to be met measures them, around the basic conditions are huge to fulfill. Replacements of props and weight-bearing elements are constructional costly, but manageable. But to accommodate at the latest with the necessary room height, and the impossibility, the

highly competitive C-curves, this whole expenditure makes no more sense. A main problem, the room height originates because the big C-curves, as a rule the given room heights sprinkle. In addition the installations come for the house technologies which are for hygienic reasons in the cover. (Spring: Gahlen J., Wie plane ich ein Hybrid OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 9, 2010) To produce folding up two Operation rooms around the necessary surface, besides, is still the smallest practice. If this comes the rebuilding at the running company which takes place in the middle of a sensitive area of the hospital. Hygiene and noise prevention are to be protected

As a rule, it should be tried to build a new Operation room area, a Hybrid-Operation room area in addition. This does not let arise many problems at all. Maybe one demands that hospitals establish together to a location, together a Hybrid-Operation room centre. This would mean the house B to itself with the costs at house A involved. House B one share of the profit can tax away and can record the Hybrid OR. With a choice of the location the feasibility of a building was essential. (Spring: Umscheid T., Erfahrungen mit einer deckenhängenden Anlage im OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 36, 2010)

14.2. Hybrid OR Building

The building of a tract with binding to the existing object for the purpose of the accommodation of a Hybrid Operation room is certainly to be preferred to the installation in an existing house. Though it comes to a cost increase, but this meets only the building cost which put out 25-30% of the production costs. The amortization of the higher issues can be promised because the introduction and Introduction substantially reasonable ones functions. The introduction amounts as a rule to 10-15% of the building cost. There comes that by the missing compromises, the spectrum of the possible interventions is substantially bigger. The extent of utilization can be increased also. It must be taken no consideration for the available structural fabric. Existing Operation rooms or COR can remain see used furthermore or are converted partly. The building can be suspended in the easiest case like a backpack to the building, like Klinikum Ludwigsburg, or be connected by means of an additional way. Thus the existing structure is preserved and another element the structure of the hospital complements. (Spring: Gahlen J., Wie plane ich ein Hybrid OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 20, 2010)

14.3. Hybrid OR New Building

A Hybrid Operation room as a new building is certainly the best solution, even if first the most expensive one. Cost confrontations on long view calculate and the assessment of the added value, however, by a better usability and a higher effectiveness as well as by the higher degree in possibilities speaks unambiguously for the new building. A solitary new building as a competence centre with all what belongs to it. The necessary compromises can be held low and the cover, the house round the technology can be planned. Future developments can be considered in the form of reserves; rebuilding's always going in the limit and leave no place for the developments. Room heights can be chosen in such a way as it requires the technology. The room height is quite cost-neutral with the new building, also the span of the cover, in a room with up to 100m2 and 8-10 widths (Spring: Gebhard F., Hybrid-OP in der Unfallmedizin, Dissertation: "Perspektiven für den Hybrid-OP", Forum Hybrid-OP, Regensburg FRG, page 31, 2010) The construction efficiency and the construction progress press the total expenses, difficult impediments can be excluded. The construction time plan is short what lowers the costs. The production costs are made up roughly of costs for the construction body and the equipment costs for medical devices and inside removal. The costs to the production of the construction body must be confronted with the costs for the rebuilding. All the other cost positions should be in m² the same. Hence, one can relatively simply create costs use confrontation in which one confronts the costs for the achievements of the master builder with a rebuilding per m² created Hybrid OR with room to that of a new building.

The new building creates rather the claim several disciplines under to bring, the extent of utilization is increased and the costs amortize more quickly. The extent of utilization is substantially in case of the consideration of the costs of a Hybrid Operation room. Hence it is to be entered the more considerably no compromises but to think integrative and to operate. Ideally several Hybrid Operation rooms would be to be pulled together as a competence centre and thereby several professional disciplines. The possible education of a common technology room or infertile good camp. That is the fact that not all hospitals need a Hybrid Operation room. A Hybrid Operation room competence centre should be left to medical centers, tandemdoctors the efficiency is thereby given also (Spring: Grützner P.A., Erfahrungen mit dem Schulungskonzept. Intraoperative 3D Bildgebung, Dissertation: "Perspektiven für den Hybrid-OP", Forum Gefässmedizin, Regensburg FRG, page 25, 2010)

14.4. Hybrid OR Architect Plans

The architect's plans are to be valued differently, because it concerns different houses with different room-functional programs. The plans still show clearly as differently the subject Hybrid-Operation room are planned or are lived. It shows furthermore the room need and the room proportions of a Hybrid-Operation room. Many projects have room reserves which are there mostly unused. Bad Nauheim and AKH Vienna are Hybrid-Operation room in the continuance is planned. The plans are very different, while the room is too small in Bad Nauheim, the room is in Vienna more than largely enough, but as badly usable. Vienna has enough room reserves, but the weight-bearing structure of the house admits no other plan.

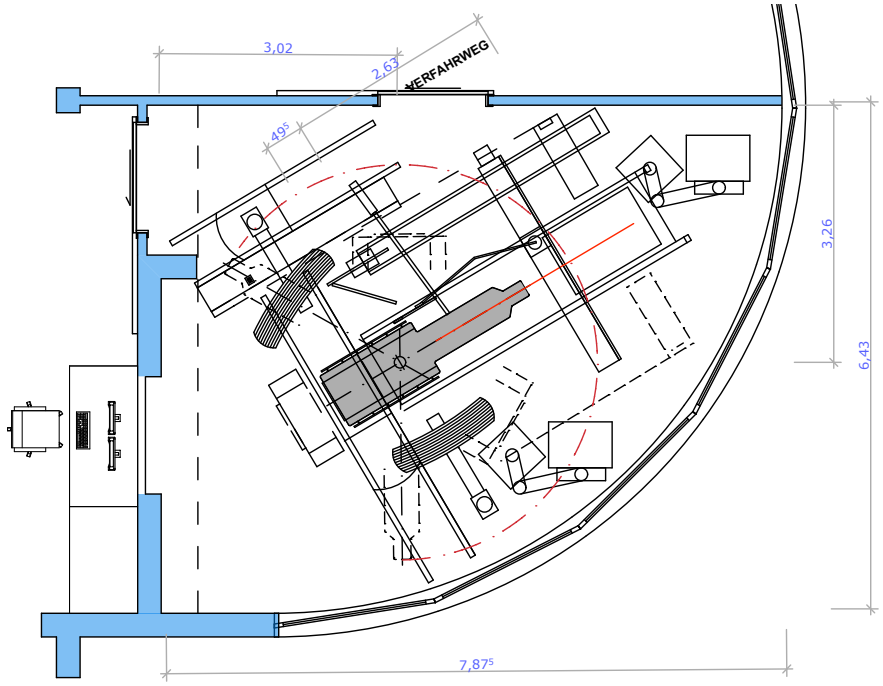


Illustration 88: Plan Hybrid OR Bad Nauheim
Picture shows an Angiography in Bad Nauheim. The room has scanty 40m2 this is no solution. Numerous problems with the hygiene by missing movement possibilities of the arrangement question the usefulness and the investment of the arrangement. (Spring: Umscheid T., Erfahrungen mit einer deckenhängenden Anlage im OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 22, 2010)

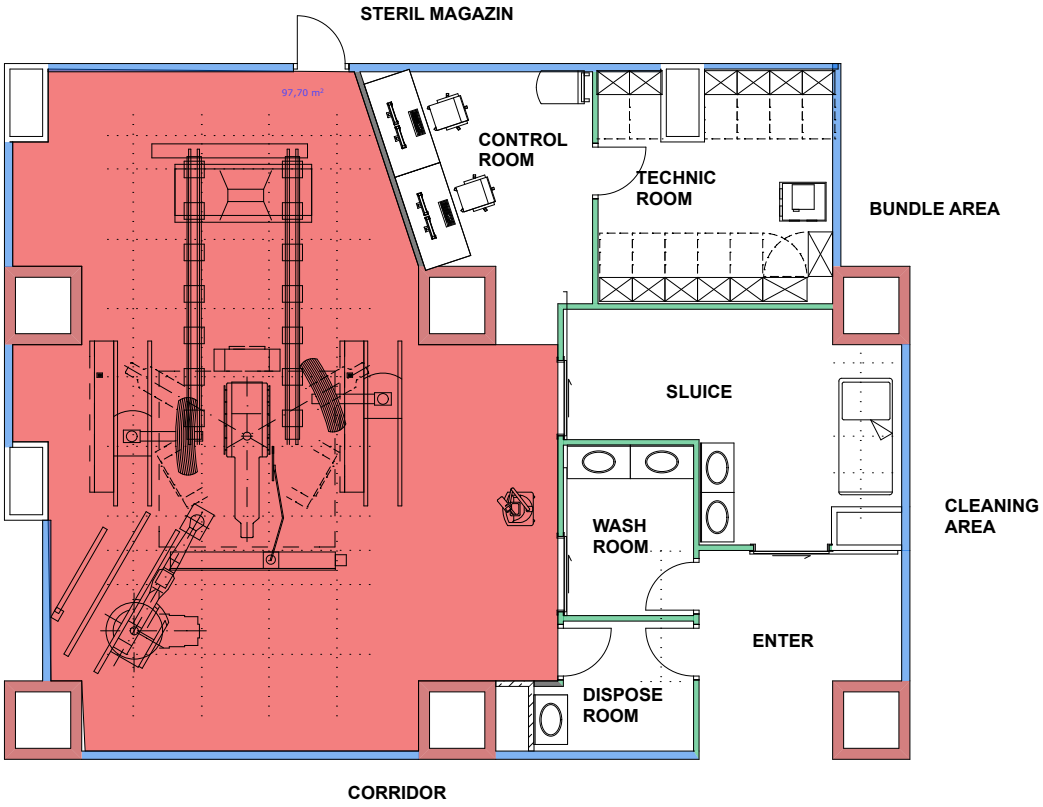


Illustration 89: Plan Hybrid-OP - AKH Vienna
Picture shows a preliminary draught of a Hybrid OPs for AKH Vienna of the company Vamed. The structurally available design features, red, admit no sensible planning. (Spring: Joch A., Interview, medical technical Manager Siemens, Vienna, 2010)

The example Bad Nauheim does not show an angiographie to arrangement in a room him the necessary spatial quality shows. It to itself, besides, around a cover-mounted arrangement of the fa Siemens. This is an arrangement middle size. One has decided here on a rebuilding of an existing room, for an Angiographie arrangement which is possibly unfavorable. The room geometry is for an OR with this equipment, does not function, the available place, cannot be thereby used. The example also shows that only the room size is not vital. The geometry matters also (Spring: Umscheid T., Erfahrungen mit einer deckenhängenden Anlage im OP, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 22, 2010)

For architects these rooms are most difficultly to the arrangement and shapes.The employees have to go during the intervention, care not to collide with the various Operation piece of furniture, how Operation carriage or with the wall by which the sterility would be endangered.

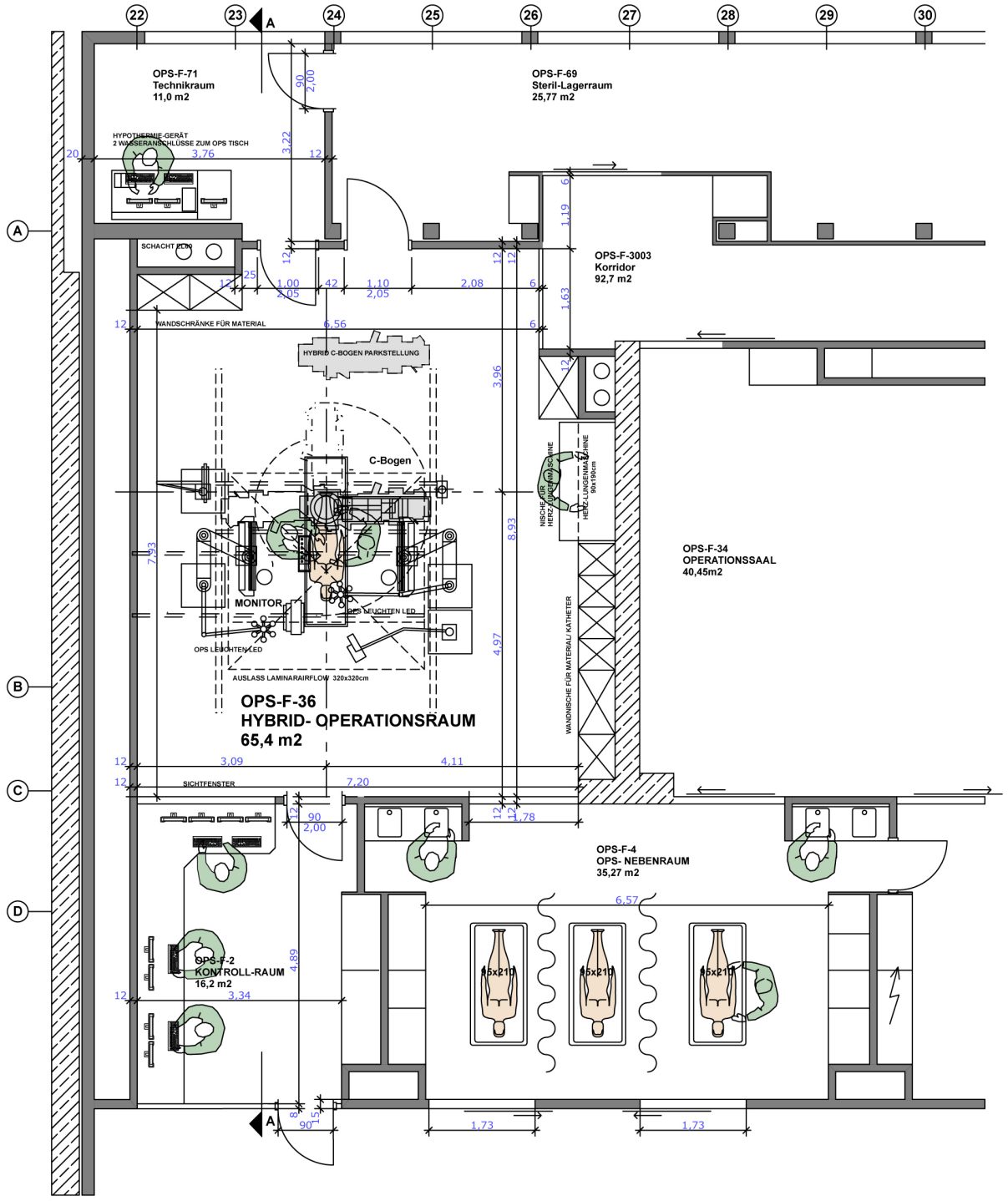


Illustration 90: Plan Hybrid OR Medical Centre Ludwigsburg

Picture shows a moved Hybrid-Operation room in Ludwigsburg. The conversion was moved strictly and without compromises. The operation room is big with 90.00 m² accordingly. Also the next rooms are generous accordingly and properly arranged. As a C-curve the multi axis system of the company Siemens, Artis ZEEGO was installed. Diagonal installation (spring: own representation)

A discussion should be also led about the window tape. Though many windows, in the round-running wall, are well-intentioned, but cause excluding problems. To create natural daylight a window would have reached; many windows are absolutely contra productive. So many windows must be shaded and be closed airtight. It creates rather the problem of the heating in summer and the reflex ions of the light, on the available screens of the Angiography arrangement. The room climate certainly does not become better by a light tape in an operation room.

The example of the planning of the company VAMED, AKH Vienna, shows another problem again. The available static and care-technical structure of Vienna AKH's, prop grids and shaft grids arrangement is so dominating that a sensible installation of a Hybrid Operation room is not possible. Though the intervention room has about 100m2, but is not to be used optimally.

There do not originate a lot of areas are usable, the Operation table looks squeezed. The controlling room virtually has no direct eye contact to Operation table and looks lost. The planning is a compromise and was not that's why also moved with certainty also. Another reason were the huge costs, because this rebuilding would have come enormously expensive.

With the rebuilding and building in the medical centre of Ludwigsburg FRG one is very determined and has strictly gone forward. The complex of buildings has grown historically and arranged accordingly very in homogeneously. The COR was renewal-destitute. One has decided on a clear cultivation without compromises and has installed this between two construction bodies.

The solution is a very successful one, one for the future. The spatial proportions are tuned to the demands of the Hybrid ORs, everything is optimally aimed and divided (Gahlen J., in 2010) The intervention room is smaller around 10m2 than the planned intervention room of Vienna AKH, still one sees immediately the better usability of the Hybrid Operation room. No annoying architectural structures of the continuance exist; the necessary next rooms are well arranged and formed by the size and adjustment optimally.

The last picture shows a study of a cluster. Clusters are typical structures him of 60th and 70th. The problem of such a solution is always the functionality of the next rooms etc. the main attention lies first on the intervention rooms, but also the necessary next rooms, like the infertile good camp, the controlling rooms, preparatory rooms are given not enough attention (Spring: Kettenbach J., et All, Minimal Invasive Therapy an allied Technolgies, paper Informa Healthcare page 54, 2010)

15. MIGTR Multifunctional Image-Guided Therapy Room

With the MIGTR the core process is central in contrast to conventional Operation rooms and Hybrid Operation rooms. Dynamism originates from the occupation of the operation rooms by the medical teams and the patient is a part of the process. Patient's orientation stands in centre, not the functions of the departments. The model assumes from the fact that the admission hangs together very strongly with the dismissal. The process orientation becomes the engine of the hospital in which no big hierarchy can exist, the teams remove the specialised divisions and work interdisciplinary on the patient. The danger of such a structure is the high specialisation, expert's islands originate. The medical specialised divisions (vertical structures) make available for the operation exerts (curve arrows). The patient is a part of the process (A, B), is important that every process has a process person responsible, (process owner) him the team chooses and leads. The process owner must be no doctor and is ordered by the board of directors. (Spring: Jacob A.L. The multifunctional therapy room of the future: image guidance, interdiciplinarity, integration and impact on patient pathways, European Radiologie No. 10, page 1763-1769, Springer Verlag New York (2000)

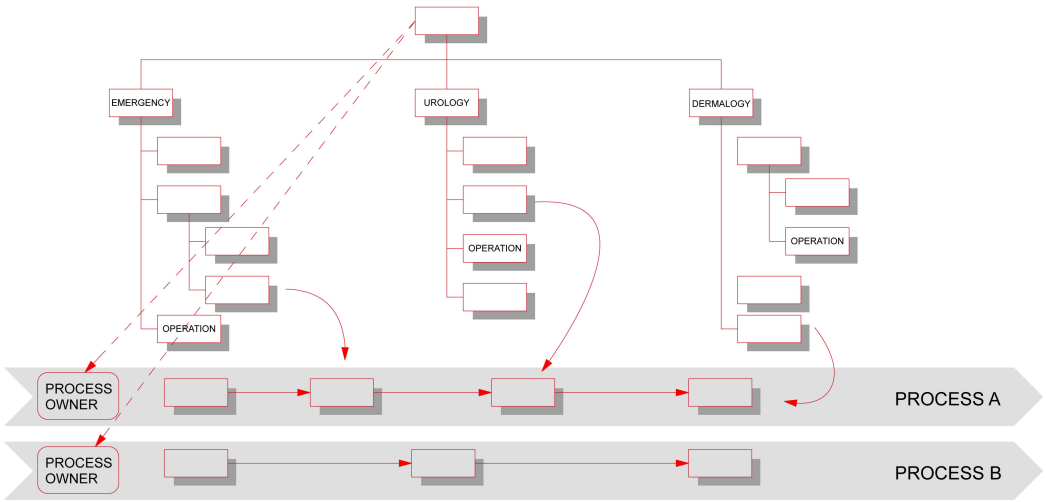


Illustration 91: Matrix model binary structure

The picture shows primary structure oriented to process, they become by med. Departments supports. The processes by teams controlled accompanies and from the process owner escorts. (Spring: Neumann Heinz, Professional MBA Health Care Management, Prozessmanagement, Vienna 2008, page 161)

The model of the MIGTR places on the synergy of processes of different medical fields around a whole ones access to allow. Around the expenditures of a MIGTR in the clutch to

agrees, the existing structures must be optimized and be reduced. A possibility would be to use the next rooms like camp, Controlling, technology room etc. together. It must be examined whether the synergy of different professional disciplines at another level can function in the Hybrid OR, e.g., by the common use of next rooms.

A multifunctional Hybrid Operation room would originate from coupling of different Hybrid Operation rooms and other great devices like MRT, CT, angio suite etc. The future will mean a tailor-made chain of actions in the patient. Interventions will occur during an operation. Like the annual service with a vehicle, even if this comparison is still ventured at the moment. The medical operation processes let themselves also how many other manufactured products describe along a process way.

As already with the Hybrid Operation room there will be different phases of the treatment. Preliminary planning, planning implementation and control as well as completion. Aim is patient-careful it and intervention-careful to operate and to lower not only the risks of the patient, but also the costs for the intervention and the care with it. It will come for a movement of the cost positions, for a change of the achievement picture of the hospital. The concept of a treatment will be anew defined in future. The patient gets a package in achievements and gets a schedule, a listing of the measures and an exact achievement description like in other branches long ago usual.

The process of a MIGTR cluster differs to the process of an Operation room radically. An operation is based on the fact that the surgeon sees individual circumstances only by opening the body, recognizes and on it reacts. This is completely different with the Hybrid OR or C-curve. A multifunctional operation room (MIGTR) bases on the arrangement of different units, Hybrid Operation room, conventional Operation room as well as another control unity like CT theoretically also MRT. The operation phases win with a MIGTR strongly in meaning and describe the planned process. The principal reason for this change is the terrifically risen complexity of the process and the coordination of the people. This shows on the one hand a challenge, however, is at the same time the reason why to the MIGTR so much potential is ascribed.

PRE SURGICAL PHASE

The preparatory phase of the MIGTR cluster is much costlier and more complicated than with a conventional OR. It must be tuned of various measures different teams analyzed, planned and be co-ordinate. The whole Operation course, all of the involved people, devices and drugs implants has to do, time wise as well as concerning the contents are planned and are tuned. Because a MIGTR disposes of a controlling room, these people must be integrated also.

The pre-surgical phase also differs by the quality of the preliminary investigations and by the application of the C-curve. Thereby can be preplanned OPERA born nit precisely and be prepared figuratively. The surgeon appeals during operation pictures of the patient and becomes by means of support by medically technical employee All these measures, all preliminary investigations, as well as the internal vote, the processing of the picture, the vote etc. must be included in the plan and be co-ordinate. If several operations during an appointment take place raised to them this expenditure. MTM of the controlling room navigated.

INTRA SURGICAL PHASE

The real intervention phase of the MIGTR cluster, the phase of the real intervention indicates above all to keep to the coordination agreed in the pre surgical phase and to expiries. The patient should get by with an operation appointment and it is a matter all necessary measures to finish in the right order. The data and picture of the patient which were prepared in the pre surgical phase minimize the expenditure of the intervention and optimize the course. Thereby it is much more exact possibly and health-careful to operate. The patient must not be opened in the extreme case anymore and is treated like a minimum-invasive measure. The very old patients who would not survive of a conventional measure can be thereby treated carefully and successfully. Steady balancing of the planning and the intervention by means of the C-curve raises the success terrifically.

POST SURGICAL PHASE

The post processing phase of the MIGTR cluster serves, like to put into archives to balance the data, pictures and results of the pre surgical ones and the intra surgical phase with a Hybrid-Operation room in addition. All measures which have occurred in the patient are controlled finally by means of the CT in the operation room and are valued. This material can be made available to the patient for later interventions etc. electronically. Furthermore it is likely

very well to lead trainings and analyses by. Provided SOP (standard OR process) are defined and moved precisely. A problem puts with certainty the huge data amounts there and their sure contact with these data. Hence, a MIGTR cluster will need a suitable computer centre; this is able to store these dates and to administer.

16. MIGTR Arrangement

MIGTR OR Arrangement, (which exists multifunctional image guide therapy room) of the same spatial components, how a Hybrid OR. These are in the essentials the preparatory room, awaking room, cloakroom, disposal room, controlling room, technology room of Hybrid OR, technology room CT, storeroom and the intervention room. See it is a sense and the purpose of a MIGTR OR that the patient receives the necessary interventions in an appointment as a receiver from primary process achievements for a limited period. In addition it is to be tuned urgently all necessary measures on each other and to co-ordinate. It is a huge change of the process and is reflected in the arrangement of the rooms and functions again.

16.1. MIGTR Preparatory Room

Is in the beginning of an operation unity and should be so in the draught that the turns of beds are possible. This tropic can be also planned in the connecting passage; however, it should be possible anyway to turn the transporter beyond the operation rooms.

The room serves like a conventional and Hybrid Operation room measure of the admission of patients before the operation. The patients wait in these rooms for the other process. In the preparatory room the last preparatory measures can take place, like the removing of prosthesis, glasses etc., however, take place also the last examination. A possible giving of drugs, however, also from contrast media takes place here.

The preparatory room serves as a buffer to be able to form the expiries and the process of the ORs consistently and without interruption. This room wins in operation rooms also as an emergency operation room are used, strongly in meaning, because is to be calculated on the fact that unplanned interventions must be inserted.

16.2. MIGTR Interventional Room

The intervention room differs in comparison to the intervention room of a conventional ORs by his size and complexity. While a conventional room OR approx. 36-45m2 shows, the intervention room of a MIGTR Operation room approx. 150m2. The intervention room is jointed in three zones which by a transport system form an alliance are.

These are this of the Hybrid Operation area, the conventional operation area and the CT area, that means two zones exist for interventions and, however, also two zones for the control of the measures. The C-curve of the Hybrid-Operation room forms the centre of the MIGTR Operation room, the place need is the biggest, and the processes are complicated. The C-curve can be aimed by the available cover rail system accordingly variably and according to intervention, the position of the C-curve changes to the patient.

A suitable park situation for the C-curve must be included in the plan. By the availability of a C-curve, Hybrid Operation room, the same next rooms, like controlling room, technology room and infertile storeroom like with a Hybrid Operation room exist. The area is complemented with numerous accessories and piece of furniture around the C-curve, furthermore becomes for the different surgical measures, a huge number of accessories near the interventions stored. A lot could be used what during an intervention, perhaps, is stored in container and chests of drawers. Operation lights, screens and other devices complement the job. According to main focus those of the Operation room forms the room will be arranged around the C-curve.

In the middle there is the conventional operation table, this comes for application if the Hybrid Operation room table and the C-curve are not used. This are customary conventional interventions, how among other things big fabric injuries. However, the patient can be also transferred by the Hybrid Operation room unity on the conventional unity by means of a suitable system. The operation table is substantially smaller than that of a Hybrid Operation room and the accessibility is not affected like with a Hybrid Operation room. With both operation units a Laminar-Airflow element (3.2 x 3.2 m) is in the cover.

Finally a CT curve exists and makes an exact control of all measures finally possible. The employees of the controlling room accompany and support the doctors with measures by means of C-curve as well as with the CT curve.

16.3. MIGTR Awaking Room

The awaking room serves the admission of the patients after the intervention. The patients are virtually ready for the transfer on the medical department. Both rooms, the preparatory room as well as the awaking room need a slight care as well as a medical observation.

16.4. MIGTR Control Room

The employees of the controlling room support the doctors by means of balancing and passing of information, data and pictures. In the pre surgical phase it was entered thoroughly on the patient and the measure was planned. With not planned operations, emergency and accident operations can be supported by providing of generally valid facts and data to the doctors. In the controlling room the employees the CT are also taxes and they work on the pictures. Alike the employee the pictures of the C-curve work on.

16.5. MIGTR Technic Room

The rooms are naturally in the next nearness to the controlling room and much further than 4-5 metres should not be removed from the C-curve, because bigger distances problems with the data transfer generate and affect this resolution and with it the image quality.

The MIGTR Operation room differs essential by the working process from all other Operation rooms. If a certain intervention, e.g., of the cardiology takes place in a Hybrid Operation room always minimum-invasive. Accordingly the staff is chosen only for this intervention and is trained. The draught of the MIGTR Operation room is based on the draught of a all together process. Surgical measures them should be expected of the patient conventionally successively would run off in an Operation room. So that this is possible, the OR team passes of various doctors different fields which are complementary and treat a patient together. The doctors like with a Hybrid Operation room are accompanied by the employee in the controlling room, also these employees are trained on different main focuses.

EXPIRIES

By the higher complexity of the processes and the linear arrangement of the zones, Hybrid-Operation room, conventional Operation room and CT curves it comes to a directed process. Naturally the whole area MIGTR Operation room becomes cyclic.

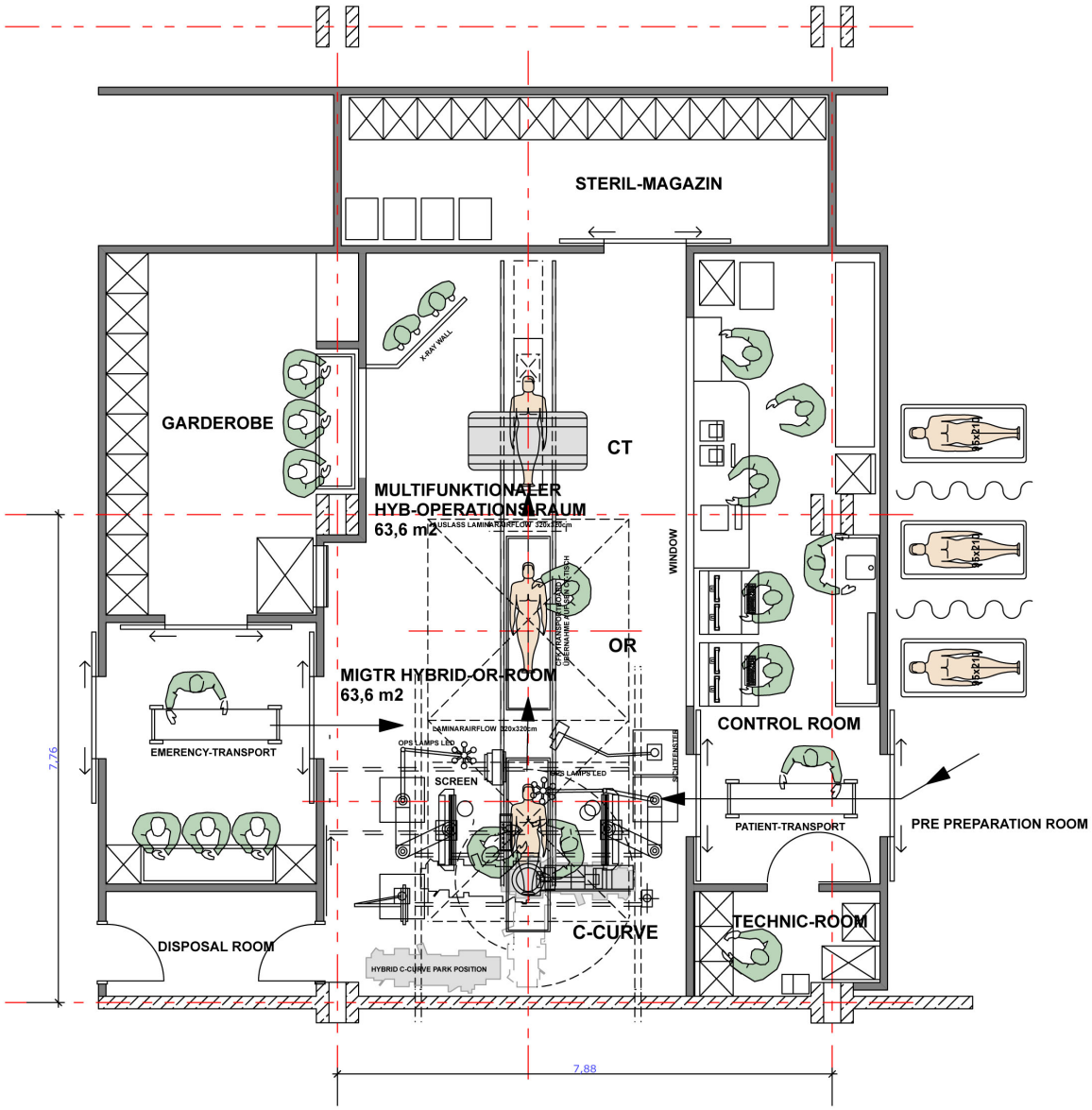


Illustration 92: MIGTR model

The graphics show the construction of the MIGTR of Jacob. It is striking that the intervention room is rather small and the functions, like cloakroom, washing and infiltration are separated. Also the important next rooms are rather modest. With this model the patient channels by the same door in and out, what is problematic in practice, above all with these place relations. The model assumes from the fact that the same Operation room are also used for emergencies, the bringing into play does not seem to function on the left really, because as a rule an emergency patient is accompanied by 2-4 people and here the approach does not seem to function. The operation process ends on the upper wall, the patient has to go if he is ready, back. The whole place relations seem to be planned too idealistic. The arrangement essential next rooms do not seem to function; the patient is led by the controlling room, or the technology room which should be removed max. 4 m from the C-curve is completely absent. (Spring: Jacob A.L. The multifunctional therapy room of the future: image guidance, interdiciplinarity, integration and impact on patient pathways, European Radiologie No. 10, page 1763-1769, Springer Verlag New York (2000) Fig. 2 page 1768)

17. MIGTR Workflow

The hospitals must act in future process-oriented to have grown to the challenges economically and medically. The departments must structure themselves accordingly and modify around the process to be able to lead. Instead of arranging to hierarchically structured departments, in parallel side by side, a model will take in future place around itself in which the departments dissolve her borders and produce overlapping with other departments. Thereby it will exist less friction and conflicts on account of local adjustment and top-down structure and, however, at the same time a competence centre which is for the pa With structures oriented to process the patient stands in the centre, specialized divisions are equivalent and arranged without demarcation possibilities.

A horizontal structure is marked by a common adjustment and patient's orientation. Struggles for power and departmental borders are lost, synergies from exchange originate. Combined with workflows they enclose all fields, by runs every patient a predefined way and gets individual, according to ailment, medical achievements will originate.

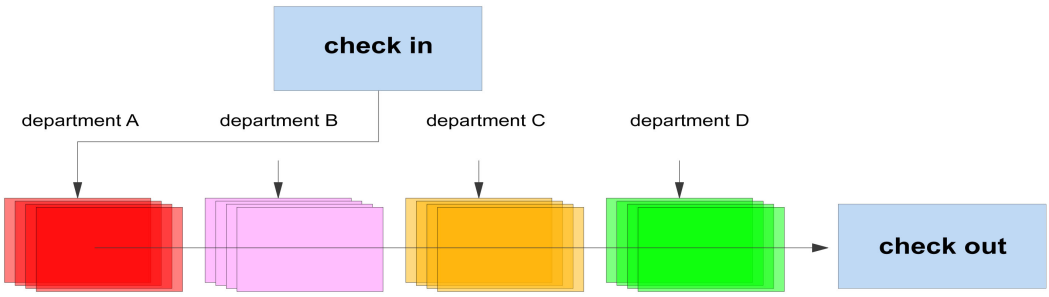


Illustration 93: Process oriented workflow

The graphics show the workflow of a not hierarchical KH structure oriented to process. The patient is examined after the admission by doctors of various departments and is accompanied. This process structure corresponds the structure of an assembly line of the industry. Spring: own representation)

The available linear, vertical structure is substituted with a horizontal workflow for him all processes and departments grasped. This entails, the fact that process optimization leads necessarily to improved shorter action ways and more compact medical units.

The thought of the process optimization by the installation of structures oriented to process, leads in the surgery necessarily to a multifunctional Hybrid Operation room to the MIGTR (multifunctional image guided therapy room).

The interventions in a MIGTR cluster raise the complexity terrifically, the patient has only one single appointment and the measures are simulated with the EDP and are planned in advance, during the OR are balanced and are controlled in the connection in the OR.

Like an assembly line for the production technical products, a ready product, in this case a cured patient leaves the operation room. This is in the comparison of a patient, who has appointments over and over again and control-operations an essential progress. Hence, the post-controls and aftercares as well as result and control-operations are cancelled. The time of the recovery in the hospital is strongly reduced, and the patient will dismiss substantially earlier, the costs for the care are lowered. See LKF system.

This development means that fewer beds, less nursing staff are required in the hospital. In succession there originate lower operating expenses (heating, stream, water, food, care) The whole costs of the hospital being would have to be defined by this development anew.

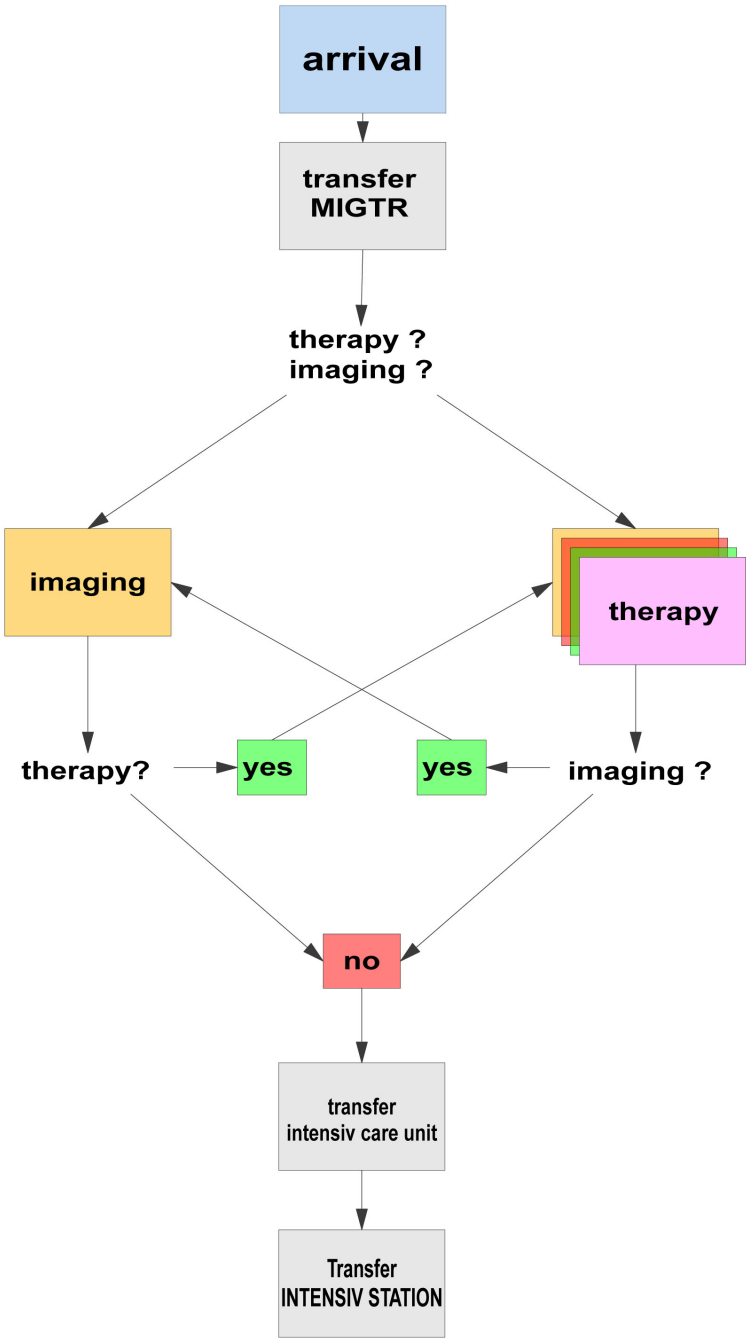


Illustration 94: MIGTR diagnostic therapeutic workflow

The graphics show the workflow of a multi-functional operation room (MIGTR) is striking which is necessary no more local change and thereby numerous transport and transfer achievements (3T-achievements) are lost. Short decisive ways bring this action briefly and reduces the costs in comparison too conventionally to existing processes. (Spring: Jacob A.L. The multifunctional therapy room of the future: image guidance, interdiciplinarity, integration and impact on patient pathways, European Radiologie No. 10, page 1763-1769, Springer Verlag New York (2000) Fig. 4 page 1767)

18. Cluster Operation Room

Operational systems are the education of a cluster a union of operational units to different companies to the increase of the operational achievement by common resource use. This can happen by synergetic effects or, however, by expenditure reduction. The innovation strength of a cluster is the magnitude of the implied knowledge relevant for competition that the actors have taken together. It is exchanged about informal contacts, the social capital of a cluster and job changes and creates innovations. (Wikipedia, in 2010)

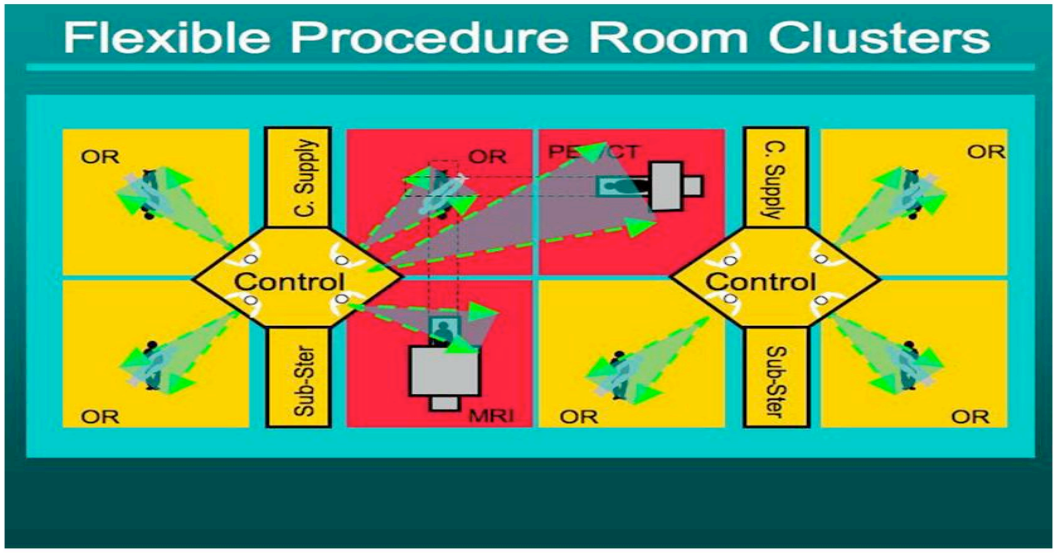


Illustration 95: Cluster model
Picture shows a draught of a Cluster OR. The draught insists on forming many synergies and on rising by temporary walls, the flexibility and thereby the use. (Spring: 2005 R. Grate mountain, Ashen+Allen Kettenbach J., et All, Minimal Invasive Therapy an allied Technolgies, paper Informa Healthcare page 54, 2010)

To organize the image structures of the hospital as a cluster is quite new nobody. Thus there were in the past over and over again in-plant processes and measures for the optimization of the expiries and lowering of the costs. In the hospital the education of a cluster is so difficult, therefore because the processes of the admission up to the intervention exist complicated and seldom linearly, but from different cyclic processes. This complicates to describe clear structures and to offer solutions. The complexity of the processes is also the reason, why the available processes were hardly structured in the hospital. In spite of the financial pressure the political will was absent in the past to initiate reforms.

In the meantime, in Europe and now also in Austria there is a trend in the health service in the direction of process optimization and consolidation. The reorganization of the processes of the operation room and his sphere means a strategically reorganization of the hospital till this day.

The opus project of Vienna KAV, a good example is for this. On this occasion, it was a matter of forming the extent of utilization of the operation rooms clear and of optimizing the existing processes in the first step. The basis for such projects is framework agreements and achievement arrangements between alliance and supplier, that's why hospital bearer comes etc. it to cooperation's and cooperation different centers and other medical facilities.

With the introduction of the software OPERA the KAV begins in Vienna exactly here and this shows with the introduction of the OPERA the achievement of the operation rooms and the responsible surgeons is made for the first time public and clear. Thereby there rises the pressure what is not only an economically favorable side effect. The problems of the everyday life are indicated for the first time, the economic efficiency of the ORs can be increased substantially without losing, besides, to quality.

In detail this is reflected in the education and construction of the operation rooms. There originate studies and models how one can move different investigation methods, CT, MRT, SR-CT. etc. in the OR. The Hybrid-Operation room was the first step and the education this operation room rescues a lot of potential processes to simplify and to optimize meaning of the operation rooms for the economic efficiency of the hospitals.

EPPENDORF

With the cluster the processes are radically differently formed than with a conventional operation or Hybrid Operation room. Processes are not any more linearly interdependent control circuits separate different OPs of different adjustment. A good example of the connections of the operational organization and the spatial complexity is the UKE (university medical centre of Hamburg) in Eppendorf, Hamburg a new hospital was established few years ago, (2008th of Dec.) by the architects H. Nickl and C. Nickl that to the most modern today's demands corresponds. Besides, not only a new hospital was built, but a new company and process structure was moved.

The process structure and the process sequence in connection with the infrastructural arrangement of the building were radically changed with the rebuilding. The historical pavilion manner widespread till then and stiff departmental structures led to the fact that the UKE has accumulated a building substance up to 2004 which lies 36 percent about the today's usable area need. 172 buildings have a usable area of about 300.000m2 75% of the construction

structure is older than 30 years. With an optimum organizational structure and construction structure about 79.000m2 less usable area would be required. (Homepage UKE Eppendorf 2011)

On the basis of this analysis were politically decided a general plan and, finally, an architectural reorganization. This was the basis of a master plan. As a result the UKE has developed in 2003/2004 a modern company draught with the help of which a room program was developed. By the development of the company draught one has gone out from different guidelines; among other things the needs of the patients, employees and student are also considered beside the aspects of the economic efficiency and the flexibility.

The clinical centers should be folded up in such a way that a common resource use will be possible. In the care, in the operation room and in the outpatient clinics uniform organizational structures are introduced, so far possibly, partially also to the interdisciplinary use.

At the same time it was completely turned upside down the financial economic structure. The most important principle contains the central supply of the clinical infrastructure concerning rooms, to devices and staff. This means, the fact that the rooms and devices are made available by the owner the user according to demand and are settled on the basis of internal achievement prices.

The personnel application is co-ordinate by the management of the centers. The operation area is organized after the cluster principle. A cluster exists in the UKE of four operation rooms; it concerns here conventional operation rooms.

The following rooms are assigned as direct rooms to every cluster

- Device room
- 2 instrument places
- 2 awake places
- 1 impure workroom

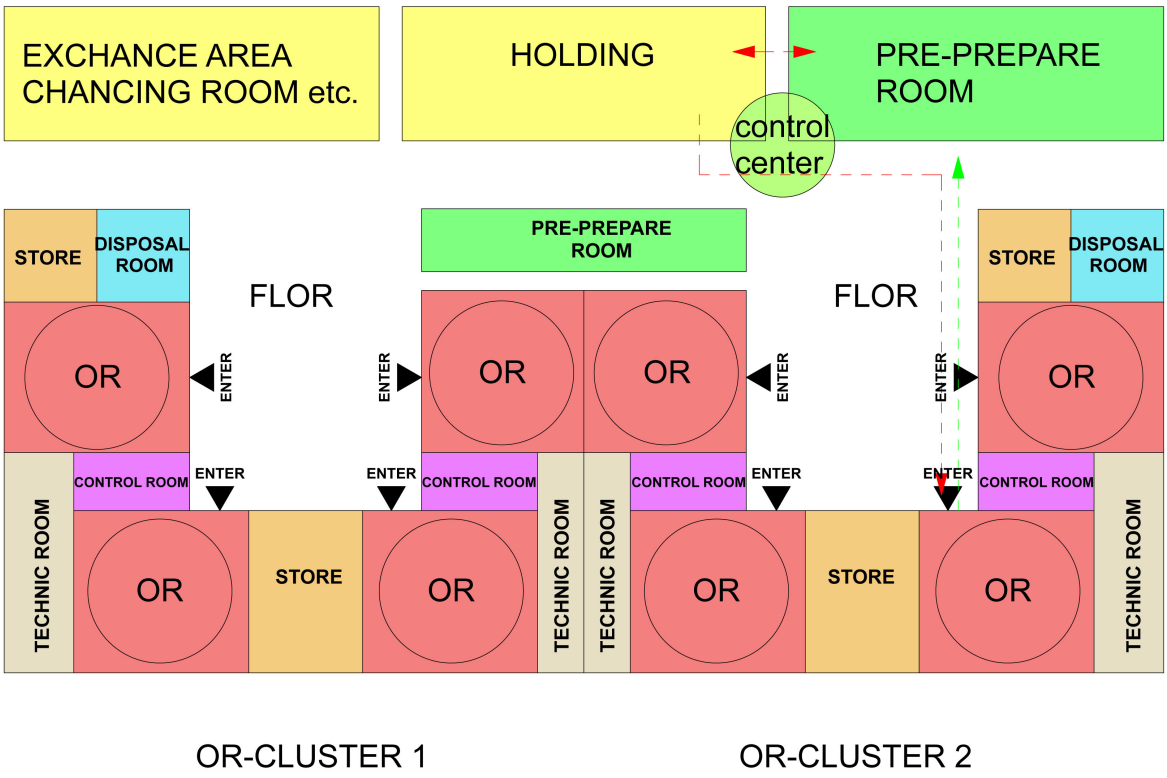


Illustration 96: Cluster OR organization structure university medical centre Eppendorf
Picture shows the organizational structure and company structure of the operation rooms of the university medical centre of Hamburg to Eppendorf. The operation rooms are not organized any more traditionally, but will surround through together used rooms. OR=operation room, G=equipment room, W=washraum, L=cosignation store, UR-=unclean room. (Spring: Plate A., Neues Klinikum, Universitätsklinikum Eppendorf, page 14, 2007)

To him forms the basis that the structure of the operational organization is also bundled up and is organized cluster-like like the spatial functions. The operational personnel organizational structure is reflected in the architectural organizational structure again. There originate centers official training centre OR (DLZ-OR) with a common adjustment room, holding room, awaking room and introduction room. Well-chosen related medical fields are organized together to a cluster, thereby it comes to a profit for all partners.

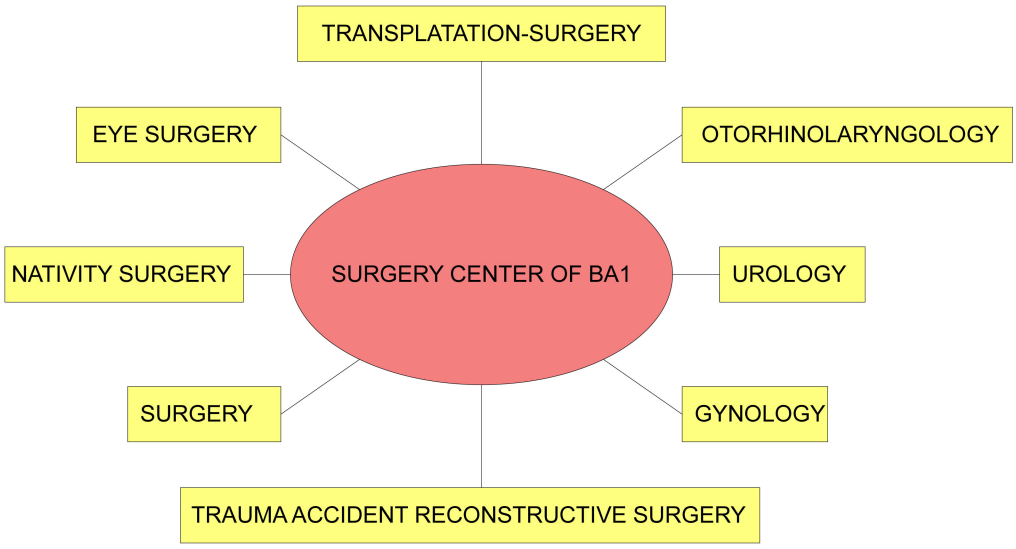


Illustration 97: Cluster OR organization chart, university medical centre of Eppendorf
Picture points med. Departments in one of both clusters in Eppendorf-Hamburg were folded up. (Spring: Plate A., Neues Klinikum, Universitätsklinikum Eppendorf, page 14, 2007)

The cluster model of this development shows that the possibility of the division of labour by process optimization, as well as the saving of single operation surfaces, by folding up of next rooms originate from sensible folding up of specialized divisions. Hence, savings are equally possible for it with the staff and infrastructure.

In the functions and company-organizational explanations of the KAV, Vienna to the hospital the north concerning one reads on the page 20 a similar description on the subject operation area. The OR area is organized basically within the scope of a centre in which the surgical functions of the sharp fields are summarized. The high hygienic demands, the complicated logistic expiries, reproaches can be covered with it for acute interventions and extensive equipment with medicine technology economically best of all. The central OR (COR) encloses 12 operation tables and also covers with it emergency ORs, septic operations and day-clinical operations. The operation area is divided naturally into two commensurate operation groups with 6 operation tables in each case and every sub range disposes of own sluices, own directing centre as well as a central introduction room. Area also belongs of the awaking room for the patients-patient's care after the operation and the holding company to the OR area for patients and female patients before the infiltration. Between these both areas an adaptable crossing should exist.

Furthermore one says, the patients and female patients reach first in the holding company area, still channeling area) in the basic preparations are met to the operation. The observation

of the patient or the patient occurs here synergetic about the supervision area of the awaking room. After occurred bedding and infiltration the patient or the patient comes to the central introduction room. From there she becomes, or he, finally, in the nascent operation room transferred. After by controlled operation the patient about the bedding (channeling) is transported in the awaking room where he is supervised up to the dismissal in the normal care area or if necessary intensive care area postal-surgically.

The optimum cluster has to go for every location, according to achievement offer are developed, because every hospital will not always offer all achievements.

By the process of the fusions and pool of operation units, one saves himself furthermore many transfer and transport achievements. The patient is not loaded any more thereby several times in which he must resign himself to too different time, different interventions, but all necessary should be done in an appointment. Hence, a cluster goes one step further, operational expiries must be ordered anew and be steered in other roads. Processes are folded up, or are simply lost partly because they are not needed any more, for example, by the discontinuation of transport and transfer achievements or the numerous cleansing achievements, or by the being cancelled of control operations.

Another profit is that to the synergy of know-how and the increase in quality by innovation and communication among the employees. This leads to the support of the employees and improvement of the processes. For the company structure the education of cluster means that the operation teams exist of doctors of different fields in which there can be no more Top-Down structure any more. The duties are split on the team members of different disciplines and are treated. The need of the interventions is solved all together, the number of the interventions and investigations can be reduced so strongly and the patient gets by with an operation appointment. However, such processes need a process coordinator; an operation coordinator would be such a function.

A person, probably a doctor who steers the processes. Somebody watches interdisciplinary over all processes and recognizes the problems.

Structurally the cluster means a perfect reorganization of the operation planning. To create place the next rooms must be folded up. For the rest, remain single intervention rooms which are adaptable according to demand or stiff. See Eppendorf-Hamburg.

This trend becomes increasingly by the fact that the clinical trend changes, while endovascular treatments like the intervention

- Radiology
- Neuro radiology
- Cardiology
- Oncology

become more complicated and become more comprehensive, the trend passes with the surgical interventions that the surgical measures such as

- Vascular surgery
- Cardio-Thorax surgery
- Neurosurgery
- Casualty surgery

less and less invasive run off. At the moment a movement of the measures takes place in the operation room, from conventionally to minimum-invasive. The best example is the job profile of the radiologist. The radiologist is more and more, a part of the operation team and carries out increasingly independently certain interventions.

The development of cluster operation rooms and multifunctional operation rooms and Hybrid Operation rooms or combinations of it, strengthen this trend in. A suitable infrastructure and operation geometry plays with the possible conversion of this trend an essential role. While the classical operation regional planning, one was separate after occupational godfathers, like the traditional surgery, casualty surgery, gynecology, orthopedics originates etc. more and more a sequential room use, how with a percutan coronary bypass operation or an endovascular intervention.

The trend with the form of the operation room (cash cow of the hospital) goes more and more in the direction of common room use, costs-lowering, higher use.

The Hybrid Operation room show the Operation rooms of the future, nevertheless, approach intervention ulna fields and minimally invasive surgical fields more and more, so that is to be expected that let themselves becomes bring together the job profile of the single fields on one

single job profile. For the development the interventional fields, however, also of the conventional surgical fields, such infrastructure is unavoidable.

New structures in the hospital to form a hospital of the future tell also to follow the processes, to understand the mistakes of the present and to avoid. To form structures which does not bring such actions any more possibly? The case study of A.L Jacob indicates the everyday life. Today the processes are not tuned to each other; patient's stream analyses and "blue prints" make clear the problems. Unstructured and not planned processes cost a lot of time and resources. While the processes of the hospital company are optimized by patient's stream analyses, "blue print" shows the perception from the point of the patient. The patient becomes more and more the customer. A change in thinking also at this level shows that the patient is the supplier and with it customer.

The example of A.L Jakob never shows processes in a private operational structure would be patient. It puts the question to itself, why this is accepted with the highest property our health.

New service providers begin exactly here and make as in the hotel business, processes; obviously they remain till this day in secrecy. Many problems are perceived for the first time. Meanwhile there is suitable software in the market with which such problems can be adjusted and be simulated. Just in the core competence area of the hospital is to be planned indispensably the processes and to steer. Exactly here the project of the KAV, OPERA, but also the operational restructuring begins in Eppendorf-Hamburg. A lot of place the persons responsible refuse because one believes that the person and the production his health is not level-cash in clear structures. This is a mistake.

A.L. Jacob points with the help of an example, "scheme of diagnostic-therapeutic cycle in emergent care" like control processes in the hospital in an acute accent case could look. It surprises why these instruments does not exist in the hospital till this day.

After the arrival, transport to the emergency room (ER) and a possible reconvalescence phase, it is decided like it goes on. therapy? etc.

Process management increases the quality and helps the persons responsible at the work not to have to think about matters of minor importance. Processes are given. Also the aid necessary in addition, like forms, check lists and process structures.

Just in the operation room where the processes are extremely varied, this is to be planned in advance essentially the processes and to steer. Process optimization also releases always resources.

The health service and the hospitals suffer especially from huge runaway costs. On the one hand there are more patients and, on the other hand, the processes always become costlier. To steer of the more important processes and to plan in advance.

19. Cluster MIGTR

Clusters in operational structures originate from folding up of company units, in this case by folding up of Operation units MIGTR. Folding up of big company Operation units should be examined here. The organizational changes originating from it and difficulties are documented.

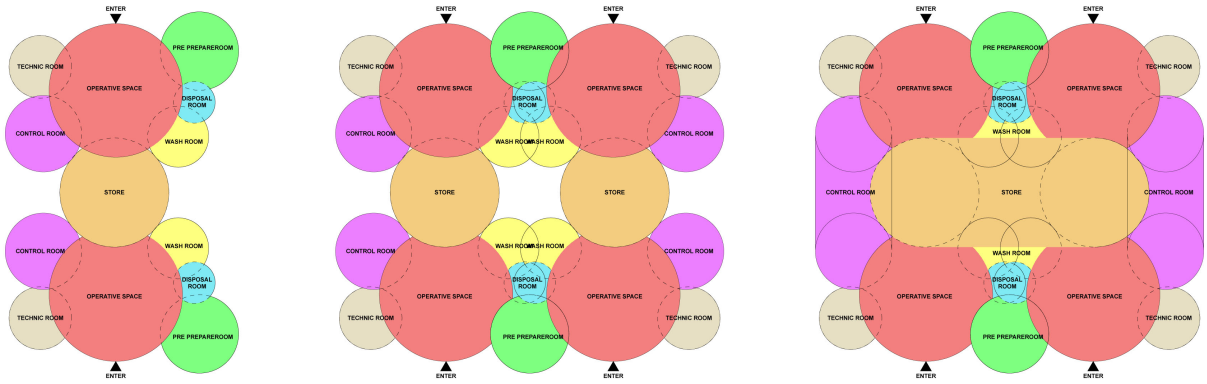


Illustration 98: Organization chart education operation cluster
Picture shows the functional spatial structure of an operation room to the education of a cluster. Links: Operation unity with a C-curve. Education of a common unity, by pool of the consignations store. Middle: Education of a cluster by pool other OR room units. On the right: By fusion of most next rooms, appear with the possible education of a cluster, problems with the operation process. The intervention rooms are strongly isolated by the next rooms. (Spring: own representation)

Chapter 5 compares folding up of Operation units, Hybrid Operation room arrangement, illustration 29/30 Hybrid Operation room bubble model, to the education of cluster leads to compromises and changes of the OR process, because the functional rooms, next rooms must be folded up. Chapter 5 compares the next rooms of an operation unity with a C-curve, Hybrid-Operation room arrangement are necessarily arranged all around the intervention room. It must be possible to the staff during an operation to enter the rooms also in stress situations quickly and to be found rightly. That is the rooms must be formed clear and clearly.

The education of cluster by folding up of MIGTR to Operation units raises numerous problems. With form from cluster from MIGTR units it concerns only bare folding up of room-functional units, but the organizational Operation units which are multifunctional. The overlapping of functions shows an economic loss, two channels should be avoided.

The MIGTR model functions if models they are moved the process and not the function in the centre put. The doctors form interdisciplinary teams, and is contributed by the medical departments, the patient is thereby in an all together process of treatment.

This sign is composed essential for the conversion of a cluster model from MIGTRs. Instead of limiting itself to folding up of next rooms, the whole Operation process should be developed by fusion of several MIGTRs anew.

Aim is outgoing from the optimization of the operation process to form the process steps so that two channels and double structures will avoid. These double structures are for typical for bare folding up of next rooms.

The process of a MIGTR cluster requires other planning processes and vote processes on grounds of a higher complexity. It matters to the hospital that the whole process all ORs of a cluster is looked and is optimized. In addition a stick place per cluster unity in which the processes and their course are co-ordinate is required.

The cluster is taken by different doctor's teams; the processes of the teams must be co-ordinate all together and be steered. Also it will be necessary to change the composition of the teams according to demand.

While the conventional surgery is still structured in fields, a well structured Cluster Operation room requires the cooperation of single fields and it comes to interdisciplinary in the fields. The cluster model puts Interdisciplinary in the centre of the events and goes on with it an essential step as a for example pure Hybrid Operation room.

The Operation process of a MIGTR cluster is formed totally anew and, hence, is not field-oriented, But process-oriented. This entails that the personnel structure will be diminished level and hierarchy. Another reason to look at the processes and at expiries all together by the installation of an operation coordinator. By the common use of the operation room, the colleagues, the great devices it can come to interest collisions and to avoid this, the expiries must be steered in the Operation room and be led.

Like a trainer on the edge of the football pitch, or a bonnet cook in a top kitchen, the operation coordinator has to recognize the necessary demands for the team and to react to it.

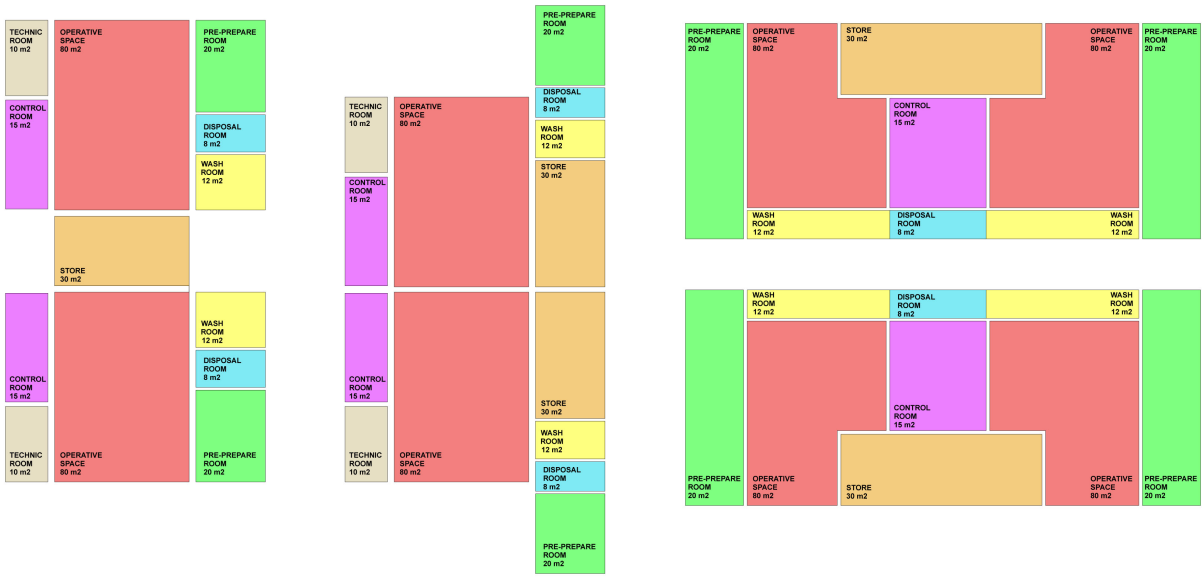


Illustration 99: Investigation to the education of operation cluster 1
Picture shows different functional spatial structure models of an operation room to the education of a cluster. (Spring: own representation)

The originating saving potential originates not only from rooms they are optimized and are tuned on each other, but also by a structural optimization what means a complete conversion of the guidance of the hospital. Both should be examined here.

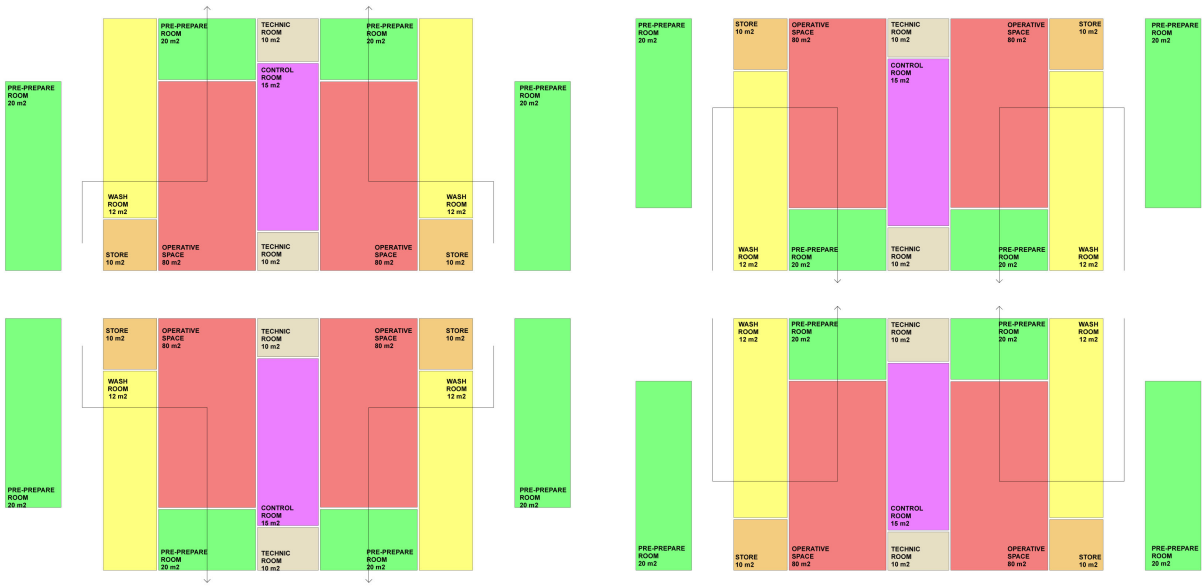


Illustration 100: Investigation to the education of operation cluster 2
Picture shows different functional spatial structure models of an Operation room to the education of a cluster with the help of the model in accordance with. Jacob. (Spring: own representation)

New forms of the cooperation originate from abolition of architectural and technical borders. Doctors of different fields treat the patient together and the focus it is laid on all steps together. So that this is possible, architectural changes must be carried out. By folding up several MIGTR units originating thing make clear that the Operation units, parallel worlds let arise. The smallest common denominator, is the common use of some next rooms, like the introduction room, control room and the technic rooms.

This shows at best an optimization, with a cluster the Operation process must melt different Operation rooms to generate from it synergies, to reduce at the same time the expenditure and to lower the costs. It is not to be melted by bare folding up of MIGTR possibly processes, it concerns merely a more economic variation than the base variation.

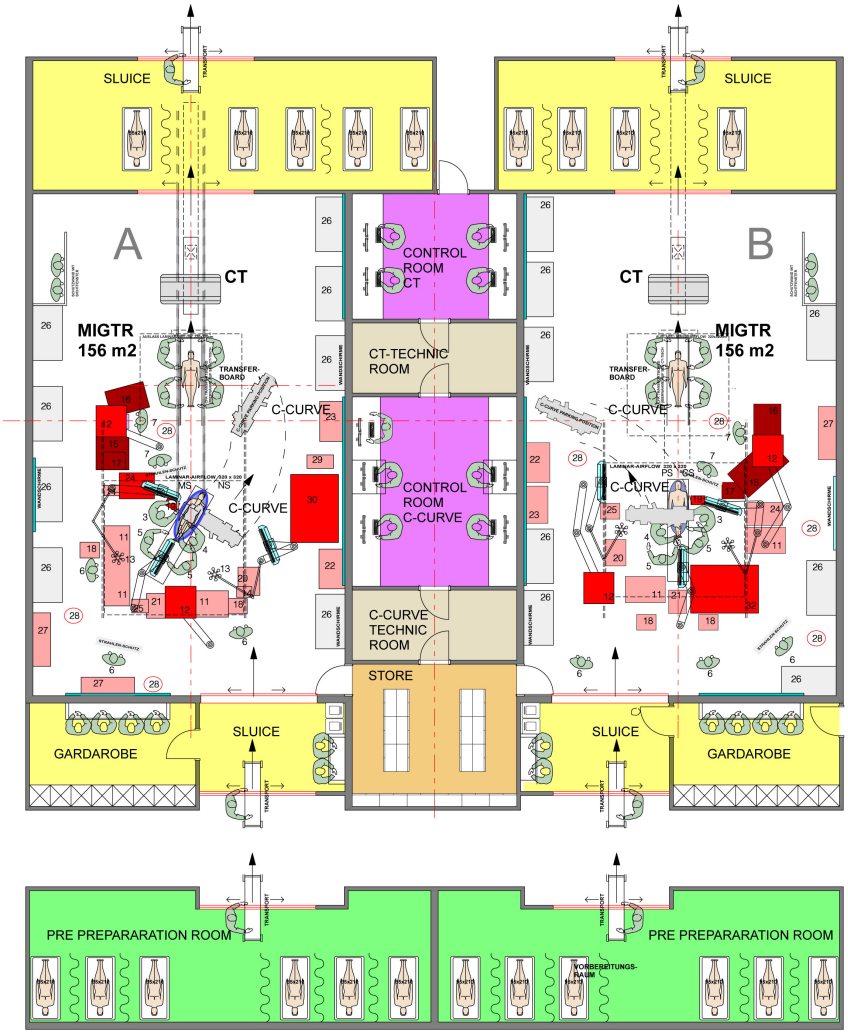


Illustration 101: Cluster MIGTR model 1

A cluster model shows the graphics in support of the model MIGTR Jacobs. The construction of a MIGTR cluster with two different Hybrid Operation rooms (L+R). The intervention room every OP exists of three zones. (Hybrid-OP, conventional OP and a CT. arrangement) in the Operation room is on the left the intervention room, the Hybrid-Operation room for cardio logical interventions straightened and on the right for an orthopedics. The accessibility of the C-curve must be considered, different equipment signs exist. (Spring: own representation)

The present cluster model is based on this compose from MIGTR after default of Jacob and exists of two intervention rooms and the around arranged next rooms. The intervention room is equipped like a MIGTR completely and is approx. 120m2 big. With the education of cluster one pushes relatively fast on a border all functions and to accommodate those of the next rooms. The intervention room is handed over by numerous next rooms whose arrangement is unavoidable around the intervention room, because they complement the intervention room in his function in the essentials. The continuation of the model of Jacob, brought on the right and necessary graduation, as well as by planning of all demands, bumps on grounds of the huge number of the functions of his border.

The intervention room is equipped with numerous container and Rack as well as operation devices, heart lungs machine, ultrasound etc. The shown dimension matters only on grounds of the necessary freedom of movement. As long as the intervention room finds out no pool, the result is not satisfactory, because merely slight synergies have originated.

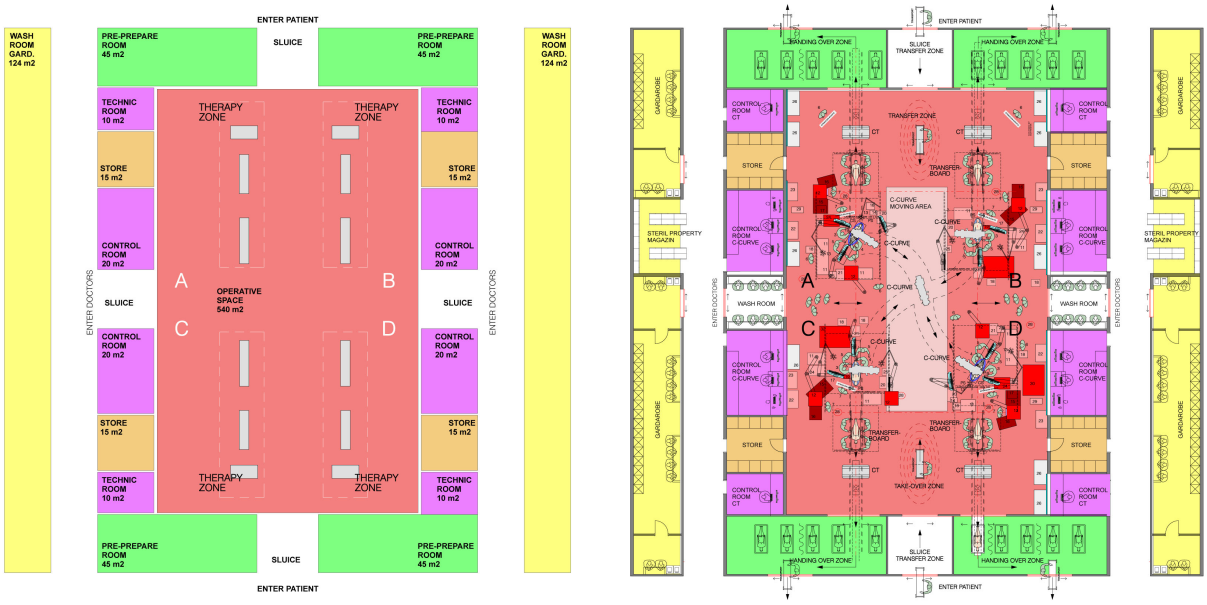


Illustration 102: Cluster MIGTR model 2

The graphics show a cluster model by fusion of the intervention room. The construction of a MIGTR cluster with two different Hybrid Operation rooms (L+R). The intervention room every OR exists of three zones. (Hybrid Operation room, conventional Operation room and a CT arrangement) in the Operation room is on the left the intervention room, the Hybrid-OR for cardio logical interventions straightened and on the right for the orthopedics. The accessibility of the C-curve must be considered, different equipment signs exist. (Spring: own representation)

A big operation room with about 500m2 and four units MIGTR originates from fusion of the intervention room how from Jacob examines. It was important with this draught, the patient's river guarantee and the access of the doctors to distinguish from which of the patients, because, otherwise, too many subsequent functions, like in and out channeling, the cleaning, as well as the functions of the awaking room and the holding company would overlap.

In the essentials this draught is divided in such a way for which four OR cycles are possible. Of every cycle exists of a C-curve, a conventional operation table and a CT arrangement.

This optimization lowers the expenditure and reduces the transfer and transport achievements. The improved cyclic process lowers the costs and the expenditure for the Operation room. It is striking that in this model both Operation rooms need own C-curve, as for the rest, all infrastructural equipment signs twice exist and shows inefficiency. Hence, the aim of a cluster must be to summarize not only the next rooms, but to reduce the expenditures in the intervention room. The saving potential is in the C-curve, because this is used per intervention 4-6 times for few minutes.

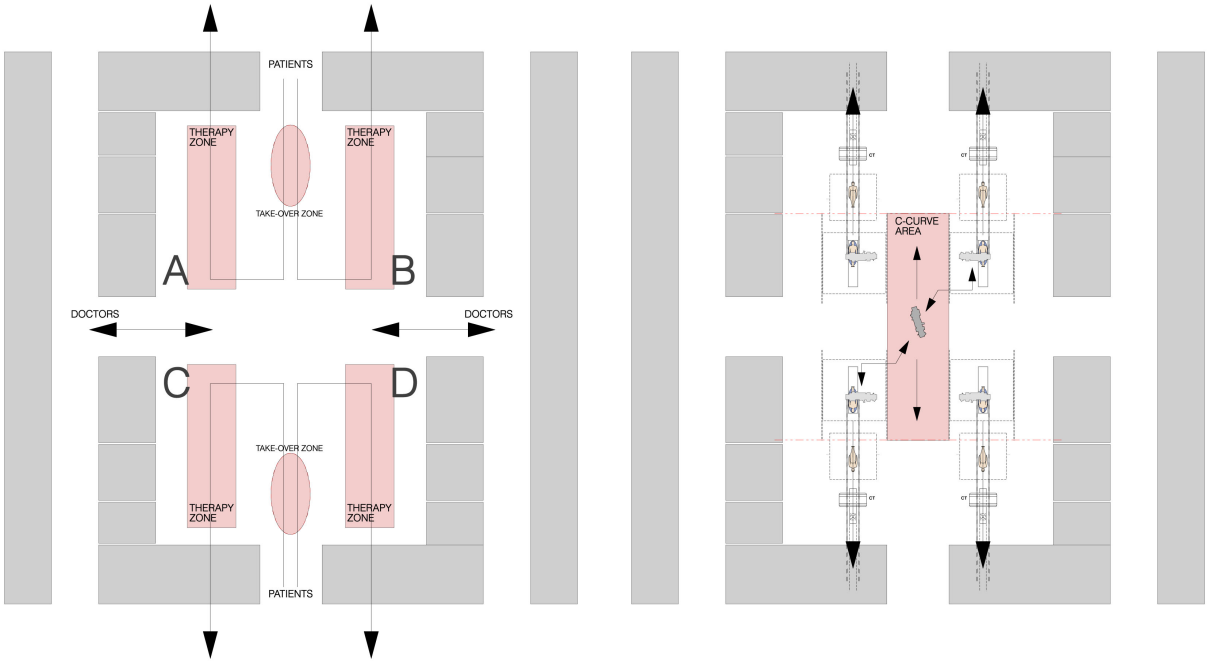


Illustration 103: Cluster MIGTR model 2 structure

The graphics show a cluster model by fusion of the intervention room. This cluster model with an intervention room shows the graphics for 4 therapy zones (A-D). The patient is taken over from an interdisciplinary operation team in the Take-Over zone. The patient wanders through a process street and is treated comprehensively by a doctor team. The team consists for every patient according to demand anew. The operation tables divide a C-curve itself in the C-Curve area between the operation tables considers. (Spring: own representation)

The medically technical employees are ready for the whole operation time and accompany the surgeons in all three operation phases.

Also the other operation equipment signs can be reduced and clubbed together. To optimize the operation process and to be able to use the doctors as an interdisciplinary team, a big operation room must be formed. An operation room with originates approx. 550m2 from it in itself four MIGTR find, consisting of a Hybrid Operation room table, as well as a customary operation table and a CT arrangement. Four Hybrid Operation rooms to tables use together about a rail system a cover-mounted arrangement. The C-curve is used together and, therefore, the parking bay is in the middle between the operation tables.

This would have the advantage that the C-curve can be positioned substantially better and be used at the same time by four different OR units. There is to be an additional rail in the cover urgently around the C-curve the suitable possibility to reach to every Hybrid-Operation room table.

This model is possible because the useful life and the frequency of the use of the C-curve, with the average duration of an intervention from 1-1$^1/_2$ houer is low. The C-curve becomes merely for few minutes on an average 3-5 times per intervention added.

The present arrangement creates a lot of place and would thereby have the advantage that the situation is to be gained control in the intervention room spatially substantially better. More place is available for the Handling with the patient. Also the operation staff has more room and better relations. The educated parking bay (yellow) for the C-curve is at the same time a room buffer, because this is used only in the area of the Hybrid-Operation room table. Now enough the zone in him is in the lengthening of this mark of the parking bay the patient is taken over.

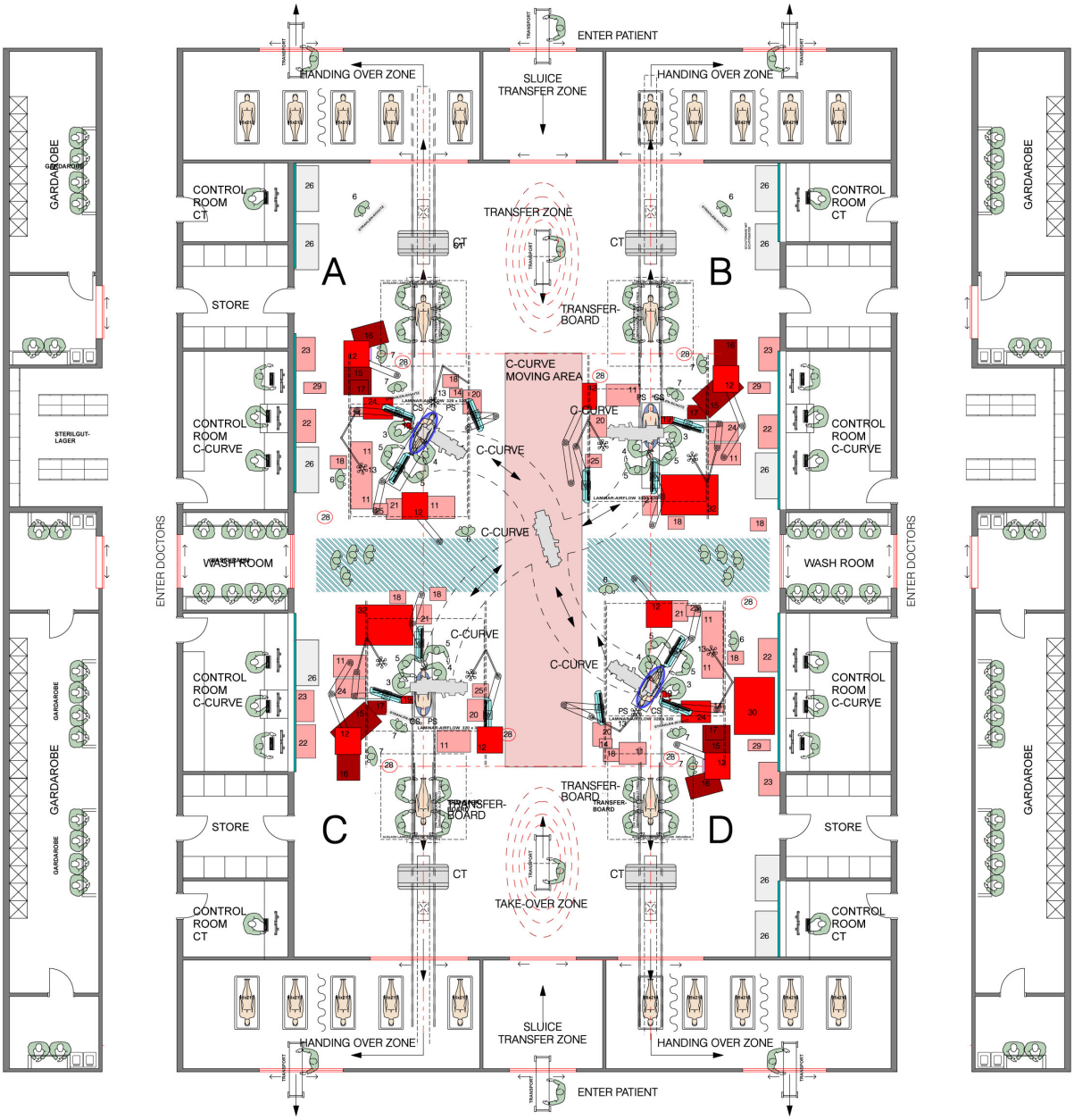


Illustration 104: Cluster MIGTR model 2

The graphics show a cluster model by fusion of the intervention room. The present cluster model MIGTR shows the full operation equipment of the different therapy operation zones. (Cardiology, neurosurgery, orthopedics, casualty surgery) in the middle between the operation tables is the C-Curve Moving area. Doctors and patients enter the multinational-intervention room by different entrances. (Spring: own representation)

20. Cluster MIGTR Financing Models

The financing of an operation cluster indicates to question the whole hospital financing system and to change. A complete rebuilding of the financing system and not only the operation area means the financing of the cluster, because by the central role which the OR takes it is to be integrated unavoidably all departments. The departments provide the doctors for the interdisciplinary process in the operation room and, in addition, must look after the patients further; concern operation main focuses the department.

At the moment the problem insists that the hospitals economize very differently and a comparison single house is very difficult. The one and same intervention causes very different costs in the different hospitals, so that it comes to different proceeds, because the juridical payment is equally high for everybody. (Diez K. In 2009, Furthermore it is a page 145 tab. 28) depending on the interventions taking place in the Operation room. A connection between the average profit and the operation time is given. (Spring: Diez K., Ein prozessorientiertes Modell zur Verrechnung von Faclity Management Kosten am Beispiel der Funktionsstelle Operationsbereich im Krankenhaus, Universitätsverlag Karlsruhe, 2009, page 157)

Therefore, it is also possible for no generalization of the saving potential, every location must be revalued. Nevertheless, a bad planning of the operation area also continues about the borders of the operation area. Hence, hospitals absolutely should try to raise the extent of utilization of the operation area, so that it comes to a full extent of utilization. (Spring: Diez K., Ein prozessorientiertes Modell zur Verrechnung von Faclity Management Kosten am Beispiel der Funktionsstelle Operationsbereich im Krankenhaus, Universitätsverlag Karlsruhe, 2009, page 146) So seems it that hospitals, in spite of a positive intervention, basic conditions, that of other houses corresponds gigantic losses by the operation drive. Then the reason often lies in the bad management and defective infrastructural basic conditions.

Hospitals do not know as a rule her cost centers and because they no expense account do the available potential remains unused. (Spring: Bogensberger Stefan, Professional MBA Health Care Management, Finanz- und Rechnungswesen 2 - Skript, Vienna 2008, page 20)

For example, very high costs fall with a customary operation for the pre phases necessary between the interventions and evaluation phases, like the cleaning etc. or for the cleansing staff that must be always held ready in. The expenditure of the cleaning covered to the surface in m² too cleaned surface is four times higher for operation rooms than for day rooms in the hos-

pital. While the temporal expenditure put out the only 1.5-fold. Works in the operation area require extreme care. The cleansing forces used in the Operation tract may not be used in other hospital areas. (Lutz W. 2000 p .239) The time of the intervention needs as a rule approx. 50% of the document time of an OPs, other 50% of the time get lost economically because in this time the OPs are prepared and are cleaned.

At the same time the costs are not unimportant for these phases which sway cost shares of a customary operation according to extent of utilization and structure of the house between 14.7 and 23.6%. The linking of the Facility management processes with the primary processes in the hospital (operation processes) forms furthermore the basis for a future-oriented strategically building planning. (Spring: Diez K., Ein prozessorientiertes Modell zur Verrechnung von Faclity Management Kosten am Beispiel der Funktionsstelle Operationsbereich im Krankenhaus, Universitätsverlag Karlsruhe, 2009, page 172)

The operation costs of an operation company of a customary operation consist of the following achievement groups

- Maintenance building 1%
- Maintenance technical appendixes 1,3 %
- Maintenance medicine technology 14.8%
- Cleaning 21.8%
- Infertile good care 40.9%
- Laundry care 6.2%
- Management, Controlling, other 7%
- FM products 7.5%
-

Illustration 105: Arrangement of the achievement groups

Table shows the composition of the cost positions of an OR company (Spring: Diez K., Ein prozessorientiertes Modell zur Verrechnung von Faclity Management Kosten am Beispiel der Funktionsstelle Operationsbereich im Krankenhaus, Universitätsverlag Karlsruhe, 2009, page 157, tab. 123)

In principle all shares of the cost positions are to be questioned with a change of the operation system, because new optimized processes, also changes, e.g., the cost shares with the infertile property and with a raised extent of utilization the relation to other positions changes.

In a customary operation company numerous cleansing processes and preparatory processes take place on one day between the operations, so that the really used time amounts to merely max. 50% in the operation room for an intervention.

All together this is usable daily by an optimized exploitation of the operation room for interventions only max. 12 hours. This shows at the same time a big loss or a big optimization potential. In this period costs originate for the cleaning them, according to structure, up to 24% of the operation total expenses put out. Hence, an optimization of this process extremely makes sense and is aim-leading, nevertheless, it concerns the source of income of the hospitals. The costs of an operation amount to about 56 Euros / m² in Germany this value are at least so high in Austria. Investigations have shown that the cost shares of the operation rooms are very different. Also the costs of the interventions are weighted per house differently, divergences of 250% are according to in That is a system change would raise the extent of utilization and lower the additional costs, as well as the cost relations to each other shift, e.g., by the reduction the Facility management costs. At the moment in detail the costs are very different for the Facility management of the operations. This depends not only on the size and number of the operations, but also on the exploitation and optimization of the processes. (Spring: Linzatti R., Professional MBA Health Care Management, Krankenhausmanagement und Krankenhausorganisation, Vienna 2008, page 56)

20.1. Cluster MIGTR workflow

The competition in the health service requires the strategically planning of the primary process portfolios of a hospital, so that the effects of future achievement movements can be recognized early and be illustrated in the personnel structure and building structure of a hospital. (Spring: Diez K., Ein prozessorientiertes Modell zur Verrechnung von Faclity Management Kosten am Beispiel der Funktionsstelle Operationsbereich im Krankenhaus, Universitätsverlag Karlsruhe, 2009, page 157, tab. 172) The workflow of a cluster differs in comparison to that of a conventional operation room by very distinctive operation phases. Pre-, intra-, post-operation phases are very exactly planned. The process of a cluster is a movement

or a pool numerous preliminary planning phase different operations to a phase. The expenditure of the coordination of her processes, as well as the complexity of the vote of the measures, rise and raise pressure on the acting people. Interventions in the MIGTR cluster are discipline-covering and must be planned substantially more exactly and are tuned.

At the same time this is called that the expenditure of an operation changes. The trend of the development goes in the direction of a minimum-invasive intervention. This changes not only the Procedure of the operation room but also all medical achievements of the pre and postal phase. The medicine is in the layout and with it will also change the hospital, the processes and the financing models.

This trend with the interventions has an influence on the education and creation of the operations. The conventional operations become less important and the minimum-invasive operations win in terrain. Structurally this is called that the trend goes in the direction of high-class control during the intervention.

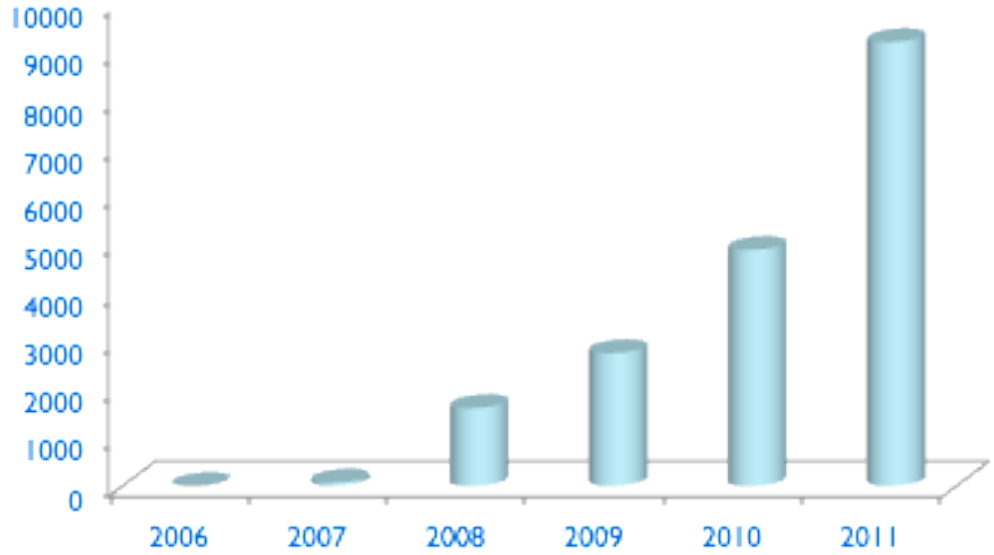


Illustration 106: Percutaneous aortic valve implantation development
The graphics show the transferring of aortas-flap implants them minimum-invasive who are moved by the "skin". (percutaneous =transmedial) With it wants to be said that the chest must not be opened for this technology. (Spring: Millenium Research Group)

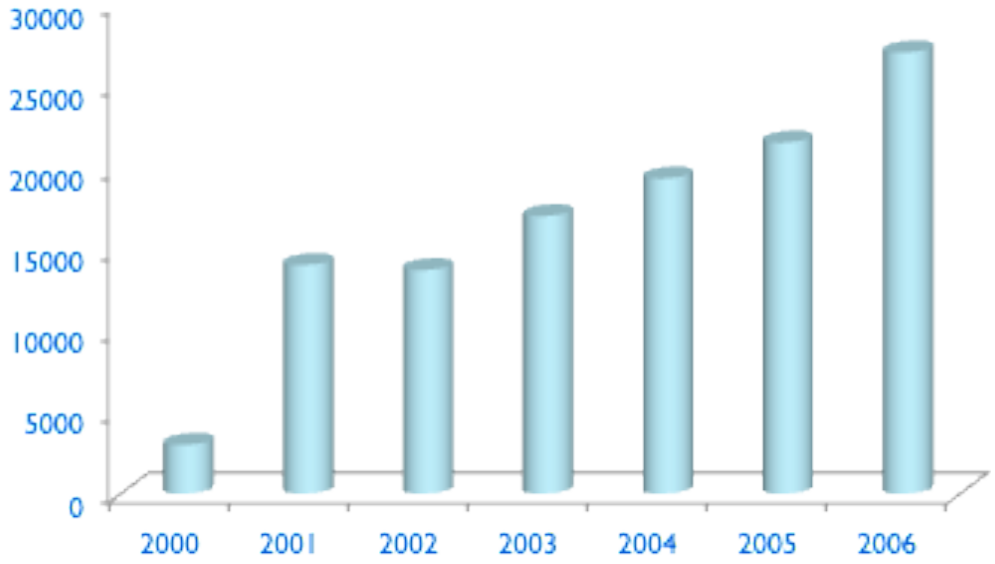


Illustration 107: Endovascular aneurysma repair development
Graphics show the development of the minimum-invasive repair endovascular aneurysmen in the USA. In 2000 less than 5,000 interventions, 6 years later to 30,000 interventions. (Spring: Frost&Sullivan, the USA)

However, at the same time the number of the patients increases, so that the whole need increases also. This hangs together on the one hand with the demographic development, patients become older and older by the life expectancy becoming greater, and on the other hand, it is possible to operate patients also at the old age by improved methods. These trends lead to the fact that the absolute number of the interventions increases and the health expenses always rise.

A Cluster Operation room demands other expiries than a conventional Operation room. With a Cluster Operation room the expiry of the intervention, as well as they, the different operations must be tuned on each other. With a cluster from MIGTR Operation the expenditure of the coordination increases again substantially, because an operation room already exists of different fields of work. It concerns numerous intervention locations with controlling rooms and other next rooms around a cumulation.

So that the whole process all operations is functioned a vote of all fields of work by a higher operation manager the coordination of all processes must take over, necessarily. Besides, in the essentials it concerns a person who has to steer the job of the taking place OR processes and to vote to each other. At the same time the expenditure per intervention decreases by the

increase of the development of the interventions in the direction of minimum-invasive by which the single operation processes are simplified and are lighter taxable. The core processes in a hospital are in the change, that is a transformation and restructuring of the operation area and the expiries is unavoidable. This has results and consequences for the whole company, for all processes of the hospital, because existing processes within few years the world has decisively changed in the operation area.

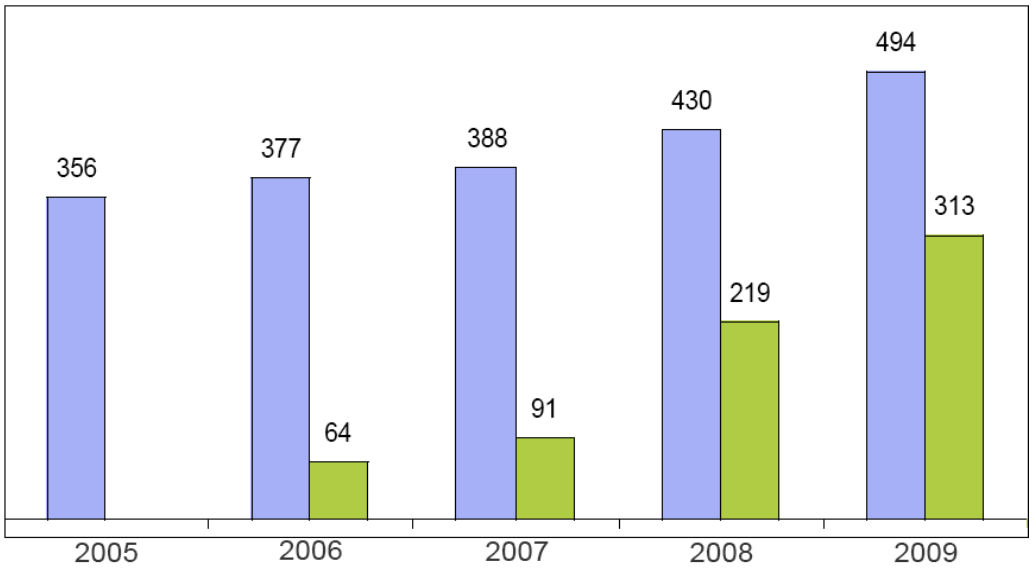


Illustration 108: Confrontation Hybrid OR conventional interventions
The carried out heart operation shows the statistics the picture in Leipzig. In 2006 it comes for the introduction of the Hybrid-Operation room and with it to new technologies. (green) The conventional interventions take in spite of the installation of the Hybrid-Operation room steadily, how before to. These graphics are a document for the concurrent need of the operation technologies. (Spring: Walther T., Herzchirurgische Anwendungen, Dissertation: “Perspektiven für den Hybrid-OP“, Forum Hybrid-OP, Regensburg FRG, page 8, 2010)

21. Commend

The lacking financing of the Austrian health system, topically strengthens by the financial crisis and by omissions and missing changes as well as structural adaptation during the last 20 years, in the meantime, the need for action is huge. Differently than the FRG has held on Austria to the existing system and has put off reforms. The transparency of the Facility management achievements and costs in the health care is of great importance. (Spring: Diez K., Ein prozessorientiertes Modell zur Verrechnung von Faclity Management Kosten am Beispiel der Funktionsstelle Operationsbereich im Krankenhaus, Universitätsverlag Karlsruhe, 2009, page 157, tab. 171)

In this country it is tried to maintain the existing ailing system healthy. However, the yearly rising issues for the health service and the structural problems becoming at the same time greater and greater in the health service, demand new structural attempts. The necessary change process can be seen as a chance to move them long ago to available knowledge and technologies in the health sector.

These due structural changes concern all areas of the health system, because too long no reform was moved, too long were solved merely, by increase of the contributions, the problems by supply more anew of financial means. This entailed that Austria has one of the financially costliest and most a conceitedly health systems of the world whose quality lies, in the meantime, merely in the centerfield. (Spring: OECD Data 2008, WHO 2007, Neumann Heinz, Professional MBA Health Care Management, Strukturen des österreichischen Gesundheitswesens, Vienna 2008, page 43)

The hospital being as one of the core areas of the health service is particularly concerned, because these are not only big employers, but because easy management tools find till this day no use. The forthcoming necessary changes meant a paradigm change, coming away of existing organization and financing models, going too free-enterprise to structured companies. The hospital has slept away the nec This leads higher quality with the expiry, to the shorter resting time is accessible by a successful process control of the primary processes of the hospital (Spring: Österle A., Professional MBA Health Care Management, Gesundheitsökonomie, Vienna 2008, page 33)

The simulation different primary process scenarios at the example of the OP area shows which is decisive for de height of the FM costs for this functional place not only the operation

duration or time of utilization. Rather different FM-cost blocks arise according to operation spectrum. The knowledge about these cost blocks is not only within the scope of the Controlling, the budgeting and the qualification of future cost risks of big interest.

According to strategically adjustment of the hospital different priorities also arise for optimization attempts concerning FM for the future. (Spring: Diez K., Ein prozessorientiertes Modell zur Verrechnung von Faclity Management Kosten am Beispiel der Funktionsstelle Operationsbereich im Krankenhaus, Universitätsverlag Karlsruhe, 2009, page 172)

The linking of the FM processes with the primary processes in the hospital forms furthermore the basis for a future-oriented strategically building planning. Hence, the whole structure of the hospital concerns changes in the core business of the hospital, the OR organization. All processes taking place in the hospital are tuned to the process of the intervention in the operation room. The operations bring the essential income and, hence, contribute substantially to the economic efficiency of the hospitals and the location. The effects by changes in this sphere, are accordingly largely organizationally as well as economically.

The models introduced here, processes they describe the operation room and the interventions taking place there, release a chain of changes. The changes do not let themselves moved without, besides, the process structure to look. The need to have to control to steer processes in the health service and to have to control sounds to be banal and logical, but fact is that this happens till this day in Austria in no hospital. Process control takes place only in small cells of departments and is not seldom; take place only on initiative of the operating people. The legislator calls no management structure in the hospital company. And although the health service becomes across-financed, the legislator is very carelessly while calling in economic data. Fact is that to everybody is known that the figures are deeply red, the responsibility is pushed away, while one veils the facts.

A vote, all processes taking place in a hospital, does not take place because there is not this whole process absolutely. Therefore, huge resources are wasted and chances are not used. The health service is a protected market, which is why it is also so difficult to make the need of reforms visible. Another reason for the omissions lies in the fact that the doctors are trained basically medically, but receive no management education. The management problems of the hospital are not seen absolutely and are not understood. Today the market slowly starts to open. One of the main causes for this gentle reform is the lack of money and the unequal dis-

tribution of the money in the health service. Strong mutual dependence, see illustration 04 Finance streams makes reforms hard partly ineffective. The most essential parameters of the

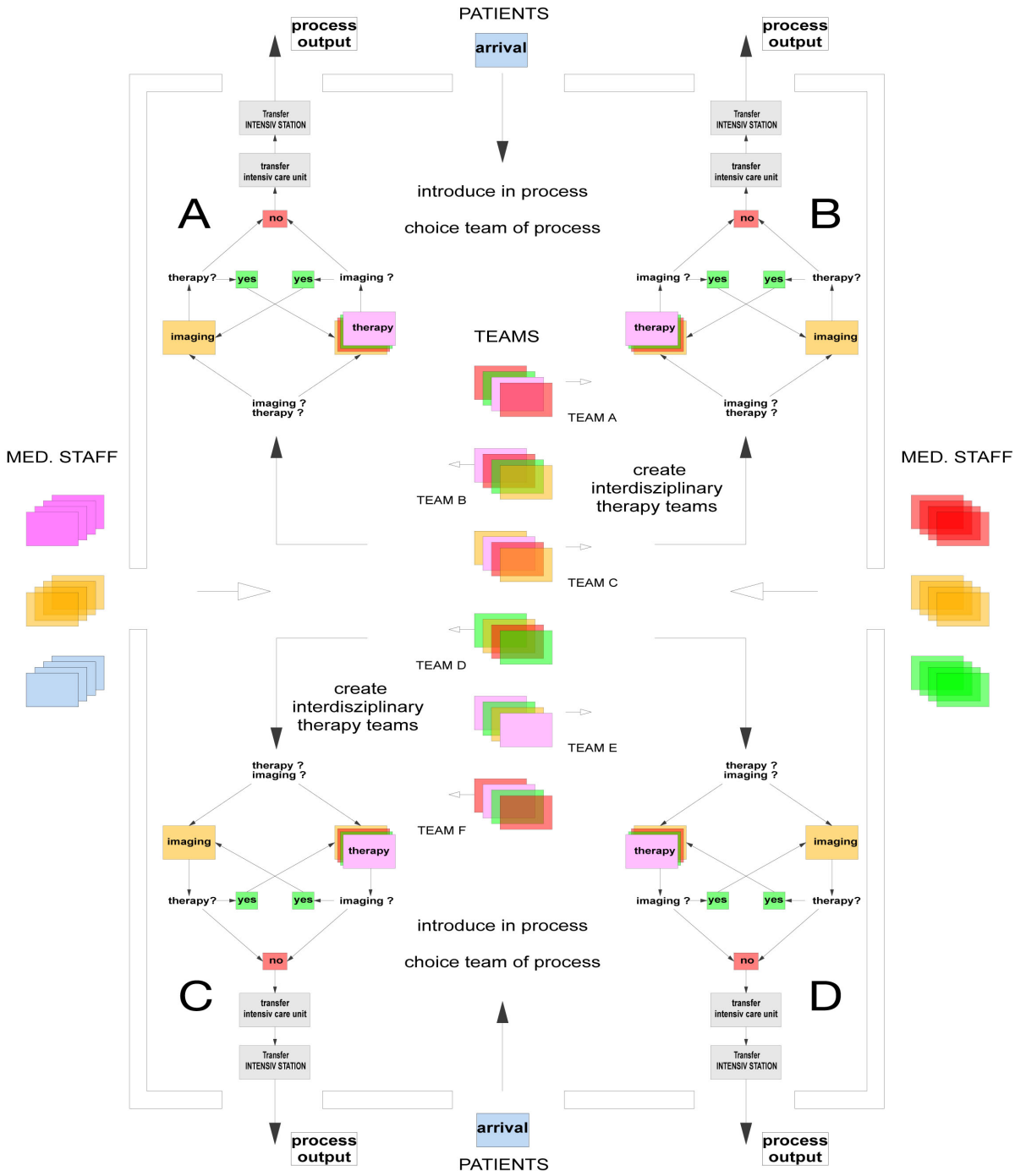


Illustration 109: Cluster MIGTR diagnostic therapeutic workflow
The graphics show the workflow of a multi-functional Hybrid Operation room (MIGTR) as a cluster. It is striking which is necessary no more local change and thereby numerous transport and transfer achievements (3T-achievements) are lost. Characteristic is the solution with interdisciplinary teams who are changing as necessary (Spring: own representation)

hospitals are shown with analyses and statistics, this are the costs, the income, the resting time, the extent of utilization, the success. Concerning the hospital being in Austria this is called that big changes approach. The dispersion of the data is serious partly. Statistical divergences from up to 50-60 percent of the Benchmark are no rarity. The health service has developed in last decades rapidly, at the same time one has agreed in Austria hardly a little bit of it with, except the great devices new in the hospitals over and over again were put up. From new possibilities in the operation being, originated by the big progress in the EDP, today let they move new operation models. Models deeply in the process structure of the hospital intervene and require a perfect change in thinking. Structural changes and new hospital processes will be necessary for the primary processes to be able to install these operation models.

One these developments is the C-curve which finds place in a Hybrid Operation room. These are computers supports systems, alike of the manufacturing robot arms of the industry the qualities new in the operation area allow. Investigations during the operation. By the application of this high tech of instruments and by the arithmetic achievement of the computers it is possible to provide sculptural representations of the organs, vessels of even moving parts like heart flaps. These possibilities demand a basic change of the available processes. Because thereby the surgeon before he opens the body, exact knowledge about size, situation and specific feature of the inside of the body of the patient (organs, vessels, heart flaps, to tumor etc.) agrees. It is to be formed by the possibility inevitably the process before and after the intervention anew. The intervention itself develops already completely differently, because the application of the C-curve of a single chief surgeon is not master able any more.

By specialized covering interventions, it comes to operation teams from different medical fields, the patient will get at the same time all necessary operations and treatments. The operation team is in the change, the surgeon is a part of the team his achievement more and more of people, colleague as well as medically technical employees is dependent.

By process control such Hybrid OR see medically to too substantially better results lead, at the same time the financial expenditure can be reduced and the resources better be started. The Hybrid Operation room demands new operation processes which are integrable, however, still in the existing models. Big differences are to be recognized with the weighting of the operation phases.

Hospitals are divided after fields and are organized; the available process structure is tuned to it. New models are not function but process oriented and this entails that the hierarchy of the fields and the top down structure of the departments would break down, because they do not function any more.

The necessary process structure of a MIGTR, multinational functional image guided therapy room, and a cluster of such an operation room is not compatible with the existing processes in the hospital and the health service, health insurance schemes, any more. These OP models point in the future, however, demand a complete rebuilding of the perception and the insurance models and his financing.

The operation sphere has huge effects on the numerous preceding and following processes in the hospital. A pool of several OR processes, how in case of a MIGTR and the process management linked with it entails that the whole process must be moved in the hospital. All departments and achievements must take part in this change, so that the operation process of such an operation room functions and makes sense. The process models are new, but hardly experienced. Studies to all at the head, "Integrating Surgery and Radiology in one Suite," of G. ten Cate et Al, have indicated as difficultly it is to change existing patterns in the hospital and to admit anew processes. Not least because these methods have not totally matured anew and inexperienced and certainly yet.

This study shows that the systems have partly still considerable problems, problems they are surely solvable. Growing pains, as well as available problems with the technology, cause that insecurity and discontent as well as a defensiveness of the doctors is taken. To him faces that the processes lived at the moment are not effective and actual and the costs are too high by the bad process structure. The developed models resumed in this work of the MIGTR have pointed which need and problems originate from it. There is the danger that new forms of the control, the control are needed by the introduction of a MIGTR and lead this to new hierarchy. However, the quality of the MIGTR exists in the level structures.

The improvement quality of the process stands in a direct connection with the improvement of the medical achievement and optimization of the legal costs. This conversion would release resource they are urgently used. It is necessary to come on the newest knowledge and models and to move the process. „The integration of an intervention room and an Angiography sys-

tem (C-curve) opens excellent possibilities for interdisciplinary processes for surgeons, cardiologists and radiologists“.

In Leipzig Walther T. is worked extremely successfully with the C-curves in the cardiology under the management, while other hospitals complain to the problems.

The remote control minimum-invasive operation system DaVinci is lying round in Vienna in the AKH unused for many years, while other hospitals work with it very successfully and recognize the advantages. To go new ways, always depends on the accompanying circumstances. In this case, the processes must be moved and the whole hospital must help carry this conversion.

The new models to all at the head the Hybrid Operation room model, so to speak, a bridge between the old hospital model, hierarchically and function-oriented, and the new model, Team-oriented and Process-oriented, have her root in the industry and economy. When Henry Ford cars on the production line wanted to make, one also explained him, this would not go. Vehicles are too complicated a lot to produce them on the production line. The new structures in the operation being still have problems, with the technology, as well as with the process expiries. These models still earn attention because the advantages are fascinating and no way goes in you.

The technology among other things the control of the C-curve must become substantially more reliable, the geometry and stability of the tables must improve, the accessibility to the patient must be given. New architectural operation models should be able to take here remedial action.

New operation technologies, like the minimally invasive methods, as well as the development of the operation technology have served to sharpen the look at the available processes. By the reorganization of the operation-processes based on new intervention possibilities have entailed that it was necessary the operation rooms anew to divide and to form. So that such changes function really and also are financially portable, it is also to be changed inevitably the framework agreements and achievement arrangements between alliance, countries, assurances as well as the suppliers, how hospital bearer etc. By these changes the patient moves again in the foreground of the events, insurance achievements are adapted increasingly in the needs of the patient, the discussion with the patients is straighter and more intensive.

The superstructure of the health service becomes more slender; at the same time the management measures increase what will become apparent in the quality of the achievements.

The logical establishment of a Hybrid Operation room, MIGTR, cluster reflects in detail the problems and changes of the existing models. While the existing models, by the bringing in of a CT, MRT, SR CT. brought no structural changes with themselves, new models demand basic radical measures. The medical possibilities those of the Hybrid Operation room offers, is certainly the right beginning, even if this model still brings numerous problems with itself. The quality of the interventions increases substantially and the load for the patient strongly sinks. A better cost use relation is the result. A substantially better documentation and patient's act is possible. To tax away these advantages economically the structures must be strictly moved.

The model of the MIGTR was introduced by Jacob at al in 2004. This model is interesting because it thinks over for the first time the equipment of the intervention room and forms anew. So that processes are to be formed in the Operation room in future more economically and qualitatively high-quality, the intervention room must be built up more functionally and be equipped than at the moment takes place. The result of such a transformation is the form of Intervention Street.

The intervention rooms illustrated there seem to come too small and not on the necessary size of a real intervention room. The room functional model is too optimistic; the bringing into play of a patient is hardly conceivable in this model. An essential component of a MIGTR is the C-curve; a process street originates from the linear arrangement of the other processes. The up to now available models seem conceived too small-scale, the actual place need of such a model, is substantially more demanding.

As for the rest there is not enough movement room. Next rooms like technology room, preparatory room and controlling room, camp are absent etc. totally or are calculated too small. Just these rooms and the complexity of the MIGTR are essential for the functioning of MIGTRs. The functional rooms of a MIGTR model are arranged as a rule all around what shows organizationally a challenge. However, at the same time a completely new process structure is necessary to allow the necessary expiries. During the Hybrid OR still in a customary hospital, by adaptation of structures is conceivable, sprinkles of the MIGTR this frame completely. The hospital being would be turned upside down by the installation of a MIGTR.

The MIGTR structure requires a centre, service zones-OR (DLZ-OR) and, hence, is only in big hospitals in areas of concentration in also enough patients in the market are conceivable.

The problems with the conversion of a MIGTR are like indicated, immense. And also if the geometry and dimension of MIGTRs are solved and are optimized, this model leaves the impression that there are still options that it still carries optimization potential in itself. The model raises questions: how does the process look actual? Or how do the teams consist and how will these change in case of need? An OR is simply pure as a rule no place where one just like that and goes out. The education of teams works interdisciplinary on the patient and also partly with the patient, which according to demand change, however, is the basis of MIGTRs.

The model introduced by Jacob of a MIGTR has no answer to these questions. On the contrary, it complicates the situation because many questions remain unanswered. The model published in this work of a Cluster MIGTR raises originally, a claim to the actual dimensions and demands of an operation room with C-curve, more various medical departments. Thus the equipment sign and the dimensions were developed according to the default and were constructed.

The result is a cluster with four MIGTRs, however, only one C-curve. This model would have the advantage that it comes to numerous operation process to relevant optimization. In the intervention room there are numerous operation teams of different compositions, these can be complementary in case of need or exchange. Hence, other synergies are possible for it under the teams. The patients go through an operation process according to the requirement are not function-oriented, are but process-oriented. From the infiltration up to channeling out the patient is in the river and must not be led again in the counter sedate direction. The advantages of a MIGTR were totally taken over. However, the area of the handing over of the patient was increased and the next rooms were arranged accordingly of the default clearly.

The present model enables to install it only one C-curve which is parked in the middle of the operation units. Really the surgeons need the C-curve only very much restricted and this only 4-5 times during the intervention. Thus not only the technical expenditure can be reduced, but also consequential costs are reduced. The employees who wait these devices look and accompany the operation process. To allow this model the arrangement which approaches the suitable operation table automatically must be gone out from a cover-complained C-curve. Prod-

ucts and features there is already. Only at the table concerned the surgeon takes over the control and carries out the screening. Remember-and Go Home functions make easier the Handling of the C-curve. It would be also possible virtually to put down a person the C-curves served; with it the coordination would also become easier.

Operation structures such magnitude need to tune whole co-coordinators around the processes and to co-ordinate the people between the teams. The operation management would win in meaning and thereby gets in the surgical area an additional job. To allow such processes in a big operation room the radical structural measures which go up to the education of the medical staff are necessary.

The present model is multiple and at the same time recordable, it rescues a huge saving potential, because the teams must not leave the operation, but take as a constant job. The composition of the operation teams can be varied during the interventions, according to demand.

The patient has all required doctors in an appointment in a treatment. Should what be to be treated unforeseen, and then there are colleagues of suitable qualification from another team. The teams are adaptable and many-sided applicable, the competence increases, by the combination of the teams. The advantage is more efficient this the interventions, quicker and more comprehensively run off, while the costs can be lowered. A cluster MIGTR can become thought for all interventions.

The development of these operations introduced here indicates the need of changes in the operation being. The available structure is not to be moved in the situation these demands and to integrate the new models. On the other hand, the systems have to go, on the new needs come around the new possibilities to move. A suitable infrastructure of the hospital and new operation geometry plays with the possible conversion of these models an essential role. This is costs-lowering and creates an added value by a higher use. Hybrid Operation room show the future of the operation rooms, nevertheless, approach intervention ulna and minimum-invasive surgical fields more and more, so that it is to be expected that the job profile of single fields, on one single job profile will bring together.

The positive development interventional conventional surgical fields, is hardly possible with the existing medical infrastructure.

This trend rescues an essential sign in itself, namely the expenditures of the intervention, but also the times of the intervention are reduced by the change from interventional operation to a minimum-invasive operation massively, so that this development demands a change of the operation structure. New structures in the hospital to form a hospital of the future tell also to follow the processes. To understand the problems and mistakes of the present and to avoid. It will be necessary to form structures the mistakes of the present not possible make.

The case study of A.L Jacob indicates the everyday life in a hospital of an admission. The study shows that the processes are not tuned to each other, single actors freely decide step by step like it goes on. This entails that the processes are expensive uncontrolled and do not make sense partly. The absence of patient's stream analyses and "blue prints" make clear the problems, the hospitals were always concentrated exclusively upon the process of the intervention and the curing, besides, the whole process has been never looked as a whole.

Badly structured processes and unplanned sequences cost a lot of time and money and show a waste of resources. While patient's stream analyses make clear the processes of the hospital, "blue print" indicates the perception of the patient, the customer. A change in thinking that the patient is the supplier of the hospital and with it the customer was already discussed of entrance and will make itself in every detail to a new necessary structure visible.

The graphics of A.L Jakob make clear if one fancies the case of a check in at the hotel instead of an accident, how badly the processes function in the hospital. Nobody check in at a hotel and covers nine hours later the room. There originate new service providers who begin exactly here and like in the hotel business, processes make obviously which make clear where it lacks at the moment.

There is suitable new software in the market with which the patient's streams are shown and are analyzed. The simulations of hospital processes are the first step to indicate the problems and to understand. Just in the core competence area of the hospital, the operation area, is to be planned indispensably the processes precisely and to steer.

A.L. Jacob points with the help of an example, today "scheme of diagnostic-therapeutic cycle in emergent care" like control processes in the hospital in an acute accent fall should look. The control process makes clear the deficits in the expiries in the hospital. It is surprising, but patterns of such expiries exist in no hospital till this day. The chance, after the arrival, transport still rules in the hospital to the provisional accommodation to (HIM) and a possible con-

valescence phase, it is decided like it goes on. Therapy? etc. The respectively official-having doctor decides on the process and with it on the expenditure, costs and circumstances how the patient is supplied.

Predefined processes and the process management increase in general the quality and help the persons responsible at the work not to have to think about matters of minor importance. Processes are give and the patient it is steered in predefined roads. Also the aid necessary in addition, like forms, check lists and process structures.

Just in the operation room where the processes are extremely varied it is to be planned in advance essentially the processes and to steer. The fears and worries of the doctors and the proposed ethical arguments should have no more places.

Process optimization also releases always available resources and capacities. The health service and the hospitals suffer especially from huge runaway costs. On the one hand there are more patients and, on the other hand, the processes become costlier and costlier. These developments make clear the need radical structural changes.

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Steyrer J. (2009); Kommunikation und Organisation Behaviour - 2. Professional MBA Health Care Management, Executive Academy, Wirtschaftsuniversität, Wien

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Life Stations

1966 Born in Lichtenvoorde, Netherlands

1966-72 *family life*

1972 Rotterdam, Netherlands

1972-79 *build tree houses*

MAVO - General School System

1980 Klagenfurt, Austria

HTBL - technical school of engine construction

***Practise** - engineer company*

1988 Study Molecular Genetic University Vienna

***Practice** - Ludwig Bolzmann Institut Vienna, (Osteology)*

1993 Study Architecture Academy of Fine Arts of Vienna

***Practice** - Architect Franco Fonatti, Vienna*

1994 *YOCOTO founded*

1997 Finish Studies Vienna

***Practice** - Franz West, Vienna (Amsterdam, Paris, Hongkong, New York)*

2000 ***Education -** Zivil Technical Engineer Vienna*

2001 *PLANIT founded*

2009 ***Education** - Hybrid OR Regensburg FRG*

2010 Start Study MBA Health Care Management. University of Economy of Vienna

Master of Business Administration - Master Thesis - Hybrid OR

2010 *ALL Promed GmbH founded*

2012 Doctoral Thesis - Technical University Vienna

Interdisciplinary process management in the hospital being. To form development of a multi functional Cluster-Operation room for various medical fields - A comparative process study for operation rooms like Hybrid-Operation room, MIGTRs and Cluster-Operation room as a pos sibility through process optimization the health service economically.