

From Axolotl to AmbLOXe – Transferring amphibian regeneration to mammalian wound healing

(Abstract ID: 57)

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Background:

In contrast to mammals, caudates like the Mexican axolotl (*Ambystoma mexicanum*) (Figure 1) are able to regenerate complex body structures such as limbs or even whole organs. This ability has turned the axolotl into a famous model organism for regeneration research. In the case of severe injury or amputation, hemostasis proceeds within seconds, followed by the induction of processes leading to complete regeneration of the lost tissue.

AmbLOXe, an epidermal lipoxygenase, was identified to play a role in regeneration processes of the axolotl. Several studies have shown a significant influence of AmbLOXe gene expression in mammalian cells as well. During in vitro experiments, AmbLOXe-transfected cells migrated faster and therefore closed wound gaps sooner compared to controls expressing a human lipoxygenase. A proof-of-concept trial in vivo showed similar effects of skin wound treatment with AmbLOXe-expressing cells. For clinical application, it is of interest to have access to sufficient quantities of biologically active AmbLOXe enzyme. Therefore, a strategy for the production and isolation of the enzyme from an *E. coli* system was devised.

Materials and methods:

Human keratinocytes and U2-OS cells were transfected with pIRES-EGFP vector (Clontech) containing the genetic sequence of AmbLOXe for a transient expression. The influence on migration in conditioned culture media was also tested by scratch assays.

For first trials of protein isolation, *E. coli* BL21 (D3) (Novagen) were transformed with pET 41 Ek/LIC_AmbLOXe by the heat shock method. This expression system produced only minimal amounts of soluble protein which proceeded to lose activity within 24h of production. As an alternative method, *E. coli* was transformed with pET28b_His-TEV-AmbLOXe3. In this case, large amounts of AmbLOXe could be produced in inclusion bodies. These inclusion bodies serve as nanopills, which allow immobilization of AmbLOXe on cell culture surfaces, as well as gradual release of AmbLOXe into the culture medium. Wound healing assays (scratch assay and electric cell impedance sensing) were performed with cells seeded onto the immobilized nanopill layer.

Results:

AmbLOXe was expressed successfully in HaCaT and U2OS cells. It exerted an influence on the migration of the cells, which was also detectable for conditioned medium (Figure 2). The protein was expressed successfully in *E. coli* systems, but expression of high amounts resulted in the production of inclusion bodies. However, it is hypothesized that amyloid-containing-forms of inclusion bodies can contain bioactive protein. Therefore, we proceeded to perform wound healing assays directly onto an immobilized layer of inclusion bodies, serving as nanopills.

Conclusion:

Due to the observation that AmbLOXe-conditioned medium exerts a positive influence on cell migration, direct application of the AmbLOXe protein seems to be a safe and interesting alternative to gene therapy with transfected cells. Therefore, the agent must be producible in high amounts. The work at hand shows the development of different strategies for the production of bioactive protein. Soluble production using GST-tags, chaperones or low induction temperatures did not lead to the isolation of significant amounts of soluble protein. Therefore, an alternative method was devised utilizing production in insoluble nanopills, which offers product stability and may contain bioactive AmbLOXe forms.

Picture:



Wildtype Axolotl (*Ambystoma mexicanum*) in laboratory keeping

Development of an Immersive Virtual Patient Simulators for teaching declarative and procedural knowledge in trauma surgery

(Abstract ID: 238)

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Background:

Clinical reasoning is based on the declarative and procedural knowledge of workflows in clinical medicine. Educational concepts like problem based learning or mannequin simulators support learning of procedural knowledge. Immersive patient simulators (IPS) go one step further as they allow an illusionary immersion into a synthetic world. Students can freely navigate an avatar through a 3D environment, interact with the virtual surrounding and treat virtual patients. We developed a university based IPS framework which was proven to have positive effect on teaching declarative knowledge. It is free to use and combines a high immersion grade with profound medical content. In this study we wanted to prove the effect of simulator usage also on procedural knowledge as knowledge about impact on knowledge gain is the key point when implementing these tools in the daily curricular.

It was our aim to develop an educational module that teaches clinical and therapeutic workflows in trauma surgery. Furthermore, we wanted to answer the question whether this new module has impact on declarative and procedural knowledge.

Materials and methods:

The new module was based on the declarative and procedural learning targets of the official German medical examination regulations. The module was part of our custom made IPS (ALICE: Artificial learning interface for clinical education). ALICE was evaluated on 100 students.

Results:

Students showed a high motivation when using the simulator as most of them had fun while using it. ALICE showed positive impact on procedural and knowledge as there was a significant improvement in finding the right diagnosis and determining the correct therapy after using the simulator. ALICE positively influenced increase in declarative knowledge as there was a significant improvement in answering multiple choice questions before and after simulator use.

Conclusion:

ALICE has positive effect on knowledge gain and raises students' motivation and has positive impact on declarative and procedural knowledge gain. It is a suitable tool for supporting clinical education in the blended learning context and must be adapted on more complex clinical scenarios.

Validation-Data of the TAPP Teacher

(Abstract ID: 286)

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Background:

A new training module for TAPP is presented. The module was developed to resemble realistic anatomical proportions and coordination of movements, mimicking a real TAPP procedure (face validity). The teacher was designed to comprehend and expose all the theoretical knowledge needed to avoid technical errors.

Materials and methods:

The laparoscopic image is provided by a Telepac System (Storz) and a commercially available Pelvitainer, using classical laparoscopic instruments. The teacher is modelled on softcast. The endoscopic view of the groin region shows direct parallelism to the human anatomy, including the shape of the lesser pelvis (important for mesh accommodation), the spermatic cord, the spermatic vessels, the epigastric vessels, the iliacal vessels, the nerves as well as the respective hernia orifices median, lateral and femoral. There is the possibility of ligation of the hernia sac (direct hernia) and of retrieval of preperitoneal fatty tissue from the inguinal canal (indirect hernia). The peritoneum-substitute used can be cutted, parietalized and sutured with commercially available suture materials and is easy to be replaced between two training units (about 1 minute à 20c/session).

Results:

We have tested the TAPP-teacher in a pilot study with trainees without any TAPP experience (n=4) and with experienced surgeons (n=6) as well as in four training courses (n=52). Content validity (theoretic steps, anatomy, different hernia types, cutting of peritoneum, parietalization of the structures, insertion and positioning of the mesh, mesh fixation as well as suture of the peritoneum) and construct validity (participants with previous experience had clearly more proficiency in solving the tasks than beginners) were demonstrated. Predictive validity has to be shown in future studies. A prerequisite for this will be the development of an evaluation system for real TAPP procedures in the OR and should be developed in cooperation with the ongoing education-module of the EHS.

Conclusion:

The TAPP teacher reflects the main surgical steps of the procedure and is suitable for use in training sessions. It should be part of the skills training of young residents.

Picture:



Comparative Analysis of the efficiency of different instructional approaches on acquiring competence in shoulder and knee examination

(Abstract ID: 290)

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Background:

Musculoskeletal diseases and injuries are the most common cause of long term pain and physical disability. Their influence on health and quality of life will clearly increase in the future due to the aging population. Therefore, every medical graduate irrespective of his future specialty should be able to perform a structured, orienting examination of the musculoskeletal system.

The instructional approach used to teach skills has substantial influence on what is memorized and what will become part of a doctor's regular examination repertoire. However, the best didactical method still needs to undergo further investigation. Being established in many medical disciplines (e.g. urology and gynecology), teaching associates have proven to be successful in imparting knowledge of various examination methods. Teaching associates are trained simulation patients, giving immediate feedback to the students, learning the method.

The aim of the present study is the comparative analysis of the efficiency of three different teaching methods for shoulder and knee examination.

Materials and methods:

Study participants were fourth year medical Students completing a 210-minute training module in knee and shoulder examination during their three weeks of obligatory surgical training. Students allotted to group one, examined each other under professional supervision. whereas students in group two examined the teaching associates and in group three students are first examined by a professional tutor followed by mutual examinations under supervision.

The training module was ruled by a professional tutor in every group. The theoretical backgrounds were illustrated by a standardized power-point-presentation. After the explanation and demonstration by the tutor, the groups had a 50-minute practice time to learn every examination. After the training module the acquired competence in shoulder and knee examination was assessed in a 5-minute OSCE station each.

Results:

136 Students (group 1: 45, group 2: 46, group 3: 45) participated in the study. In the OSCE station representing the shoulder examination the Students attached to group 2 performed significantly better than group 1 ($p < .001$) (group 2: 49.43 + 3.8, group 3: 47.62 + 3.9, group 1: 27.42 + 9.9). In the OSCE station representing the knee examination group 2 performed significantly better than group 1 ($p < .001$) (group 2: 31.07 + 2.9; group 3: 29.6 + 3.7; group 1: 21.18 + 5.1).

Conclusion:

The use of Teaching Associates in shoulder and knee examination improves the acquired competence significantly. The influence of the different instructional approaches on longterm retention will be measured in two more point in time and the results presented on the congress.

Influence of expert video feedback, peer video feedback and standard video feedback on students performance of basic surgical skills

(Abstract ID: 292)

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Background:

Receiving constructive feedback can significantly improve future performance. Furthermore, reviewing one's performance by video seems to be a useful adjunct. This study investigates the impact of video feedback on the acquisition of practical surgical skills.

Materials and methods:

Fourth-year medical students completed a structured training of practical skills as part of their mandatory rotation in surgery. All students received the same training of practical skills. However, for the feedback of their performance of wound management and bedside test, students were assigned to one of four study groups: expert video feedback (receiving feedback by an expert after reviewing the recorded performance), peer video feedback (receiving feedback by a peer student after reviewing the recorded performance), standard video (giving feedback to a standardized video of the skill), oral feedback (receiving feedback by an expert without a video record). Afterwards, students completed two OSCE stations, where they were assessed regarding their acquired competencies.

Results:

A total of 199 students (48 expert video feedback, 50 peer video feedback, 52 standard video, 49 oral feedback) were included in the study. There were no significant differences between the four groups in the OSCE directly after the training, neither in the checklist rating, nor in the global rating.

Conclusion:

Students' performance does not differ directly after training as a function of the type of feedback. The longterm effect of the different feedback types will be measured in two more point in time and the results presented on the congress.

Computer video analysis of the tasks of BESTA simulation training for automated proficiency assessment

(Abstract ID: 453)

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Background:

The Russian Society for Simulation Education in Medicine, ROSOMED [rossomed] in cooperation with the Russian Society of Endosurgeons created in 2015 the BESTA program (Basic Endosurgical Simulation Training and Assessment). Objective metrics of proficiency were determined for each of 10 practical exercise. The learning curve for each task demonstrates 20 to 50 trials - up to 500 attempts totally. The feed-back is essential for education of adults, but in such a case it requires substantial amount of human resources. Our aim was to create a system for computer analysis of the video to provide automated evaluation of proficiency in a real time.

Materials and methods:

The working group has analysed international training programs such as TopGun, Yales, MISTELS, FLS, PLUS, E-BLUS, SUTT, LASTT and numerous national endosurgical training programs. 10 exercises have been selected both for the training and assessment. Among them 5 tasks were adopted from the course FLS* (Fundamentals of Laparoscopic Surgery), one task - from E-BLUS** and 4 tasks were developed originally by the working group.

Navigation of 300 Scope (original). Peg Transfer (FLS 1). Scope-Instrument Coordination (original). Precision Cutting (FLS 2 modified). Clip and Cut (original). Needle Guidance (E-BLUS 4 modified). Extracorporeal Suture (FLS 4). Endoloop (FLS 3). Intracorporeal Knot Suture (FLS 5). Continuous Suture, original.

The standard FLS training equipment was used: commercially available Lap trainer with HD-camera connected via USB to a notebook. The standard 10 mm 300 laparoscope with attached digital HD camera was used in the tasks 1 and 3. The standard laparoscopic instruments were used in all tasks without any modification. Standard and original training devices were used in the tasks. The original software was developed for tracking of the instruments movements, event recognitions and accuracy determination.

Results:

All 10 tasks have been preliminary evaluated for the possibility of the computer video analysis. Eight of them have been determined to be suitable for automated recognition of the several objective metrics, such as: 1) automated timing count by start and finish of the exercises, 2) measurement of the ambidexterity ratio, 3) instruments path and 4) velocity. The tasks 1 and 3 were not analysed yet, as at the tasks a movable camera attached to laparoscope is used. The following events recognition and accuracy criteria can be automatically obtained: correct transfer of triangles at the task 2 (Peg transfer); correct and precise cutting alongside the marked circle in the task 4 (Precision Cutting); precise suture placement through the marks and number of throws in the tasks 7, 9 и 10 (Extracorporeal suture, Intracorporeal knot and continuous sutures); precise placement of the loop to the marking 8 (Endo-Loop). Detailed results can be reported at the DGCH conference.

Conclusion:

Automated computer analysis of the real time video of the tasks can be performed. Duration of the tasks, ambidexterity ratio, instruments path and velocity can be determined automatically without modifying the training equipment or endosurgical instruments. The proper or incorrect performance of the tasks and proficiency criteria can be determined as well. That allows to use the computer analysis of BESTA (Basic Endosurgical Simulation Training and Assessment) in a teacher-free environment as a part of endosurgical training.

OpenHELP colorectal: Realising a realistic phantom model for research and training in laparoscopic colorectal surgery

(Abstract ID: 628)

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Background:

Laparoscopic surgery requires extensive training of surgical residents in order to ensure safety in a clinical setting. Thus, preclinical training curricula have been developed and it has been shown that skills obtained in a preclinical setting can be transferred to the operating room. Here, animal training offers a very realistic training environment, but comes with high costs and ethical problems. Phantom models on the other hand often don't support training of several steps in a procedure, but focus on single tasks in an artificial environment. To overcome this limitation we developed a phantom for simulating rectal resection based on the Open Heidelberg Laparoscopy Phantom (OpenHELP).

Materials and methods:

The procedure of laparoscopic rectal resection for rectal cancer was analyzed and a model of the different steps was created. For each step a certain task was defined that could be reproduced in a phantom model and then was realized using organs made from silicone and peritoneum made from latex sheets.

The final phantom model was used by a single surgeon to test its applicability for laparoscopic training and as a model for research on surgical robotics. Here, the whole procedure was performed several times (n=20) and task time for the single steps as well as for the whole operation was recorded.

Results:

The procedure of laparoscopic rectal resection was divided into 13 steps: mobilization of sigmoid, mobilization of descending colon, mobilization of splenic flexure, inspection of colon, lancing of retroperitoneum, delineating vessels, division of artery, division of vein, opening of lesser pelvic peritoneum, dissection of rectum, transect rectum, salvage rectum and finally visual inspection of lesser pelvis. The duration of the whole procedure decreased from 71:06 minutes for the first operation to 19:40 minutes for the 20th operation. Here, opening of the lesser pelvic peritoneum was the longest step, duration decreasing from 11:45 min to 4:22 min, and visual inspection of the lesser pelvis was the shortest step, duration decreasing from 0:52 minutes to 0:28 minutes.

Conclusion:

We developed a phantom model that mimics several steps of a complex laparoscopic procedure, the resection of the rectum for rectal cancer. This phantom model also includes different quadrants of the abdomen to operate in as well as handling of organs as different as colon, spleen and inferior mesenteric vessels. Feasibility of training in this phantom model was shown. Further studies have to include more participants in order to test validity of the model.

Additive mental imagery training improves the learning curve in simulator based laparoscopy training

(Abstract ID: 921)

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Background:

Simulator-based training improves the operative performance in endoscopic surgery, but it is time-consuming and can be costly. Therefore the training-sessions must be conducted most efficiently. Mental imagery training is widely used by athletes and pilots. To support the motoric process in complicated movement patterns, this method can also be used by surgeons. We conducted a randomized, controlled study to test the effect of additive mental imagery training on the learning curve of a standardized simulator-based laparoscopic skills training.

Materials and methods:

Medical students without previous laparoscopy-experience were randomized into two groups. 4 tasks of the "fundamentals of laparoscopic surgery" curriculum were trained on box-trainers in a standardized set of 5 sessions. One group received 4 sessions of an additive mental imagery training (MITG), the control-group (CG) received no additive training. Multiple efficacy and accuracy parameters were recorded to quantify performance before, during and after the training. For data analysis we compared established performance scores and the learning-curves between the groups.

Results:

48 participants were included and completed the study. The performance in both groups improved significantly in all 4 tasks. The MITG achieved proficiency faster in the tasks "PEG-transfer" and "pattern-cutting" (No. of trainings needed to achieve proficiency: CG 0.54 ± 0.51 ; MITG 0.09 ± 0.29 ; $p=0.008$ and CG 1.88 ± 1.23 ; MITG 1.08 ± 1.16 , $p=0.018$ respectively). Variance-analysis showed a significantly steeper learning curve for the MITG in the task "pattern-cutting" (effect-size 0.24; $p<0.05$). The overall performance of the MITG tended to be better also in the tasks "ligating-loop" and "intracorporal-suture" but variance-analysis showed no significant correlation.

Conclusion:

With this study we prove the non-inferiority of additive mental imagery training for simulator-based laparoscopy education and saw a significant beneficial effect on the learning curves in two out of four training-tasks. Mental imagery training is an ubiquitous disposable, not time-consuming and affordable technique which should be integrated into the surgical education. Further studies are needed to specify the value and the mode of deliverance of mental imagery training in surgical education.

Regulations for academic medicine in Germany: Simple business or higher competence? Results from the KARiMED I study

(Abstract ID: 15)

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Background:

Academic medical degrees represent important steps in the career planning of many medical doctors. However, limited resources and changing job prospects for young academic personnel as well as changed social and educational structures increasingly question these qualifications for many years. Due to different regulations in every federal state of Germany there is a known unconformity in prerequisites and regulations for academic degrees at German medical faculties throughout the country. The aim of the presented study was to compare and discuss these differences in order to determine whether reaching an academic medical degree is a simple business or not.

Materials and methods:

This report is the first part of the KARiMED-study (career in medicine; www.karrierestudie.de). An analysis of all regulations for a medical doctorate ("Dr. med."), postdoctoral lecture qualification ("Habilitation"), and associate professor ("außerplanmäßiger Professor"; APL) from all German medical faculties (n=37) were carried out, according to different primary outcome measures and an established scoring system.

Results:

The average total score of doctoral regulations was 57.2±9.5 points out of 100 scoring points. Three faculties reached the highest scorings as given by 72-85 points. Only five faculties achieved low scores of 42-45 points. While certain aspects have been defined in all regulations (written thesis, review process, examination requirements and grading of thesis) some items such as the introduction into good clinical practice, the knowledge of methodology as well as the check for plagiarism only seemed to be minor. The overall scoring for habilitation regulations was 21.9±4.0 points (range 12-28; 95% confidence interval (CI) 20.6-23.3) out of 34 scoring points. The habilitation scoring increased significantly in a 12-year comparison from 15.2±5.1 points (p<0.001; 95% CI 13.6-16.9). This rise was mainly due to increased requirements in terms of publication activity, teaching and mandatory board certification. Furthermore, the narrower 95% CI, showed some standardization of the habilitation requirements at German medical schools. The scoring for the APL-requirements was 13.5±3.7 out of 20 points (range 5-19). Sufficient performance in teaching and research with adequate scientific publication was mandatory in more than 88%. Furthermore, 83% of the faculties expected an expert review of the candidate's performance. Conference activities as well as the reduction of the minimum time as an assistant professor appeared to be secondary.

Conclusion:

The academic medical career is still of high importance in Germany. If it is used for a formal scientific-academic or for a personal-occupational career does only play a minor role. The regulations for academic degrees at German medical faculties, however, show exceeding heterogeneity with highly location bound requirements. Furthermore, the criteria by which the respective work will be reviewed

and evaluated are intransparent and often poorly defined. These differences counteract structured transparency and career planning and therefore antagonize equivalent national as well as international opportunities. Taken together, there is a need for substantial changes in form and content of the regulations. Improvements must also be done for better international comparability and visibility. Standardized federal regulations for academic medical degrees might help to increase transparency and would establish scheduled career paths for young motivated academics throughout the country.

Academic career planning in medical mid-level faculty: from high scientific interest, good performance and little support

(Abstract ID: 76)

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Background:

After the introduction of the Bologna reforms in Europe the educational landscape in Germany has changed significantly. In addition, the social structures have changed, thus the claims of employees from the Generation Y (born between 1980-1999) to the work-life-balance were much more important and represent a key element in the career planning of young medical professionals. However, receiving a doctors degree (Dr. med.) still represent an important step in Germany, while the habilitation thesis is significantly less important. This is underscored by risky job positions in science and research and unknown perspectives for higher academic positions.

Materials and methods:

As part of the 4th arm of the KARiMED-study (career in medicine; www.karrierestudie.de) we conducted an online survey inviting the medical mid-level faculty in Germany starting in March 2016. The online survey was done asking biographic parameters, subjective ratings and potential needs for reforms concerning the academic and professional career.

Results:

Actually 679 participants finished the survey of which 44 % seem to be well informed about their career options. However, 47 % are not and would seek better information. This is underscored by 63 % who never received any kind of strategic career mentoring. Generally, academic degrees were found important by 65 %. This is highlighted by the association for better future prospects with a doctorate (58 %), but only in 45 % with a postdoctoral lecture qualification (PLQ; Priv.-Doz.). Furthermore, 91 % think to have better chances for higher job positions with a doctorate. Therefore, 9 % of the participants seek for a doctorate (75 % already have a doctorate), 38 % for PLQ and 18 % for a full professorship. However, only 17 % rate high to very high chances to get a full professorship. In contrast to that 80 % of superiors expect that their medical staff will receive a doctorate, however, only 25 % feel to be well supported by their boss. Additionally, the unproblematic release of clinical work for research activities seems only possible in 3 % and is therefore done mostly in the freetime (48 %). Taken together 52 % wish reforms including structured programs for higher academic qualifications with mandatory agreements, standardized federal regulations, reduced dependency on professors and more transparency as well as the relieve of the clinical working burden.

Conclusion:

The academic career in medicine is highly valued and seems to be associated with better job positions and future prospects although the chances for a full professorship were only rated low. This is conflicted by the historically grown complex German graduation system but also by a great lack of support of the institutions and direct superiors of the candidates itself. Science and politics agree that young researchers must be offered better career prospects what has already been recommended by the German Science Council in 2013. Therefore there is the need for substantial structural changes providing projectable career pathways such as the tenure track program. In addition, the potential new personnel concept for young (medical) professionals (Y-model) might also be supportive, enabling the

introduction of the internationally known position as an assistant professor for those who are definitely interested in an academic career as well as giving support to those who choose to find their career paths inside or outside of science, however, without higher academic merits.

Surgical residency – Passing the button or the end of the world as we know it? Results from a Survey among medical students in Germany

(Abstract ID: 237)

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Background:

The current student generation has their own expectations towards professional life and pay particular attention to work- life balance. Less interest in work- intensive specialties leads to a shortage of skilled candidates especially in surgery. In order to motivate students into a surgical residency, new priorities become important. A deeper understanding of the underlying arguments and students' expectations towards a surgical training are necessary to counteract a future shortage of specialized surgeons.

Materials and methods:

We conducted an internet- based survey among medical students at two representative German university hospitals to gain more information about the underlying mechanisms that lead to and against the choice of a surgical career. We particularly paid attention to gender differences and differences between students of different academic years.

Results:

A total of 1098 students participated in the survey. Sixty-four percent were female. The majority of the students are of the opinion that surgery is an interesting and meaningful profession. In contrast, when it comes to their own career choice, most students (89% female and 81% male) are not willing to choose a surgical specialty. Students are very well willing to spend a high amount of time on their professional life but by the same time demand planning reliability and a sufficient work life balance. Flexibility in working hours and an existing childcare program were identified as predominant factors for all students and in particular for female students. Same counts for a respectful conversational tone and appreciation of the individual work. The factors prestige and salary were less relevant than "self-fulfillment" in terms of respectful interaction and reconciliation of work life and private life. There was significant difference in female and male students as female students have clearer ideas concerning career planning but at the same time are less self- confident than their male colleagues. Moreover there was a significant difference between junior and senior students regarding career planning with a shift to less work intensive specialties and especially away from a surgical residency in older students. Adjustments of work time models, working environment, clinical curriculum and a respectful interaction are factors that might increase the willingness of young students to choose a surgical career.

Conclusion:

In summary our survey reveals that the current student generation is motivated and willing to spend a certain amount on professional life but has clear ideas about "self-fulfillment" and self- confident expectations on future workplace. The responsible surgical leaders should consider to further enhance clinical education, improve working environments and pay attention on a respectful professional interaction. We furthermore have to be aware that according to our data a good percentage of students negatively changes their view on surgery based on their final years of medical school.

Why so many young physicians burn out – and the three things they need to know

(Abstract ID: 982)

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Background:

The incidence of burn out among physicians is among the highest in the working population. Over 60% of young physicians are reported to show at least one sign of burn out, such as emotional and physical exhaustion, depersonalization and cynicism.

Materials and methods:

This disturbing fact is not only important for the health and wellbeing of the individual physician, but also holds direct implications to patient safety and treatment as well as economical consequences for health care providers.

Results:

It is important to understand why burn out rates among young physicians are so high and on the rise and the consequences that derive from it.

Conclusion:

But even more important are ways and techniques for the individual physician to reduce the risk of burn out and maintain mental and physical health amidst the strains of the 21st century medical work environment.

Morbidity and Mortality Conference as a Tool for Quality Assurance

(Abstract ID: 315)

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Background:

The implementation of morbidity & mortality-conference-results is the background and rationale behind this project. Quality assurance is a very important aspect of daily life in a neurosurgical clinic as well as an important parameter for the neurosurgical patient. Quality assurance programs of some sort are common but still not implemented in all units.

In 10.000 surgical procedures including neurointerventional procedures over a period of 5 years a regular morbidity and mortality conference was organized in our institution. The morbidity and mortality conference was organized not just a control of all neurosurgical and neurointerventional procedures done in the month before, but also as a didactic session to teach residents, fellows, guests and students. Digitized presentation using power point and key note with inclusion of the topic related publications are mandatory.

Materials and methods:

Shortly after the ending of a month, there were in a medium between 150 - 200 procedures analyzed in a regular way in the whole team. Not the neurosurgeon involved is of utmost importance, but the case, the indication for surgery, the procedure, the potential complications and the relation to published literature. A written protocol and a summary and also an implementation of the results discussed into the clinical standards were given.

Results:

From every morbidity & mortality-conference at least one, sometimes more conclusion were extracted from discussion and implemented in the clinical standards as a very important contribution.

Conclusion:

In the meantime this implementation and the regular organization of morbidity & mortality-conference is not just a must from the view from the chairman of the department, but also a requested and very important didactic session in education and training of the neurosurgeons in the whole clinic.

Effectiveness of local hemostatic agents to prevent postoperative bleeding in thyroid surgery: a systematic review and network meta-analysis

(Abstract ID: 318)

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Background:

For many benign and malignant disease of the thyroid surgery is the treatment of choice. Improvement in surgery and surgical instruments has led to a reduction in postoperative bleeding. Local hemostatic agents are another growing trend in the field of thyroid surgery. These agents achieve hemostasis either passively by contact activation of the intrinsic coagulation pathway, or actively using added thrombin and/or fibrinogen to produce a fibrin seal. The objective of this systematic review and network meta-analysis was to investigate the value of hemostatic agents to prevent postoperative bleeding after thyroidectomy.

Materials and methods:

Randomized controlled trials (RCTs) meeting the following criteria were included: adult patients undergoing unilateral or bilateral thyroid resection for benign or malignant disease; comparison of active (AHA) or passive hemostatic agents (PHA) to each other, or to a control group without the specific intervention of interest; and reporting of one or more of the following outcomes. The primary outcome was the rate of cervical hematoma requiring reoperation. Secondary outcomes were as follows: total volume of postoperative blood loss (defined as drain volume in mL until drain removal), time to drain removal (in hours, defined as time from the end of the operation until <20 mL was collected in the drain over a 24h period), rate of cervical hematoma that did not require reintervention, rate of postoperative wound infection, rate of postoperative seroma, length of hospital stay (in days), rate of postoperative recurrent nerve palsy (transient or permanent), and rate of postoperative hypocalcaemia (transient or permanent).

For the primary outcome, a Bayesian random-effect model for network meta-analysis with minimally informative prior distributions was performed. Taking clinical heterogeneity in trial participants and treatments into account, a random-effect model was chosen for the meta-analyses.

Results:

In regards to the primary endpoint no significant difference was observed in the pooled odds ratios. The reoperation rate due to bleeding is highest in the control arm with 58.0% probability, in the AHA arm with 30.2%, and in the PHA arm with 11.8% probability. The precision of the pooled results was low, resulting in large confidence intervals. Active hemostatic agents led to a significantly lower total volume of postoperative blood loss compared to both control and passive hemostatic agents. The probability of blood loss volume was the lowest in the AHA. AHA also proved beneficial with respect to operating time, with a mean reduction of 11 and 20 minutes compared to control and passive hemostatic agents, respectively. No difference was observed for time to drain removal or length of hospital stay.

Primary Endpoint AHA vs. control OR [95% CI] PHA vs. control OR [95% CI] PHA vs. AHA OR [95% CI] Reoperation rate due to bleeding 1.53 [0.21; 10.77] 2.74 [0.41; 16.62] 1.77 [0.12; 25.06] 5 studies, 564 participants

Table:

| Primary Endpoint | AHA vs. control | PHA vs. control | PHA vs. AHA | OR | |
|----------------------------------|--------------------|--------------------|--------------------|------------|------------------|
| | OR [95% CI] | OR [95% CI] | [95% CI] | | |
| Reoperation rate due to bleeding | 1.53 [0.21; 10.77] | 2.74 [0.41; 16.62] | 1.77 [0.12; 25.06] | 5 studies, | 564 participants |

Conclusion:

The use of local hemostatic agents does not reduce the risk of clinically relevant postoperative bleeding (cervical hematomas with regard to reoperation), thus raising the question of whether their use should be continued as a standard prophylactic measure.

To operate or not to operate – what the surgical risk calculator tells us?

(Abstract ID: 436)

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Background:

Calculating the perioperative risk[1] in surgical patients often relied on expertise of the surgeon and complication factors known from the literature. Many are guided by the American society of Anaesthesiologists (ASA) classification. This classification originated from a workgroup in 1940 and was first published in the 1960s. Although widely known and well established, several studies have shown the ASA classification to be a poor predictor of in-hospital deaths following inpatient surgery. This is a direct result of poor risk measurement; poor identification and weighting of threat and opportunity impacts and likelihoods. And then critically, making a balanced decision that weights the threat against the opportunity based on objective measures that are contextualized to the case in hand.

Many different surgical risk calculators exist trying to calculate perioperative morbidity and mortality, especially in cardiac surgery or orthopedic surgery. Other surgical subspecialties have tried to stratify surgical risk using scoring systems for individual surgical procedures such as hernia repair.

The American college of surgeons developed an open access preoperative surgical risk score (Surgeons National Surgical Quality Improvement Program, ACS-NSQIP) which calculates the perioperative risk for a patient for a specific procedure for various outcomes. This program has collected data from 393 hospitals. It allows the surgeon to calculate the perioperative risk and predicted length of hospital stay for a specific procedure predicting 8 major outcomes.

[1] Axelos Global Best practice, "Management of Risk: Guidance for Practitioners' (2010 Ed), p.135 defines a risk as "An uncertain event or set of events that, should it occur, will have an effect on the achievement of objectives. A risk is measured by a combination of probability of a perceived threat or opportunity occurring and the magnitude of its impact on objectives."

Materials and methods:

A review of all publications related to the ACS NSQIP was performed. So far we found 35 papers directly comparing a patient cohort to the calculated risk given by the ACS NSQIP. Some have found the calculated risk not to differ significantly from the observed risk. Others have found a statistically significant difference between the calculated and the observed complication risk. We give an overview of the methods of the ACS NSQIP, literature review and outcomes so far

Conclusion:

Several models exist to aid surgical decisionmaking. Preoperative knowledge of possible complications and outcomes is crucial for precise planning and informed consenting of the patient. Riskcalculators can help in the planning process, however can not be safely relied on. The thesis of this report is to determine objective measures of risk and opportunity probability and likelihood based on ACS-NSQIP data, defining principles to apply them in context and weight the factors accordingly to provide an objective, auditable and defensible risk barometer.

Perioperative antiplatelet therapy and pancreatic surgery: friend or foe?

(Abstract ID: 583)

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Background:

INTRODUCTION: With increasing age, the number of patients with cardiac co-morbidities do increase and with this also the individual mono- & dual antiplatelet therapy. This regime seems to increase the perioperative bleeding risk. Therefore, international guidelines recommend to shift the operation in these patients up to one year, which is not possible in pancreatic cancer/PCa.

Thus, we aimed to clarify whether PCa patients with a pre-existing mono- or dual antiplatelet therapy have an increased risk of bleeding compared to patients with no antiplatelet therapy and with patients who started an antiplatelet therapy postoperatively.

Materials and methods:

METHODS: For this, 838 patients with a pancreatic resection between 2007 and 2015 were analyzed retrospectively. 467 Patient without anticoagulation were the control group. Patients with anticoagulative therapy were divided into 5 different groups: group (I) 62 patients with perioperative Aspirine/ASS, (II) 8 patients with perioperative ASS and Plavix, (III) 32 patients with oral anticoagulation (OAC) converted to perioperative therapeutic low-molecular-weight heparin (=tLMWH), (IV) 44 patients with preoperatively paused medication and (V) 136 patients with new postoperative onset of therapy. Lastly was divided into three groups: (Va) only ASS, (Vb) tLMWH, (Vc) TLMH + ASS. The control group was defined as patients with no history of anticoagulative therapy. Perioperative bleeding was classified according to recommendation of ISGPS and the postoperative complications according to Clavien-Dindo.

Results:

RESULTS: 125 (14.9%) patients received pre-operative anticoagulatory medication (group I-IV). In these patients, there was no difference in the incidence and severity of bleeding compared to the control group. The cardiac and overall complication rate did not differ in these groups. However, 136 patients (16,2%) who received postoperatively a novel anticoagulatory therapy regime (group V) demonstrated significantly more and severe postoperative bleeding (group Va: $p = 0.009$; Vb: $p = 0.027$; Vc: $p < 0.0001$). Also the rate of overall complications was higher only in this special subgroup of patients (Vb: $p = 0.003$; Vc: $p = 0,019$).

Conclusion:

CONCLUSION: Overall, it seems that pre-operative mono or dual platelet inhibition does not increase the risk of perioperative bleeding and complications. Patients with novel postoperative anticoagulatory therapy seem to be more at risk. However, until subsequent studies with larger cohorts are present, individual risk assessment should be performed.

Patient Safety in Europe and other parts of the World

(Abstract ID: 597)

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Background:

More than 234 million surgeries are performed worldwide per year including approximately 40 million surgeries in Europe. The over-all inpatient complication rate is around 10% resulting in more than 3.5 million complication-associated-deaths per year worldwide. Besides the effects on patients' health, serious complications result in a tremendous increase of hospitalization costs and a general economic damage. However, almost half of the adverse events are preventable. This presentation focuses on medical safety in Europe and other parts of the world and compares the tools and options that are available and used.

Materials and methods:

Available data and publications concerning 'Patient safety in surgery' were identified and analyzed through PubMed, the Cochrane Library, the WHO database, the European Commission database and publications and recommendations by several national and international surgical societies. An overview of the current literature on 'Patient Safety' is presented.

Results:

In Europe, the overall mortality ranges between 0.8 and almost 4% in surgical patients. 75% of the adverse events in surgical patients occur intra-operatively. Thus, the operating room is a high impact area for safety improvements. In 2009 the WHO published the 'Surgical Safety Checklist' and the 'Guidelines for Safer Surgery'. The use of the WHO checklists and guidelines has shown to reduce the inpatient death rate almost by half and complications by one third. The WHO checklists and guidelines are used in two thirds of all European patients, with marked variation across the different European countries (0 - 100 %). In addition to the WHO checklists the European Commission published a 'Patient Safety Package' including 'Patient Safety in the EU' and an overview on 'Reporting and learning systems for patient safety incidents across Europe'. Guidelines for a variety of diseases and surgical procedures have been published by several national, European and international surgical societies. Surgical quality is checked and approved through various certification programs, 'high volume' requirements for some of the more complex surgeries exist. In the past years the American College of Surgeons (ACS) has established several quality programs like the National Surgical Quality Improvement Program (NSQIP) and a 'Surgical Risk Calculator' that demonstrated lower complication rates and mortality rates and a significant saving of costs in the participating hospitals.

Conclusion:

In Europe and other parts of the world the use of surgical safety checklists and guidelines has shown to result in a significant drop of adverse events and complication-associated deaths. Also, the number of non-lethal-complications can be reduced significantly. Further improvements on patient safety can be achieved through the use of risk calculators, critical incidence reporting systems, a good complication management, morbidity and mortality conferences, certification and re-certification processes and the classification of departments in 'centers of competence, reference or excellence'. Alone in Europe, more than 750,000 harm-inflicting medical errors, 260,000 incidents of permanent disability, and more the 95,000 deaths per year appear to be preventable through best practice perioperative medicine and best practice complication management.

Acute kidney injury in the surgical intensive care unit – an underestimated complication with severe consequences: retrospective study of 7119 patients

(Abstract ID: 824)

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Background:

Acute kidney injury (AKI) is a frequent complication after major surgical procedures, however its consequences are often underestimated, especially if compared to other surgery-related complications. Therefore we evaluated incidence of non-dialysis (AKI/noRRT) and dialysis-dependent AKI (AKI+RRT) and association with outcome in surgical ICU-patients.

Materials and methods:

Data on 7119 adults admitted to surgical intensive care unit at tertiary university hospital were retrospectively analyzed during a 5-year period (from January 2011 to December 2015). All patients and also subgroups after major non-cardiac surgical procedures such as: major liver resection, major pancreatic resection, esophageal resection, gastrectomy, multivisceral operation with peritonectomy and hyperthermic intraperitoneal chemotherapy (HIPEC), open and endovascular aortic surgery were assessed for incidence of AKI and need for renal replacement therapy (RRT) according to hospital database, using International Statistical Classification of Diseases (ICD-10) and OPS (Operation and Procedures Codes 2016). Moreover, length of ICU- and hospital stay, age, severity of illness and discharge destination were evaluated.

Results:

In total 7119 patients were admitted to the surgical intensive care unit between January 2011 and December 2015. 1 737 patients (24.4%) developed AKI during their hospital stay, of whom 575 (8.1%) required RRT. The incidence of AKI increased annually from 20.8% in 2011 to 28.6% in 2015. Patients without any AKI had the shortest length of ICU and hospital stay, compared to patients with AKI/noRRT and patients with +AKI/+RRT, which showed the longest duration of ICU and hospital stay (4.3 vs 6 vs 21 days and 20 vs. 25.7 vs 46.8 days). Having analysed the hospital discharge process we found a significant association between the degree of AKI severity and likelihood for homeward discharge: no AKI vs AKI/no RRT: odds ratio OR 1.77, $p < 0.001$; no AKI vs AKI+RRT OR 8.79, $p < 0.001$; and AKI/no RRT vs AKI+RRT 4.96, $p < 0.001$. Comparing individual surgical procedures, highest incidence for AKI was seen after adult liver transplantation (60.3%), followed by open and endovascular AAA repair (38.7%; 34.9%). Patients undergoing major liver resection or oesophageal and gastric surgery had significantly higher risk to develop AKI and AKI with RRT during ICU stay compared with patients after pancreatic resection or multivisceral operation with peritonectomy and HIPEC (AKI: odds ratio OR 1.35; 95% CI 1.01-1.80; $p = 0.043$ and AKI+RRT: OR 1.79; 95% CI 1.13-2.83; $p < 0.013$).

Conclusion:

Incidence of AKI in surgical ICU-patients is increasing and its consequences affect short-term patient outcome, e.g. increased mortality and length of stay as well as long-term quality of life, e.g. rarely discharge homewards. Therefore, patients undergoing major surgical procedures like liver transplantation, aortic, major hepatic, esophageal and gastric operations, should be broadly informed about the considerable risk to develop an AKI in postoperative course. Preventable causes of AKI,

such as perioperative hypovolemia and nephrotoxic medication may be reduced by postoperative intervention using early biomarker-guided strategies, as investigated in ongoing prospective randomized studies.

How to Measure the Performance of Surgical Novices with the Example of Totally Implantable Central Venous Access Devices (TICVD)

(Abstract ID: 835)

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Background:

Beside theoretical knowledge, operative skills are of major importance in surgical training. Traditionally, skills are trained and evaluated in daily work and education. Objective measuring of surgical abilities is challenging and uncommon. We identified the implantation of totally implantable central venous devices (TICVDs) as a potential model to analyze basic surgical skills and progress in operating performance.

Materials and methods:

Five surgical novices without any surgical experience were trained in standard implantation of TICVDs via cephalic or subclavian vein in local anesthesia. After assisting 10 operations and performing another 15 procedures under supervision of a surgeon, the beginners started to do cases on their own. A successful operation was defined by two items: (a) operating time < 40 minutes, and (b) no need for assistance by a surgical specialist. For evaluation of the surgical performance, the cumulative sum technique (CUSUM), a sequential analysis statistical method, was used. Acceptable and unacceptable failure rates were defined with 0.8 and 0.7. Operating times were analyzed for the first and the last 25 cases. For group comparison of operation time, the one tailed independent t-test was used. For analysis of need for help by specialists, a logistical regression model with a binary dependent variable and post-hoc significance test was used.

Results:

In 4 of 5 surgeons a decrease in the mean operating time was noticed, 2 of them significantly improved with -13,8 minutes and -13,1 minutes ($p < 0,05$), 2 improved with -1,7 minutes and -4,2 minutes on average while one had an increased mean operating time with +3,7 minutes. Three surgeons needed assistance less than 6 times throughout all 50 TICVDs. Two others with 10 and 19 assisted TICVDs needed significantly less assistance with growing experience over time ($p < 0,05$). The odds ratios showed a 7% and 12% decreased probability for need of assistance for every TICVD done by these two surgeons ($p < 0,05$). CUSUM demonstrated a successful learning curve for 4 of 5 surgeons. Three of 5 surgeons met the preset criteria for success after 14, 37 and 38 procedures respectively (Fig. 1). One surgeon achieved the criteria temporarily but showed a decrease in performance in the later operations. In one surgeon no progress could be identified (Fig. 1).

Conclusion:

TICVD-Implantation can be learned fast and performed independently by the majority of surgical residents within their first 50 procedures. The CUSUM-method offers a good model to evaluate performance of surgical novices.

Picture:

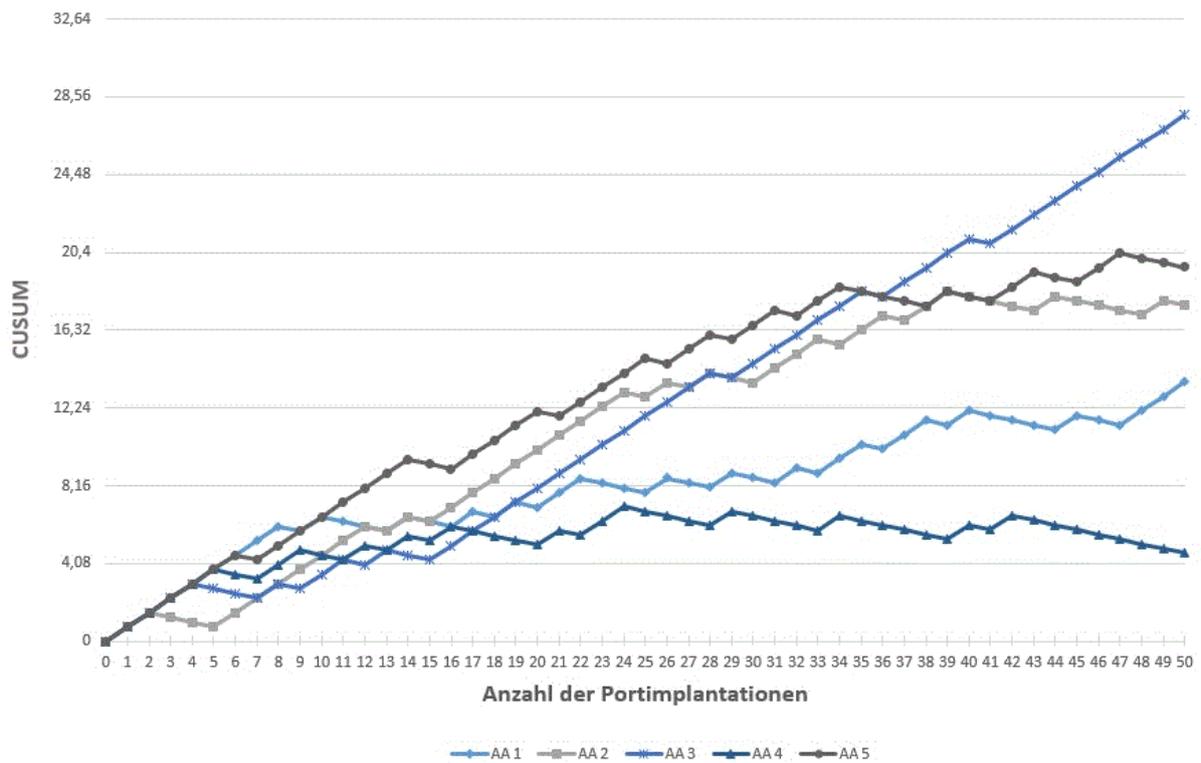


Figure 1 CUSUM-test plot for Implantation of totally implantable central venous access devices by five surgical novices: AA1, AA2, AA3, AA4 and AA5. The horizontal lines represent the upper and lower boundaries respectively. Success is displayed as a decrease in CUSUM, while failure is displayed as an increase.

Preoperative pyloric balloon dilatation decreases the rate of relevant functional pyloric stenosis after ivor-lewis esophagectomy

(Abstract ID: 947)

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Background:

The rate of postoperative functional pyloric stenosis and delayed gastric emptying after esophagectomy and gastric pull-up reconstruction is a common complication and in 15-20% of patients clinically relevant. This functional stenosis can lead to severe postoperative complications and is mostly endoscopically treated via pyloric balloon dilatation in the postoperative phase. The preoperative endoscopic balloon dilatation during the common re-staging gastroscopy is an approach to prevent postoperative functional pylorus stenosis and reduce the rate of this complication. In this study we investigated the value of preoperatively pylorus dilatation in patients prior ivor-lewis resection compared to the patients without preoperative pylorus dilatation.

Materials and methods:

We performed a single-center retrospective analysis of patients who received an ivor-lewis esophagectomy between August 2013 and May 2016, without regard to staging, comorbid conditions, length of hospital stay and other complications.

Results:

81 patients receiving ivor-lewis esophagectomy were included, 54 (67%) patients were dilated preoperatively (PDG, pylorus dilated group), 27 (33%) patients did not receive preoperative pylorus dilatation. 13 patients were dilated postoperatively due to functional pylorus stenosis (16%) during follow-up, 11% in the PDG and 26% in the non-dilatation group (NDG, $p=0.11$). However in the first 14 days after the ivor-lewis resection, only 2 PDG patients (4%) but 4 NPG patients (15%) underwent re-endoscopy and pylorus dilatation due to functional pylorus stenosis ($p=0.09$). The anastomosis leakage rate and median hospital stay was reduced in the PDG group, however not significant ($p=0.18$).

Conclusion:

It seems that preoperative pyloric balloon dilatation reduces the risk of postoperative delayed gastric emptying especially in the early postoperative phase. However our limited retrospective data gives only an idea of the potential of preoperative pylorus dilatation, but does not significantly prove this finding; a prospective randomized trial is needed.

Berlin OStomy-Study (BOSS) – Quality of life, safety and care in 2,647 patients

(Abstract ID: 603)

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Background:

It is unclear whether the type of ostomy or operation variety influences quality of life (QoL). In a German observational study of 2,647 patients, QoL after colostomy (CS) or small bowel stoma (SBS) formation was evaluated.

Materials and methods:

Questionnaires of the European Organisation for Research and Treatment of Cancer QLQ-C30 and CR-38 were answered by patients and medical care specialists. Patient characteristics, retrospective information about the ostomy and previous treatments, and current stoma-related complications were recorded. All questionnaires were distributed and collected by stoma therapists at the German homecare company PubliCare®.

Results:

In 1,790 patients a CS and in 756 a SBS was performed. The mean Global Health Score (mGHS—a general QoL indicator) was 52.33 in CS and 49.40 in SBS patients ($p = 0.004$), but effect size (Cohen's d) was 0.1. In SBS patients, all functional scores were lower and most symptom scores were higher.

Table:

| Variable | | Colostomy (%) (n=1790) ** | Small Bowel Stoma p (%) (n=756) ** | |
|----------|-----------------|------------------------------|---------------------------------------|----|
| Gender | Female | 48.3 | 50.1 | ns |
| | Male | 49.0 | 45.3 | |
| Age | | 8.6 | 19.9 | |
| | >50-70 | 34.2 | 38.2 | |
| | > 70 | 41.9 | 23.6 | |
| BMI | < 18.5 | 3.2 | 5.6 | |
| | 18.5-25 | 36.0 | 43.1 | |
| | >25 | 45.9 | 30.6 | |
| Disease | Benign | 24.4 | 37.4 | |
| | Malign | 69.8 | 52.7 | |
| Surgery | Elective | 58.3 | 57.1 | ns |
| | Emergency | 26.8 | 28.0 | |
| | MIVAS | 11.1 | 16.0 | |
| | Open | 80.0 | 74.9 | |
| Therapy | Chemotherapy | 45.2 | 38.5 | |
| | No Chemotherapy | 50.6 | 57.2 | |
| | Radiotherapy | 34.1 | 22.8 | |
| | No Radiotherapy | 59.5 | 69.4 | |
| Stoma | Temporary | 16.3 | 52.6 | |
| | Permanent | 69.5 | 33.0 | |
| | Loop | 7.8 | 49.6 | |
| | Terminal | 68.8 | 24.9 | |

Conclusion:

QoL differed significantly for CS and SBS patients, but patient's effect size was only marginal. Especially female patients need an advanced care after emergency operations. Nevertheless, ongoing professional education and guidance are necessary for all patients.

The limits of informed consent and the resulting importance of trust in case of urgent operations, using appendectomy as an example

(Abstract ID: 113)

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Background:

Informed consent (IC) before surgery is common practice in Germany. The main purpose of IC is to allow the patient to make decisions according to their own will (autonomously). Is IC possible to its full extent in cases of urgent operations and what role plays the trust between patient and doctor in these cases?

Materials and methods:

Beauchamp and Childress illustrate the requirements for IC in the most influential American Medical Ethics book. These requirements are competence (to understand and decide) and voluntariness (in deciding). [1]

Urgent operations which should be carried out within a few hours from the time of indication are to be distinguished from emergency and elective surgeries. The time pressure, pain and other symptoms associated with for instance appendicitis, result in a reduction of competence and voluntary action of the patient, hence limiting IC. The time pressure limits the possibility for the patient to obtain information and reduces his knowledge about the impending procedure. To allow the patient to remain able to act on his own behalf trust has to increase. "Trust means to build a positive relationship with the not-knowledgeable person. It makes actions possible despite lack of knowledge." [2] Trust means to put your concerns about something into the hands of someone else and to allow this person scope of discretion [3] The main purpose of IC, is to ensure the autonomy of the patient. On the relationship between autonomy and trust: "However, it is also clear that autonomy and trust support each other and that there are many situations where one relies on the other." [4]

Table:

- 1 Beauchamp TL und Childress JF (2013): Principles of Biomedical Ethics. 7th ed., Oxford
 - 2 Han B-C (2012): Die Transparenzgesellschaft. Berlin
 - 3 Baier A (2001): Vertrauen und seine Grenzen. In: Hartmann M und Offe C (Hrsg.) Vertrauen, Die Grundlage des sozialen Zusammenhalts, Frankfurt a.M.
 - 4 Steinfath H (2016): Das Wechselspiel von Autonomie und Vertrauen - eine philosophische Einführung. In: Steinfath H und Wiesemann C (Hrsg.) Autonomie und Vertrauen. Wiesbaden
- References

Conclusion:

In case of urgent operations some requirements of IC are not met to ensure autonomous decision-making of the patient. The article addresses the importance of trust in doctor-patient relationship before urgent operations and its implications for clinical practice.

The importance of trust in the Doctor-Patient Relationship in times of modern information technology

(Abstract ID: 399)

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Background:

Trust is one of the key components in the Doctor-Patient Relationship (DPR). The possibilities of obtaining information has changed significantly in our present modern societies, that potentially impact the trust factor in DPR. The intention of this paper is, to show the relevance of trust, from the perspective of the patient and also the reliability of the internet based information from the patients point of view.

Materials and methods:

Between June 17 2016 - July 22nd 2016, around 243 patients, visiting a general hospital seeking help in the field of visceral or trauma surgery, were interviewed concerning the importance of trust in the DPR. They were asked to answer five questions anonymously with an analogue scale (1 to 10) during their waiting period.

Results:

46% of the 243 interviewed patients were female, 54% male; 59% of all patients required trauma surgery and 41% visceral surgery.

The number of patients was split into six different age groups, which were largely homogeneous. The age group ranging between 30-39 years was inadequate, representing only 9,8% . The most highlighted response was given to the importance of the trust factor in DPR of 77.7% of all patients, as "very important" (10= very important , 1 =not important). 10,7% of the respondents rated the same question with 9 points on this scale.

Analyzing the subgroups, there were no significant differences regarding age or discipline. But regarding gender, the importance of trust was rated significantly higher by female patients.

49 % of the respondents use the internet to obtain further information about health issues. In the group ranging over 60 years still 41 % use this information tool. The reliability of healthcare-information in the internet has been reviewed by those who use it, with an average grade of 5.1 points (1 = low, 10 = high). The group of patients that doesn't use this information, gave an average rating of 3.8 points, this difference was considered significant.

Conclusion:

Finally we could say that trust is a major factor in the Doctor-Patient-Relationship for a vast majority of the interview patients.

The reliability of healthcare information provided in the internet was evaluated as rather low by the same group.

Can visual diagnoses be misleading? – Staphylococcal scalded skin syndrome

(Abstract ID: 311)

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Background:

A 46-year-old female patient was transferred to us because of a persistent phlegmon of the abdominal wall after laparoscopic adhesiolysis, exzision of a necrotic epiploic appendix and exzision of an ovarian cyst due to abdominal pain one month before. Despite of antibiotic therapy with penicillin for over a week, excision of the abscess and even slightly falling inflammatory markers, the wound situation did not improve. On admission at our hospital there was a phlegmon of the whole lower abdomen with superficial necroses and erosions of the skin. Although the local finding resembled a necrotizing fasciitis, the general condition of the patient was surprisingly good.

Materials and methods:

Because of the good overall condition we refrained from operating on the patient directly and first decided to take biopsies of the wound margin and wound swabs in cooperation with our dermatologists. The swabs and the biopsy only showed evidence of staphylococcus capitis after an enrichment process. Histologically we found acantholytic cleavage of the epidermis as well as vesicles and bullae due to an exfoliative dermatitis of the type of the staphylococcal scalded skin syndrome. Therefore we continued the conservative procedure with infusion therapy, an adjusted intravenous antibiotics with clindamycin and cefuroxime and daily wound inspections. Dressings were changed daily with fatty gauze and compresses.

Results:

During the next week of conservative treatment, the clinical finding improved rapidly. There was a nearly complete reepithelialization of the wound surface. The patient could be discharged after two weeks with normalised inflammatory markers. Two weeks later the skin was completely reepithelised.

Conclusion:

Visual diagnoses can sometimes be misleading. In this case one would tend to operate on the patient because of the local findings which suggested the diagnosis of a phlegmonous process or even a necrotizing fasciitis. Furthermore, the patient had no typical risk factors of the staphylococcal scalded skin syndrome: It is a seldom syndrome which occurs primarily in infants. Immunosuppressed adults with tumour disease, HIV, after organ transplantat, alcohol abuse or patients with renal failure rarely face the disease which is caused by the exotoxins of staphylococcus aureus. The patient had no known comorbidities or any earlier purulent infections. The only laboratory-confirmed bacterium was Staphylococcus capitis which is part of the normal flora of the skin. Staphylococcus aureus could not be detected within the swabs or the biopsy, which probably due to the precedent antibiotic therapy. Nevertheless, the histological findings confirm the most likely diagnosis of the staphylococcal scalded skin syndrome. If we had operated on the patient, there would have been a huge open wound of the abdominal wall with the need of a complex covering technique. If the patient's general condition does not go along with the local findings and the expected diagnosis, one should always think of differential diagnoses.

Picture:



Wound infection rates in an observational study comparing preoperative skin preparation with alcoholic povidone-iodine solution (Braunoderm™) versus chlorhexidine (Chloraprep™)

(Abstract ID: 758)

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Background:

Surgical site infections (SSI) are rated as one of the most pressing issues in perioperative nosocomial infections calling for new action plans. All measures contributing to the prevention of SSI are highly valuable as they reduce the burden for patients most of all, but also for health care professionals, and decrease costs and unnecessary hospital stay for departments and payors.

Materials and methods:

Two different intraoperative surgical skin disinfective agents were prospectively compared in an observational study on alcoholic povidone-iodine solution (Braunoderm™) and chlorhexidine (Chloraprep™). The new agent Chloraprep was introduced and used for 750 consecutive cases and after that the procedure returned to the long established alcoholic povidone-iodine solution Braunoderm for the next 750 cases. Both groups were compared and tested for statistical significance between groups using SPSS.

Results:

In the overall analysis skin preparation with Chloraprep showed a lower incidence of SSI, with 5.7% in comparison to 8.5% with Braunoderm skin preparation (Graphic 1). The most significant effect was to be noted for emergency procedures with 7.5% SSI in the Chloraprep group versus 15.3% in the Braunoderm group. Longer surgical procedures showed the most profound effect with lower incidences in SSI after use of Chloraprep, whereas in the subgroup of elective surgical procedures no significant difference could be observed (Table 1).

Table:

| | Braunoderm N=644 | Chloraprep N=739 | P |
|--------------------------|------------------|------------------|------|
| SSI | 8.5% | 5.7% | |
| SSI in elective surgery | 6.6% (N=500) | 5.0% (N=539) | n.s. |
| SSI in emergency surgery | 15.3% (N=144) | 7.5% (N=200) | |
| Operating time 30-90min | 3.8% (N=344) | 3.5% (N=403) | n.s. |
| 90-180min | 9.0% (N=177) | 5.9% (N=204) | |
| >180min | 21.1% (N=123) | 12.1% (N=132) | |

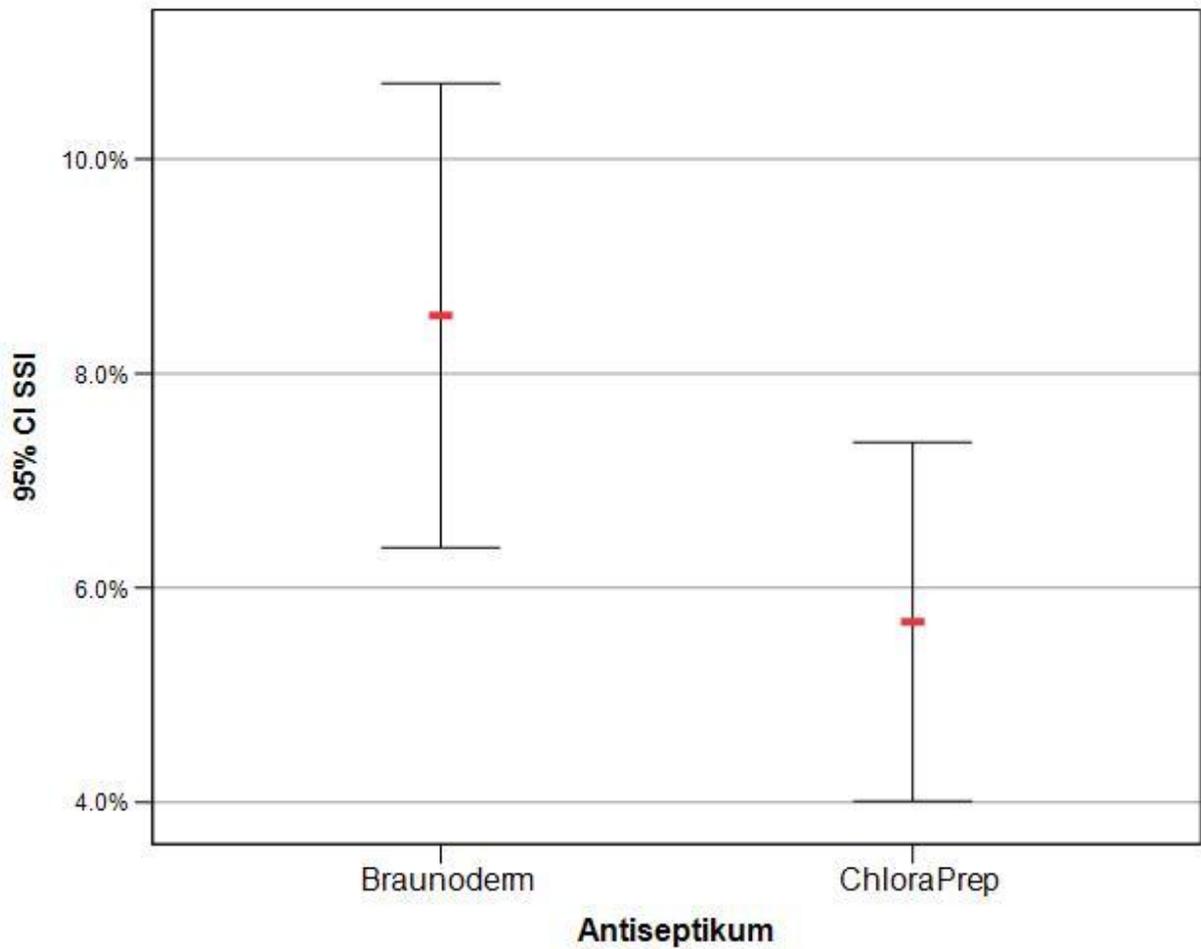
Differences in SSI in subgroups elective versus emergency surgery and operating time

Conclusion:

In the overall analysis skin preparation with Chloraprep showed a significantly lower incidence of SSI, although this difference was due to the significance in emergency procedures and not in elective surgery. A clear increase in SSI could be shown with a longer the operating time, and from 90 minutes onwards the difference between the skin preparation became significant. In the longer procedures a lower rate of SSI was to be noted for Chloraprep. A randomized study is therefore warranted to yield

solid results in order to justify the expenses of the more costly agent, if it can be shown to be superior in the prevention of SSI also in the randomized setting.

Picture:



Overall rate of SSI between groups

Fulminant Streptococcal Myositis – report on a local „outbreak“ of a highly aggressive clone with lethal outcome

(Abstract ID: 767)

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Background:

Streptococcal myositis is a rare and often fatal acute infection of the superficial fascia and the muscle. The initial symptoms are nonspecific until the fulminant course with tissue destruction and septic shock starts. The lack of classical symptoms makes an early diagnosis and start of therapy difficult. The heavy general symptoms in patients with a history of streptococcal infections in relatives and massive pain should bring up the consideration of a streptococcal myositis. We report on two cases with fulminant streptococcal infections, one of them with lethal outcome within hours after hospital admission. Interestingly, in both cases pain was the major symptom, whereas inflammation markers or radiographic findings were rather unspecific. We want to present clinical data, intraoperative findings as well as the microbiological analysis of the involved bacteria. Additionally, we show a review on the literature especially concerning the role of radiographic imaging, initial antibiotic regimen and surgical strategy.

Epicutaneous negative pressure therapy to prevent wound infection: A prospective clinical trial

(Abstract ID: 784)

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Background:

Postoperative wound infections after laparotomy are associated with a prolonged in hospital course, often requiring surgical revision. The current literature states that approximately up to 20% of patients suffer from surgical site infections (SSI) after elective laparotomy. Therefore, one goal seems to be the prevention of SSI. Epicutaneous negative pressure therapy (ENPT) has been shown to be beneficial in a series of cases, however mainly for gynecological and therefore non-contaminated surgeries. In our current investigation we aim to explore the usefulness of EPNT preventing SSI on a visceral surgery population.

Materials and methods:

This study includes 49 consecutive patients undergoing laparotomy for elective or emergent surgery with an incision of at least 20 cm. Four cases were excluded due to not-wound associated reoperation. Abdominal and wound closure was performed in a standardized fashion, following application of an epicutaneous negative pressure drape with continuous suction of 125 mmHg. Perioperative data including demographics, risk factors for SSI, such as BMI, smoking, diabetes, vascular comorbidities and immunosuppression, as well as operative data (peritonitis, enteral anastomosis, stoma and wound size) were captured prospectively. The drape remains for 5 to 7 days postoperatively if no clinical signs for wound infections occurred. Failure of ENPT is defined as any SSI requiring wound opening within 30 days.

Results:

The study population consists of 45 patients (mean age 57 ±17 years, 18 female, 27 male, mean BMI 28.3 ±8) that underwent midline laparotomy. Sixteen (35%) cases underwent surgery for incisional hernia, 27 (60%) for gastrointestinal resection and 2 (4%) for cytoreductive surgery with HIPEC. Eighteen percent of them were emergency procedures. SSI infection requiring surgical wound management occurred in 33% overall. Although, SSI tends to occur more frequent after emergency surgery, it did not reach statistical significance (50% vs. 29%; $p=0.241$). However, neither BMI, smoking, diabetes, vascular comorbidities, nor wound length and depth show any significant correlation to postoperative SSI. Also, enteral anastomosis, peritonitis or presence of an enterostoma was not significantly associated with SSI when ENPT was applied.

Conclusion:

Although limited by small sample size and heterogeneous study population, our results reveal an alarming high occurrence of SSI even when ENPT is applied. Raising the question of the true benefit of this perioperative treatment modality. However, further prospective randomized trials for evaluation of ENPT in patients requiring laparotomy are necessary to reveal the true (dis)benefit.

Epicutaneous negative pressure therapy: an ex-vivo model

(Abstract ID: 785)

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Background:

Epicutaneous negative pressure therapy (ENPT) experiences a true hype for prevention of surgical site infections (SSI) for any kind of laparotomy. However, there is no randomized clinical trial that demonstrate the true benefit yet. ENPT, whether as ready-to-use or customized system, is utilized to protect the surgical incision from contamination and to drain fluids and potential infectious material from the depth of the incision. Yet, there is no study that proofs this theory. Hence, we aim to develop an ex-vivo model to bring some light into the depth of surgical incisions.

Materials and methods:

Our ex-vivo model is embodied by pork belly, measuring 30 by 30 by 5 cm. An incision is made over a length of 20 cm with various depths to 4 cm in 1 cm increments. A catheter with 4 circumferential pressure detectors, 4 cm apart, is placed on the ground of each incision and connected to the computer-based receiver (Medical Measurement Systems International, Enschede, NL). Wound edges are protected with adhesive drape circumferentially. A black foam is trimmed to 22 by 4 by 3 cm and placed on top of the incision. An additional adhesive drape secures the foam in place (figure 1). Now, baseline pressure is set zero. Continuous suction of 75, 100, 125 and 150 mmHg is applied and recorded for 5 minutes respectively. Finally, stained water is injected through the catheter in 1 ml increments until water level reaches the foam and presents within the connection-tube. After additional 5 minutes of suction, the drape is removed.

Results:

The intra-incisional pressure increases by 4 mmHg at 1 cm as well as 4 cm with continuous suction of 75 mmHg. With increased suction up to 150 mmHg the immediate pressure doubled, returns to 4 mmHg after 10 seconds however. Simulation of wound fluids using stained water, also increases the immediate pressure within the incision with each injected ml, followed by "normalization" to 4 mmHg, independently of incision depth. After injection of 12 ml stained water at 4 cm depth, it rises up to the foam and presents within the connection-tube. After removing the drape, the entire tissue of the incision was stained. However, 25% of the fluid remained on the ground of the incision.

Conclusion:

Our data represent the first ex-vivo treatment model for epicutaneous negative pressure therapy. We have shown a noticeable and measureable effect of ENPT in our model. However, the drainage of fluids seems to be insufficient on deeper incisions. Although, handling these results with care, as they do not represent the physiologic environment and clinical treatment time, they do proof the physical effect of ENPT for its purpose.

Picture:

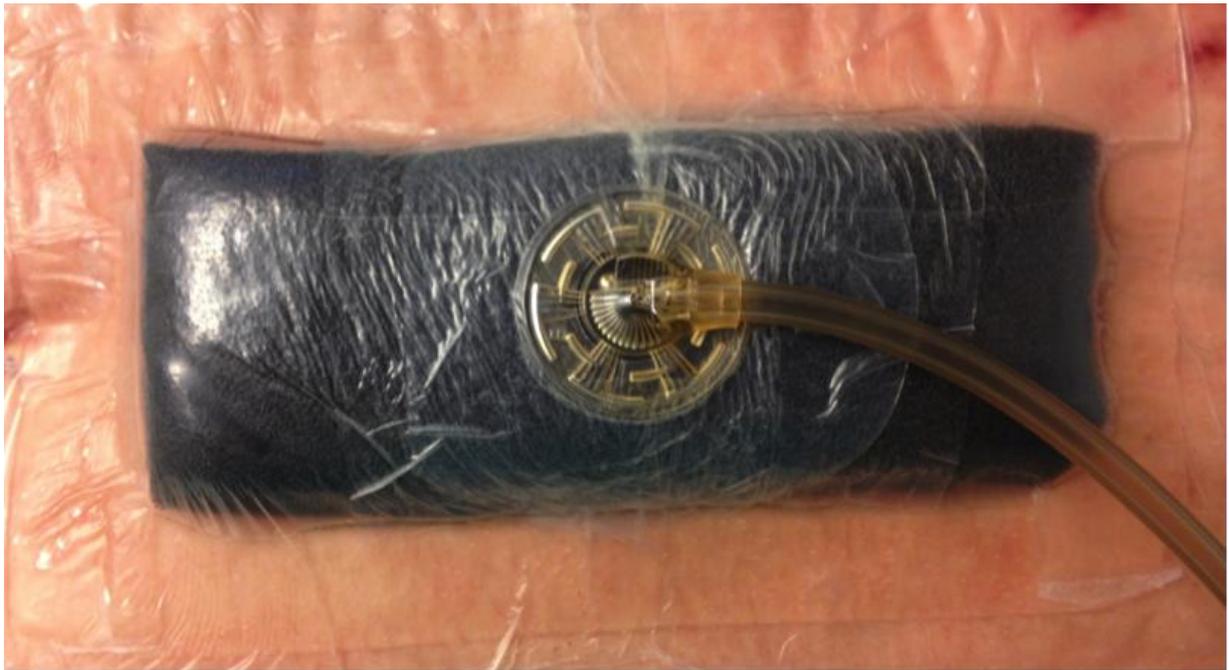


Figure 1

Pyoderma gangrenosum after complex reconstruction of a large scale lower limb defect by combined parascapular latissimus dorsi flap: A case report

(Abstract ID: 249)

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Background:

Pyoderma gangrenosum (PG) is a rare neutrophilic skin disease characterized by rapidly progressing painful, necrotic ulceration and typically affects patients in their third to sixth decade of life. It most frequently involves lower extremities and is often a diagnosis of exclusion, as there are no specific laboratory or histopathologic findings. In most cases, an underlying systemic disorder, such as inflammatory bowel disease, Hepatitis C, Rheumatoid arthritis, hematologic or lymphoproliferative disorder can be identified but a substantial amount of cases remain elusive. In 25-50 %, skin lacerations by trauma or surgery will eventually trigger new lesions (pathergy phenomenon) and thereby exacerbate progression even further. This renders PG a malicious and challenging disease, especially in the surgical patient.

Materials and methods:

A 58-year-old woman with a large lower limb tissue defect after elective knee replacement surgery was transferred to our Department for reconstruction. As wounds were rapidly progressing, Necrotizing fasciitis was initially suspected but eventually ruled out by histopathological analysis. A 50 x 15 cm defect was then reconstructed by a combined parascapular latissimus dorsi flap before, a couple days later, the patient developed tender pustules and ulcers on flap and donor site. The diagnosis of Pyoderma gangrenosum was suspected and local and systemic therapy was initiated but treatment proved to be challenging and insufficient at first.

Results:

Persistent ulcerative necrosis eventually led to flap loss and the patient had to be amputated on her left leg atop of the knee. Repeated histopathological examination never actually confirmed the diagnosis of Pyoderma gangrenosum but clinical presentation and progression was pathognomonic. The treatment was therefore continued with topical corticosteroids and orally administered prednisolone at 1 mg/kg body weight. Over the next weeks, dermatologic symptoms eventually succumbed and, after 3 more surgeries, including plastic coverage of the eroded donor site by rhomboid transposition flap, the patient finally recovered and was able to be transferred to a rehabilitation unit.

Conclusion:

Pyoderma gangrenosum is rare but should always be included as a differential diagnosis when rapidly progressive ulceration on surgical sites is observed. Almost 80 years after its first description, the disease still remains poorly understood and its appearance is especially challenging in patients requiring large scale tissue reconstruction. With PG, any further surgical intervention may lead to uncontrolled disease exacerbation (pathergy) and must therefore be carefully scrutinized, thereby substantially limiting therapeutic options. Confirmation of diagnosis may be exclusively achieved by clinical appearance and progression. Histopathology and laboratory parameters are non-specific and may even be potentially deceptive.

Multidisciplinary treatment of visceral artery aneurysms – single center experience and current clinical management

(Abstract ID: 471)

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Background:

Visceral artery aneurysm (VAA) is a rare and potentially lethal vascular disease. Both surgery and endovascular management are considered appropriate therapeutic strategies. We evaluated our 10-years-experience in a multidisciplinary team.

Materials and methods:

All patients treated for VAA at Bonn University Hospital between 2005 and 2016 were retrospectively enrolled. Demographic and clinical data were reviewed and postinterventional outcomes in endovascular or surgical treatment groups were compared. The results are discussed with respect to the current guidelines of the German Society of Vascular Surgery (Deutsche Gesellschaft für Gefäßchirurgie).

Results:

A total of 24 patients (14 women and 10 men; median age 62 years; range 36-91 years) presenting with 28 VAAs were identified. The most common locations were splenic artery (N=8), followed by hepatic artery (N=6), superior mesenteric artery (N=5) and left gastric artery. The larger part of patients with VAA presented with symptoms (N=12), with 6 patients treated because of a life-threatening bleeding after rupture. Surgery was performed in 10 patients while 12 patients were treated with an endovascular procedure. In 2 patients a watchful waiting approach was preferred due to small size asymptomatic VAAs. In case of emergency, the majority of the patients were treated with an endovascular procedure (N=5). Overall morbidity was 33%. No difference regarding posttherapeutic morbidity was observed between the endovascular and the surgery group ($p=0.337$). 30-day hospital mortality was 0% in both groups.

Conclusion:

VAA is a life-threatening condition and no standard treatment strategy exists. Our data confirm that both surgical and an endovascular approaches are safe and feasible if performed in specialized centres with multidisciplinary experience.

A Surgical Training Tool for Planning Complex Hepatic Resections: Comparing a Virtual Reality Environment to established planning methods? A Randomized Controlled Study

(Abstract ID: 489)

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²Karlsruher Institut für Technologie, Karlsruhe

Background:

Hepatic resections are one of the most complex surgical procedures with considerable morbidity rates. Deciding on the appropriate approach involves appreciating tomography images and considering patient's clinical information. Three-dimensional (3D) operation planning promises to make complex liver surgery better and safer. There are however two problems of current planning systems: first imaging data, although 3D reconstructed, is displayed at two-dimensional (2D) screens depriving the surgeon of an authentic visualization of the intraoperative situation, second crucial clinical patient information is not integrated into the planning environment complicating the decision making process. We present a comprehensive, interactive and immersive method for visualizing operation planning data in a virtual reality (VR) environment using a head-mounted-display Oculus Rift (Oculus VR LLC, California, USA) and compare it to established methods.

Materials and methods:

Three patients from the Surgical Department of the University Clinic in Heidelberg who underwent hepatic resection were selected. 3D-Models of the liver and gallbladder surface, the arterial, venous and portal venous vasculature, the bile ducts and the liver tumors were created from computed tomography data using open-source tools. We used the VR-HMD to visualize the intraoperative anatomical situation in the abdomen. By using the HMD the user could access the 3D-visualized upper abdomen, clinical patient data and the original CT images in virtual reality. Users could interact with all presented data using a mouse as input device. The opacity of the liver and the intrahepatic structures could be adjusted to fit the needs of the user. In the first step of the evaluation medical students were included and randomized in a 1:1:1 ratio. Operation planning was performed with 2D CT-data on a standard monitor (2D), with a 3D-model on a standard monitor (3D) or within VR. All participants evaluated three consecutive liver cases with increasing difficulty. A score was determined from the correctness of the answers on an 11-item-questionnaire assessing liver anatomy, tumor involvement and proposed liver resection as well as the time to answer. At the end participants evaluated the satisfaction, usefulness and potential of their visualization method.

Results:

90 medical students from the University of Heidelberg were included with $n = 30$ in either group (2D, 3D, VR). Correctness score was 5.21 ± 1.60 with 2D, 7.02 ± 1.60 with 3D and 7.00 ± 1.60 with VR. The differences between 2D vs. 3D ($p < 0.001$) and 2D vs. VR ($p < 0.001$) were significant. The difference between 3D and VR was not significant ($p = 0.925$). Attended time per case was $09:13 \pm 03:10$ with 2D, $6:44 \pm 02:22$ with 3D and $6:24 \pm 02:43$ with VR. The differences between 2D vs. 3D ($p < 0.001$) and 2D vs. VR ($p < 0.001$) were significant. The difference between 3D and VR as not significant ($p = 0.419$). Participants were more satisfied with VR as compared to 3D and 2D, although 3D visualisation was more pleasant compared to VR and 2D.

Conclusion:

VR can be used to accurately and quickly identify relevant anatomy and anomalies in complex liver cases and decide on an operative strategy. Satisfaction and usefulness is high with VR. It may also help medical students to better understand the underlying anatomy of a surgical case and the reasoning behind the surgical decision-making processes. At the current development stage VR seems to be equal too 3D. Further development might increase VR value to surpass 3D visualisation.

Closed cannulation of subclavian vein versus open cut-down of cephalic vein for totally implantable venous access port implantation: A systematic review and meta-analysis of perioperative and postoperative complications

(Abstract ID: 585)

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Background:

The implantation of totally implantable venous access ports (TIVAP) is one of the most commonly performed operations in general surgery. The two main approaches for TIVAP placement are open cut-down of the cephalic vein (OCD) and closed cannulation of the subclavian vein (CC). Because of the low incidence of complications, no single trial has been able to report valid data of complication rates so far. However, due to the increasing number of TIVAP implantations worldwide and the presence of potentially severe procedure-related risks such as hemo- and pneumothorax, high-level evidence for procedure-related complications is mandatory. This systematic review and meta-analysis compares CC with OCD and summarizes evidence of complication rates.

Materials and methods:

Randomized controlled trials (RCTs), controlled clinical trials (CCTs) and case series (CS) reporting peri- and/or postoperative complications of at least one of both techniques were searched for in The Cochrane Library, MEDLINE and Embase. A priori defined data were extracted and methodological quality was assessed. For RCTs comparing OCD and CC, random effects meta-analyses were conducted with the odds ratio as effect measure. For RCTs, CCTs and CS separately, pooled estimates of complication rates with corresponding 95% confidence intervals were calculated on the base of the Freeman-Tukey double arcsine transformation within a random effects model framework. Heterogeneity was evaluated by the I² statistic. This systematic review is registered with PROSPERO (CRD42013005180). Funding was granted by the German Federal Ministry of Education and Research (grant number: 01KG1217).

Results:

Of 1,618 records screened for eligibility, 76 studies involving a total of 26,480 patients were finally included. The results of the performed meta-analyses comparing OCD and CC show no significant differences regarding hemo-/pneumothorax (OR 0.609 [0.116;3.196], p=0.557, I²=0%), early re-intervention (OR 0.419 [0.074;2.378], p=0.326, I²=0%), late re-intervention (OR 3.082 [0.697;13.621], p=0.138, I²=0%), TIVAP-related thrombosis (OR 0.807 [0.294;2.216], p=0.678, I²=16.3%), late malfunction (OR 0.500 [0.044;5.700], p=0.577, I² not applicable), pinch off phenomenon (OR 1.000 [0.019;52.362], p=1.000, I² not applicable), and dislocation/disconnection (OR 1.241 [0.084;18.283], p=0.875, I²=55.6%). Effect estimates show a tendency towards lower event rates in the OCD group. Pooled estimates of event rates for OCD and CC are comparably low for all endpoints analysed. Specific risks such as hemo-/pneumothorax and pinch off phenomenon are exclusively related to CC.

Conclusion:

This systematic review and meta-analysis is the most comprehensive to present critically appraised and quantitative data on perioperative and postoperative complications of TIVAP implantation performed by OCD compared to CC. These data strengthen existing evidence showing that both OCD and CC are safe procedures with low complication rates in general. However, OCD seems to be superior to CC in the prevention of clinically relevant complications such as hemo- and pneumothorax.

Robot guided Stereoelectroencephalography without Computed Tomography Scan for Referencing – Analysis of Accuracy

(Abstract ID: 709)

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Background:

Recent studies with classical frame-based stereotaxy but also robot-guided stereotaxy use computed tomography (CT) scans for referencing the system to the patients' head. The planning of the trajectories is performed on magnetic resonance imaging (MRI), which are fused with the CT dataset. We will present an accuracy study of implanted stereoelectroencephalography electrodes (sEEG) by a robot using only preoperative MRI datasets referenced with a laser scan of the patients face.

Materials and methods:

Data from patients who underwent robot-guided implantation of sEEG electrodes by the robotic surgery assistant (ROSA, MedTech, Montpellier, France) were analyzed. Before the implantation, a MRI scan was performed and transferred to the ROSA software. Trajectories were defined to achieve a representative recording of the potential epileptogenic zone, in due consideration of anatomical limitations. After surgery, the final position of the electrodes was identified on a postoperative CT scan, which was merged with the preoperative MRI scan for further analysis. The accuracy was determined by calculating the target point error (TPE) and the entry point error (EPE) applying the Euclidian distance.

Results:

Five patients (three male / two female, mean age of 31 years) with epilepsy who underwent robot-guided sEEG implantation were included. Preoperative MRI scans were taken within five days before surgery (mean 2.6 days). Out of 40 electrodes, 31 were placed in the temporal lobe. The mean TPE was 2.96 mm, the mean EPE 2.53 mm. Depending on the location, the TPE varied. The mean TPE in electrodes that were implanted temporal was 3.02 mm, the mean EPE was 2.39 mm. We also observed a difference in accuracy depending on the MRI field strength. One patient received a 1.5 Tesla MRI as her pacemaker would not tolerate 3 Tesla. The mean TPE (1.72 mm) was better than the average TPE we achieved in our patients. The mean time of recording was 8.8 days (minimum five days, maximum 11 days), afterwards the electrodes were explanted under sterile conditions in local anaesthesia. No complications related to the procedure were observed.

Conclusion:

Compared with recent studies using CT scans and the TPE ranging from 2.04 mm to 4.4mm, the overall TPE of 2.96 mm and the EPE of 2.53 mm we achieved using MRI-data for planning the trajectories are satisfying. Although a 1.5 Tesla might be more precise regarding surface registration, 3 Tesla imaging provides a better resolution and therefore a more precise display of anatomical structures. Which technique results in the safest and most precise sEEG implantation is yet to establish in further studies.

Open-Source Tools for Abdominal Organ and Vessel Segmentation for Surgery: How we do it

(Abstract ID: 813)

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Background:

Three-dimensional visualization of medical images is a key aspect in pre- and intraoperative virtual and augmented reality. This technology allows surgeons to easily visualize individual patient anatomy, tumor size and position, security margins and structures at risk. This can be used for three-dimensional operation planning, intraoperative navigation, oncological follow-up, surgical research and training. Segmentation describes the process of identifying anatomical or pathological structures and attaching labels to them. It is the essential skill that allows for the extraction of three-dimensional models out of clinical CT and MRT data. Several commercial and open-source software solutions exist for medical image segmentation. Commercial segmentation solutions for operation planning are also available. However, there is no comprehensive hands-on guide for abdominal organ surface and vessel segmentation using open-source tools to facilitate surgical research in this field. This article provides such a guide based on our experiences.

Materials and methods:

A medline and internet search was performed on articles for abdominal organ and vessel segmentation. Open-source programs for medical image segmentation were identified and evaluated for five key steps in the creation of three-dimensional anatomical models: (1) pre-processing, (2) segmentation of abdominal organ surfaces, (3) vessel segmentation, (4) image registration and (5) post processing.

Results:

We identified nine free open-source software solutions. Four for pre-processing, registration and organ and vessel segmentation, one exclusively for vessel segmentation and three for image post processing. One software solution was not evaluated due to operating system incompatibility. We divided the segmentation process into three sections: pre-processing (resampling, selection of image series and region of interest and image registration), segmentation (general considerations and segmentation of organs surfaces, vessels and lesions), post-processing (mesh corrections and clean-up, remeshing, mesh calculations and saving). We provided a step-by-step approach to create a three-dimensional representation of the abdominal organs for surgical research.

Conclusion:

Segmentation of abdominal organ surfaces and vessels with open-source software is possible and reliable. This article provides a hands-on and do-it-yourself guide to medical image segmentation and processing for surgical research and training.

Acknowledgement: The current study was conducted within the setting of the Collaborative Research Center 125: Cognition Guided Surgery funded by the German Research Foundation (DFG).

Hardware and Tools for Virtual and Augmented Reality in Surgery

(Abstract ID: 815)

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Background:

Virtual and augmented reality in surgery is used for preoperative planning, intraoperative visualization and in surgical training. Technological advances in this field are moving forward rapidly. Mobile, immersive and interactive hardware and tools are becoming broadly available. These new technologies need to be assessed for their use in surgery and for their clinical benefit. This article attempts to present trends and new tools useful for virtual and augmented reality in surgery and outline research performed in this field.

Materials and methods:

A medline, google scholar and internet search was performed on articles about virtual and augmented reality tools for surgery published between 2010 and 2015. We identified key technologies and summarized completed and anticipated surgical research activities with these technologies.

Results:

We identified optical head mounted displays, smart-glasses, holographic glasses, virtual reality head-mounted displays and tablet computers as trending tools for augmented and virtual reality in surgery. Most research activity could be registered for tablet computers, optical head-mounted displays and smart-glasses. The research activity was published as articles in international peer-reviewed journals, websites, technology reviews and internet videos.

Conclusion:

Technology for virtual and augmented reality in surgery is a fast-paced field with much research activity. However, there needs to be more sound studies and translational research to bring pilot experiments to surgical practice.