

pharmacokinetics, and resumed on POD3 after unremarkable postoperative imaging. Primary outcomes are the incidence of hemorrhagic and thromboembolic complications in the first 3 months after surgery.

**Results:** Outcomes of 153 patients were analyzed (45.8% in the AT-Group and 54.2% in the Control-Group). 41.8% of the patients had a craniotomy for tumour surgery (53.1% intra- and 46.9% extra-axial), 17.0% for transsphenoidal pituitary surgery, 9.8% for cranioplasty, 7.2% for vascular surgery, 5.9% for shunt surgery and 18.3% for various other surgeries. In the AT-Group, 48.6% of the patients were treated with ASA, 35.7% with non-vitamin K oral anticoagulants (NOAC), 4.3% with vitamin K antagonists, 5.7% with a combination of AT and 5.7% with various other AT. The haemorrhagic complication rate was 4.5% (95% CI [0.5-9.1]) in the AT-Group and 6.0% (95% CI [1.6-12.8]) in the Control-Group ( $p=0.9$ ). The rate of thromboembolic events in the AT-Group was 2.9% (95% CI [0.9-6.7]) in comparison to 6.0% (95% CI [0.9-11.1]) in the Control-Group ( $p=0.3$ ).

**Conclusions:** The presented perioperative management protocol of continuation or ultra-early resumption of AT in elective cranial procedures appears to be safe. Moreover, it seems to protect patients from thromboembolic complications.

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### BRAIN AND SPINE 3 (2023) 101794 101952

#### THE USE OF AUGMENTED REALITY AS AN EDUCATIONAL TOOL IN MINIMALLY INVASIVE TRANSFORAMINAL LUMBAR INTERBODY FUSION

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The Ethics of Waiting lists and Rationing access to care (Ethics Parallel Session), September 26, 2023, 4:50 PM - 6:20 PM

**Background:** One of the major challenges in training neurosurgical and orthopedic residents the technique for minimally invasive transforaminal lumbar interbody fusion is the lack of visualization of surgical landmarks (pedicle, pars, lamina). This is due to the limited access to the bony spine through a tubular retractor, in addition to a smaller working corridor or patient-specific factors such as bony overgrowth, disc space collapse, and listhesis). These factors increase the possibility for surgical error and prolonged surgery time. Augmented Reality (AR) is an emerging technology, which superimposes digital images onto the real-world environment. It is being used clinically for placement of pedicle screws with the surgeon wearing a headset, but its use for the remainder of the procedure including the facetectomy, decompression and discectomy part has not been reported. With AR, relevant surgical anatomy can be projected directly into the user's field of view through the microscope. The purpose of this study is to assess the utility, accuracy, efficiency, and precision of AR-guided MIS-TLIF and to determine its impact in spine surgery training.

**Methods:** At two centers, twelve neurosurgical residents performed a one-level MIS-TLIF on a high-fidelity lumbar spine simulation model with and without AR projection into the microscope. Screw placement which is being done routinely with navigation or AR was omitted and the study focused on the facetectomy, decompression, discectomy and cage placement. For the MIS-TLIF procedures with AR, surgical landmarks were highlighted in different colors on preoperative image data. These landmarks were visualized in the spinal navigation application on the navigation monitor and in the microscope in order to confirm the relevant anatomy. All procedures were recorded for evaluation and time measurements. Post-procedural surveys (NASA task load index) were given to the residents. Descriptive statistics, correlations, and ANOVA were performed to compare resident performance with and without AR and AR-specific factors on overall workload and by subscales.

**Results:** 12 neurosurgical residents were included in this prospective, multi-center, randomized-controlled trial. AR-guided procedures had a consistent impact on resident anatomical orientation and workload experience. Procedures performed without AR had a significantly higher mental demand ( $p=0.003$ ) than with AR. Residents reported to a significantly higher rate that it was harder work for them to accomplish their level of performance without AR ( $p=0.019$ ).

**Conclusions:** AR can bring a meaningful value in MIS teaching and training in order to confirm relevant anatomy in situations where the surgeon will have less direct visual access. AR employed in surgical simulation can also speed the learning curve.

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#### SURVEY ON TRAINING SATISFACTION AMONG GERMAN NEUROSURGICAL TRAINEES

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The Ethics of Waiting lists and Rationing access to care (Ethics Parallel Session), September 26, 2023, 4:50 PM - 6:20 PM

**Background:** There has been a fivefold increase of neurosurgeons over the last three decades in Germany, despite a lesser increase in operations. Currently, there are approximately 1000 neurosurgical residents employed at training hospitals. Little is known about the overall training experience and career opportunities for these trainees.

**Methods:** In our role as resident representatives, we implemented a mailing list for interested German neurosurgical trainees. Thereafter, we created a survey including 25 items to assess the trainees' satisfaction with their training and their perceived career prospects, which we then distributed through the mailing list. The survey was open from 1st April until 31st May 2021.

**Results:** 90 trainees were enrolled in the mailing list and we received 81 completed responses to our survey. Overall, 47% of trainees were very dissatisfied or dissatisfied with their training. 62% of trainees reported a lack of surgical training. 58% of trainees found it difficult to attend courses or classes and only 16% had consistent mentoring. There was an expressed desire for a more structured training programme and mentoring projects. In addition, 88% of trainees were willing to relocate for fellowships outside their current hospitals.

**Conclusions:** Half of the responders were dissatisfied with their neurosurgical training. There are various aspects that require improvement, such as the training curriculum, the lack of structured mentoring and the amount of administrative work. We propose the implementation of a modernized structured curriculum, which addresses the mentioned aspects, in order to improve neurosurgical training and, consecutively, patient care.

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### BRAIN AND SPINE 3 (2023) 101794 101954

#### FOETAL NEUROSURGERY AND NEURAL TUBE DEFECTS: A CRITICAL REVIEW OF THE ETHICAL CONSIDERATIONS

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The Ethics of Waiting lists and Rationing access to care (Ethics Parallel Session), September 26, 2023, 4:50 PM - 6:20 PM

**Background:** A congenital neurological anomaly connected to the growing central nervous system is myelomeningocele. The Management of Myelomeningocele (MOMS) study (2011) demonstrated that prenatal surgery improved motor results, albeit at the expense of maternal-foetal hazards, when compared to the postnatal surgical protocol. It is paramount to continue the conversation on the ethical implications of the MOMS trial notwithstanding its comprehensive bioethical requirements to ensure that participants could make an informed decision.

**Methods:** According to PRISMA criteria, a critical review was conducted on the ethical issues concerning prenatal neurosurgery for myelomeningocele. Additional research publications assessing the outcomes of the MOMS were included in the review. Between 2011 and 2023, the terms "myelomeningocele," "surgery," and "ethics" were utilised in the PubMed search. This yielded 9 results when combined with the previously specified inclusion criteria.

**Results:** All the examined literature (n=9) highlighted the significance of thorough patient counselling in discussions of the ethical consequences on the mother and foetus in prenatal surgery. While most clinicians (65%) agreed that denying mothers prenatal surgery would be unfair to the unborn child, a study indicated that the clinicians' individual values may affect their recommendations to mothers. This emphasises the necessity of offering all eligible surgical candidates an ethics-focused interview (included in the MOMS research protocol) to