

Digital visualization and analysis of patient referrals and transfers at a university hospital [Abstract]

Xenia Hautmann, Peter Baumgarten, Nadine Lilla, Christian Hinske, Dorothee Mielke

Angaben zur Veröffentlichung / Publication details:

Hautmann, Xenia, Peter Baumgarten, Nadine Lilla, Christian Hinske, and Dorothee Mielke. 2026. "Digital visualization and analysis of patient referrals and transfers at a university hospital [Abstract]." *Brain and Spine* 6 (Supplement 2): 107389. <https://doi.org/10.1016/j.bas.2026.107389>.

Nutzungsbedingungen / Terms of use:

CC BY-NC-ND 4.0



correlation with age of patients ($t = -2.73$; $p = 0.21$) (Table 2).

Conclusions: The success of early clinical outcomes following surgical treatment of intracranial meningiomas depends significantly on the extent of resection and the patient's condition upon admission. A more radical surgical intervention can considerably reduce the rate of reoperations, while the histopathological grade does not affect intrahospital mortality.

<https://doi.org/10.1016/j.bas.2026.107387>

545

Oral e-Poster Presentations 8 -Booth 4, October 3, 2026, 1:00 PM - 2:00 PM
Brain and Spine 6 (2026) 107388

Management of Antiplatelet and Anticoagulation Therapy in Patients Undergoing Elective Craniotomy: A Delphi-Based Swiss National Consensus

Tabea Stössel^{1,2}, Lukas Anderegg³, Fabian Baumann⁴, Menno Germans⁵, Raphael Guzman^{1,2}, Serge Marbacher^{3,6}, Mahmoud Messerer^{7,8}, Davide Milani⁹, Manuel Moser¹⁰, Gerrit Schubert^{3,11}, Carlo Serra^{5,12}, Christian Zweifel^{2,10}, Jehuda Soleman^{1,2}

¹ University Hospital Basel, Basel, Switzerland; ² University of Basel, Basel, Switzerland; ³ Cantonal Hospital Aarau, Aarau, Switzerland; ⁴ Cantonal Hospital Lucerne, Lucerne, Switzerland; ⁵ University Hospital Zurich, Zurich, Switzerland; ⁶ University of Bern, Bern, Switzerland; ⁷ Centre hospitalier universitaire Vaudois, Lausanne, Switzerland; ⁸ University of Lausanne, Lausanne, Switzerland; ⁹ Regional Hospital of Lugano, Ente Ospedaliero Cantonale (EOC), Lugano, Switzerland; ¹⁰ Cantonal Hospital Graubünden, Chur, Switzerland; ¹¹ RWTH Aachen University, Aachen, Germany; ¹² University of Zurich, Zurich, Switzerland

Data on the consequences of continuing or discontinuing antiplatelet (AP) or anticoagulant (AC) therapy in the perioperative period of elective cranial procedures remains limited. Therefore, discontinuation of antithrombotic therapy (AT) prior to elective craniotomies remains common practice. This nationwide Delphi consensus questionnaire assessed leading Swiss neurosurgeons' management of AP and AC therapy in elective cranial procedures, focusing on discontinuation and resumption time, as well as lesion-specific strategies.

Methods: We conducted a Delphi-based questionnaire among leading Swiss neurosurgeons to assess current perioperative management of AT therapy in elective craniotomies, followed by descriptive statistical analysis. Leading neurosurgeons were defined as those holding a position either as senior physician or as chief physician. A consensus was defined as $\geq 70\%$ agreement among respondents.

Results: In the first questionnaire round, out of the 45 invited neurosurgeons 16 responses (35.6%) were obtained, followed by 11 (24.4%) responses in the second round. Out of 12 centers approached, at least one response came from 9 centers (75.0%). Half of the respondents reported institutional guidelines for perioperative AP and AC management, while 87.5% emphasized the need for more evidence. Furthermore, nearly all respondents (93.8%, $n=15$) indicated that they do not perceive an increased risk of bleeding when AT is interrupted for fewer than 14 days compared with interruptions longer than 14 days. Consensus was reached for 87.5% of queried time points: low-dose aspirin 5-day preoperative interruption (81.2%), no consensus on postoperative resumption (45.5% day 3 vs. 54.5% day 10); direct oral anticoagulants 3-4-day preoperative interruption (86.7%), resumption on days 10-13 (72.7%); vitamin K antagonists 7-day preoperative interruption (72.7%), resumption on day 14 (81.2%); ADP-receptor-blockers 7-10-day interruption (80.0%), resumption on day 14 (72.7%).

Conclusions: Despite heterogeneous practices, consensus was achieved for most key aspects of perioperative AT management in elective craniotomy. These results may guide future guideline development and lay the groundwork for large-scale randomized controlled trials.

Optional Image

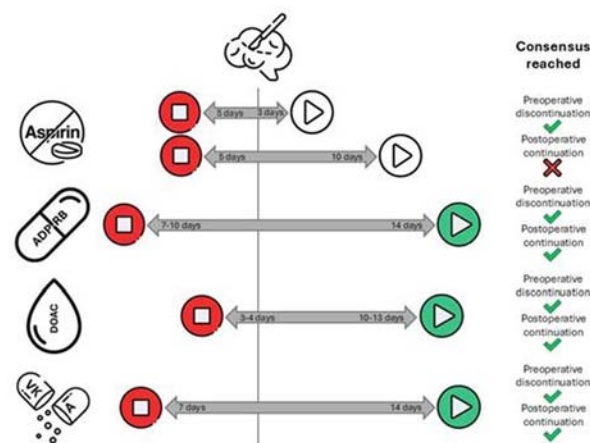


Figure 1: Overview of consensus results on perioperative management of antithrombotic therapy in elective craniotomy. Schematic representation of pre- and postoperative discontinuation and resumption times for antithrombotic agents, including ASA, ADP-RB, DOAC, and VKA. Arrows indicate recommended interruption and resumption intervals. Red symbols represent preoperative discontinuation, and green symbols postoperative continuation. Check marks indicate consensus reached among Swiss neurosurgeons during the Delphi process ($\geq 70\%$ agreement).

<https://doi.org/10.1016/j.bas.2026.107388>

708

Oral e-Poster Presentations 8 -Booth 4, October 3, 2026, 1:00 PM - 2:00 PM
Brain and Spine 6 (2026) 107389

Digital visualization and analysis of patient referrals and transfers at a University Hospital

Xenia Hautmann¹, Peter Baumgarten¹, Nadine Lilla¹, Christian Hinske¹, Dorothee Mielke¹

¹ University Hospital Augsburg, Germany

Transferring patients between hospitals is a common practice. To date, numerous studies have investigated the safety of interhospital transfers. To gain a deeper understanding of our referral structure, we developed a digital map that visualizes patient transfers to our hospital.

Methods: Patient data from our university hospital were extracted. Geographic coordinates were obtained through geocoding. An application visualizing patient referrals using a map and two diagrams was built using Python libraries. Displayed data can be filtered using drop-down menus. Factors potentially influencing referral behavior were analyzed using Chi-square test.

Results: A total of 11,869 neurosurgical cases treated at our clinic between January 2023 and December 2025 were analyzed. Of these, 4,159 were treated on an inpatient basis. Following the change in chief physician, referrals from outpatient clinics declined from 59 to 45 per month during the first six months, followed by an increase to 49 referrals per month in the subsequent six months. Inpatient transfers from other hospitals also decreased immediately after the change in chief physician, from 20 to 12 transfers per month. During the following six months, transfers increased to an average of 14 per month. Primary source of these transferred patients was a rehabilitation facility; these cases largely represent return transfers, potentially associated with complications. The number of such transfers declined from 4 to 2 per month during this period. The introduction of a hygiene guideline in July 2024 was identified as a contributing factor. Comparison of inpatient diagnoses before and after implementation of the guideline revealed a reduction in postoperative infections from 42 to 19 cases per year; however, this difference did not reach statistical significance ($p = 0.065$).

Conclusions: Our digital tool facilitates the direct identification of referral trends and therefore offers the potential to improve patient care, particularly in

specialized fields such as neurosurgery.

<https://doi.org/10.1016/j.bas.2026.107389>

782

Oral e-Poster Presentations 8 -Booth 4, October 3, 2026, 1:00 PM - 2:00 PM
Brain and Spine 6 (2026) 107390

Cranioplasty infection in porous hydroxyapatite: Potential antibacterial properties

Antonella Maria Giardina¹, Andrea Cardia¹, Francesco Marchi¹,
Davide Milani¹, Corrado Iaccarino¹, Ismail Zaed¹

¹ *Eoc Lugano, Switzerland*

Intensive research is dedicated to the development of novel biomaterials and medical devices to be used as grafts in reconstructive surgery, with the purpose of enhancing their therapeutic effectiveness, safety, and durability. A variety of biomaterials, from autologous bone to polymethylmetacrylate, polyether ether ketone, titanium, and calcium-based ceramics are used in cranioplasty. Porous hydroxyapatite (PHA) is reported as a possible material for bone reconstruction, with good signs of biocompatibility, osteoconductive and osteointegrative properties. In the present paper we studied the possible antibacterial properties of PHA in a laboratory test in order to provide a possible overview of the occurrence of post-operative infections in PHA cranioplasty.

Methods: The test method has been designed to evaluate the potential antimicrobial activity of specimens under dynamic contact conditions to overcome difficulties in ensuring contact of inoculum to the specimen surface. The test was conducted using *Staphylococcus aureus* ATCC6538 as a bacterial strain.

Results: Two experimental sets were performed to evaluate the antimicrobial properties of the specimens against two different *Staphylococcus aureus* concentrations. The first preliminary test (a) verified the antibacterial property at 0, 1, 2, and 4 h of contact time; the second confirmatory test (b) was repeated to verify the antibacterial property at 0, 4, 8 h. In the first experiment, after the first hour of contact, the bacterial inoculum was reduced by 7.96% compared to "inoculum only," which increased to 26.11% at the second hour, and up to 52.33% after 4 h. In the second experiment, the confirmation test showed that bacterial growth reaches maximum inhibition after 4 h of contact. At 4 h, there was a higher bacterial reduction of 72.93%, which decreased at 8 h (36.45%).

Conclusions: Analyzing the growth trend of viable microorganisms under Dynamic Contact Conditions it can be seen that PHA cranioplasty appears to inhibit exponential growth by inducing bacterial stasis in the early hours of contact, reaching a maximum reduction within 4 h, in this adopted experimental condition.

<https://doi.org/10.1016/j.bas.2026.107390>

786

Oral e-Poster Presentations 8 -Booth 4, October 3, 2026, 1:00 PM - 2:00 PM
Brain and Spine 6 (2026) 107391

A Detailed Study of Infection Following Custom-Made Porous Hydroxyapatite Cranioplasty: Risk Factors and How to Possibly Avoid Device Explantation

Andrea Cardia¹, Antonella Maria Giardina¹, Francesca Faedo¹,
Franco Servadei¹, Salvatore Chibbaro¹, Ismail Zaed¹

¹ *Eoc Lugano, Switzerland*

Postoperative infection is a significant complication following cranioplasty procedures. This study aimed to assess infection risk factors and clinical outcomes in patients undergoing cranioplasty with custom-made porous hydroxyapatite (PHA) implants, with a particular focus on treatment strategies used to manage infections and avoid implant explantation.

Methods: This retrospective multicenter analysis included 984 patients who underwent PHA cranioplasty as part of a post-market clinical follow-up. Clinical data included demographics, surgical characteristics, infection features, microbiological results, infection management strategies, and outcomes. Associations with infection risk and implant explantation were assessed using chi-square tests.

Results: Seventy-six patients (7.7%) developed postoperative infections. Infection risk was significantly associated with second-line procedures ($p = 0.011$) and implant location ($p = 0.037$). Most infections were superficial (92.1%) and

early-onset (≤ 2 months from the surgery, 61.9%), with *Staphylococcus* spp. as the predominant pathogens. Explantation occurred in 77.6% of infected cases. The infection management strategy- whether initial conservative treatment with antibiotics alone ($n = 18$ of which 11.1% explanted) or surgical reoperation ($n = 58$ of which 93.8% explanted)-along with surgical cleaning and local (in situ) antibiotic use alone, was significantly associated with explantation outcomes (all $p < 0.001$). Among 18 patients treated with systemic antibiotics alone, 88.9% retained their implants. Notably, all successful cases had received broad-spectrum antibiotics for at least 4 weeks. Local antibiotic therapy was administered in 13 patients; no explants occurred among those who also received prolonged systemic treatment. Pathogen type was not significantly associated with the risk of explantation.

Conclusions: Prolonged systemic antibiotic therapy, especially when combined with local treatment, may allow implant retention in selected infections, supporting individualized, conservative management strategies.

<https://doi.org/10.1016/j.bas.2026.107391>

823

Oral e-Poster Presentations 8 -Booth 4, October 3, 2026, 1:00 PM - 2:00 PM
Brain and Spine 6 (2026) 107392

Toward Digital Functional Endpoints In Vestibular Schwannoma: A Systematic Framework Review Of Wearable Balance Metrics

Shayndhan Sivanathan¹, Christian Than², Chrystalina Antoniadis³,
Aiden Doherty⁴, Sanjeeva Jeyaretna⁵

¹ *Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford, Oxford, United Kingdom;* ² *Cambridge University Hospitals, Cambridge, United Kingdom;* ³ *Nuffield Department of Clinical Neurosciences, Oxford University, Oxford, United Kingdom;* ⁴ *Nuffield Department of Population Health, Oxford University, Oxford, United Kingdom;* ⁵ *Nuffield Department of Surgical Sciences, University of Oxford, Oxford, United Kingdom*

Balance dysfunction is a major determinant of reduced quality of life in vestibular schwannoma (VS) yet remains inadequately characterised by conventional clinical assessment. Standard reliance on patient-reported measures and brief clinic tests fails to capture dynamic mobility, compensatory behaviour, or real-world function. Wearable digital health technologies enable objective continuous measurement of movement; however, their clinical relevance in VS remains unclear. This systematic review evaluates wearable-derived balance endpoints for perioperative monitoring and rehabilitation applications.

Methods: A PRISMA-guided systematic search of major electronic databases was performed (PROSPERO:CRD420251181322). Studies assessing wearable-based balance or mobility in unilateral sporadic VS were included. Outcomes were thematically synthesised into a taxonomy of straight-path gait, turning and dynamic mobility, standing balance, and head-trunk coordination. Risk of bias and certainty of evidence were assessed using ROBINS-I and GRADE.

Results: A total of 634 articles were screened, with 16 studies meeting final inclusion (333 VS patients). This comprised 10 cross-sectional and 6 prospective cohort studies. Wearable technologies included inertial measurement units (IMUs) across several body locations or pressure-based insoles. Straight-path gait measurements showed limited discriminatory value between VS patients and controls. In contrast, variability-based metrics, turning performance, and head-trunk coordination emerged as higher-yield functional signals revealing significant impairment and behavioural adaptation, particularly during low-light conditions and simulated real-world tasks. Turning metrics were sensitive to change and demonstrated responsiveness to vestibular rehabilitation. Evidence quality ranged from moderate to serious risk due to heterogeneity and confounding, with limited free-living data or linkage to meaningful clinical outcomes.

Conclusions: Wearable sensing enables nuanced characterisation of balance impairment in VS and identifies turning and variability-based metrics as promising digital endpoints. These findings challenge reliance on traditional clinic-based assessments and support integration of objective functional monitoring into neurosurgical perioperative pathways and personalised rehabilitation. To identify at-risk subgroups, future work should prioritise standardisation, validation against meaningful clinical outcomes, and longitudinal real-world assessment.

<https://doi.org/10.1016/j.bas.2026.107392>