

- Initial BP (the first initial BP recorded in trauma centre)
- Initial Hb (the first initial Hb recorded in trauma centre)
- Other injuries (if any)
- Intubated pre-admission (yes/no)
- Comorbidity (where this is known, we can include this)
- Seizures
- Anti-coagulation
- Hypotension (same categories will be used)
- Hypoxia (same categories will be used)
- CSF leak
- Use of antibiotics
- CT scan findings (as per radiology report)
- Time of injury to surgery
- Postoperative drain
- Craniotomy vs craniectomy
- GOSE (in-hospital and 30 day)
- Time from injury to ICU admission
- Time from injury to first CTB
- Mannitol (yes/no)
- Hypertonic saline (yes/no)
- Duration of neuromonitoring
- Duration of ICU
- Other Surgeries
- ICP management parameters
- Decompressive craniectomy (yes/no and when)

Blood biomarkers to be collected at 24 hours, 48 hours and 72 hours after the admission: Glial fibrillary acidic protein (GFAP), Ubiquitin C-terminal hydrolase-L1 (UCH-L1), Neurofilament light (NF-L), Interleukin 10 (IL-10), Tau, β -amyloid isoforms 1-40 (A β 40) and 1-42 (A β 42) and S100 calcium-binding protein B (S100B).

Collected biomarkers from South Africa will be analyzed using the Human Neurology 4-Plex A assay (N4PA) on an HD-1 Single molecule array (Simoa) instrument according to instructions from the manufacturer (Quanterix, Lexington, MA) in Finland and Sweden.

Study co-ordinators: Iftakher Hossain and Peter Hutchinson, Cambridge, UK.

Principal investigator: Anthony Figaji, Cape Town, South Africa

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THE CLASSIFICATION OF PUBMED NEUROSURGICAL ABSTRACTS USING PRETRAINED BERT MODEL

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Background: Automated text classification is a natural language processing (NLP) technology that may significantly facilitate scientific literature selection, e.g. in screening for systematic reviews. In the last years, pretrained large neural language models provided impressive gains in many NLP applications. This study aimed to assess the neurosurgical abstract classification quality using the Bidirectional Encoder Representations from Transformers (BERT) model as the state-of-the-art approach in NLP.

Methods: The dataset for experiments was initially obtained from PubMed while performing a systematic review of artificial intelligence applications in neurosurgery. The abstracts were manually divided into two classes. An article was assigned to the “relevant” class (to be included in the review) in accordance with the following criteria:

- original research peer-reviewed article;
- abstract in English was available;
- the pathology/treatments discussed in the article were directly related to neurosurgery;
- the paper reported the results of AI assessment in diagnosis, treatment, prognosis, rehabilitation, or prevention.

The “irrelevant” class contained all other publications, which did not meet these requirements. To automate by-class division we used a PubMedBERT model pretrained from scratch on 14 million PubMed abstracts.

Results: A dataset of 630 article abstracts was classified in 323 as relevant and 307 as irrelevant. We proposed 27 parametrized options of PubMedBERT model and 4 ensemble models to solve a binary classification task on that dataset. Three hundred tests with resamples were performed in each classification approach. The best PubMedBERT model demonstrated F1-score = 0.857 outperforming the best ensemble model reaching F1-score = 0.853.

Conclusion: The classification of scientific publications by their abstracts might be to a certain extent technically solvable and provide a basis for literature tracking in user-defined tasks. The classification quality might be improved using the latest state-of-art approaches. The research was supported by the Russian Foundation for Basic Research grant 19-29-01174.

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DIVERSITY IN NEUROSURGERY

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Background: Over the past century, the field of neurosurgery has evolved and expanded in many directions. Neurosurgeons have continuously pushed the boundaries of the specialty with scientific discovery and innovation. A diverse array of neurosurgical techniques, treatments, and new areas of study have emerged within the field. Meanwhile, the neurosurgical workforce has remained demographically homogeneous. Certain groups remain underrepresented based on social identities and categorizations including gender, race, and ability status. **Methods:** Contemporary events of 2020 inspired us to initiate a discussion that highlights some of the underrepresented groups in neurosurgery and chronicles the important contributions and achievements that individuals from these groups have made in the field, often despite structural barriers and discrimination. Diversity in Neurosurgery was addressed in a peer-reviewed publication, book chapter (in press), and a series of departmental conferences, grand rounds, and visiting professor lectures. We present and discuss evidence from the basic sciences, economics, business, and other disciplines that illustrate the concept that diversification of neurosurgery is not only a just pursuit, but also the most rational path to ensure positive growth and advancement of the field.

Results: Diversity enriches neurological surgery and augments our capacity to serve the heterogeneous population of patients in our society. Our discussions at neurosurgical departments across the United States and the world have demonstrated an international interest in addressing the challenges of increasing diversity in the field and in identifying concrete and implementable solutions to the issue.

Conclusions: In order to sustain excellence and drive innovation, there needs to be a continuous discussion that forms a strategic vision of action and an ongoing deliberate, organized, and systematic initiative to change the status quo and make the field more inclusive and diverse.

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NEED FOR ENSURING CARE FOR NEURO-EMERGENCIES – LESSONS LEARNED FROM THE COVID-19 PANDEMIC

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Background: To investigate whether patients with critical emergency conditions are seeking or receiving the medical care that they require we characterized the reality of care for patients presenting with Neuro-emergencies during the first phase of the COVID-19 pandemic.

Methods: In this observational, longitudinal cohort study, all neurosurgical admissions that presented to our Department between February 1st and April 15th during the COVID-19 pandemic and during the same time-period in 2019 were identified and categorized according to the presence of a Neuro-emergency, the route of admission, management, and the category of disease. Further, the clinical course of patients with chronic subdural hematoma (cSDH) was investigated as a Neuro-emergency representative for a wide variety of semi-urgent symptoms.

Results: During the pandemic, the percentage of Neuro-emergencies among all neurosurgical admissions remained similar as in 2019 but a larger proportion presented through the emergency department than through the outpatient clinic or by referral (*p=0.009). The total number of Neuro-emergencies was significantly reduced (*p=0.0007) across all types of disease, particularly in severe vascular (*p=0.036) but also in spinal (*p=0.007) and hydrocephalus

(*p=0.048) emergencies. Strikingly, elderly patients with cSDH and mild to moderate symptoms presented less frequently, with more severe symptoms (*p=0.046) and were less likely to reach favorable outcome (*p=0.003).

Conclusions: Despite pandemic-related restrictive measures and reallocation of resources, patients with Neuro-emergencies should be encouraged to present regardless of the severity of symptoms because deferred presentation may result in adverse outcome. Thus, conservation of critical healthcare resources remains essential in spite fighting COVID-19.

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HOW MUCH MONITORING IS REQUIRED AFTER ELECTIVE CRANIOTOMY?

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In most neurosurgical departments patients undergoing an elective craniotomy are postoperatively admitted to ICU or IMC for monitoring until the next morning. In this study we aim to evaluate the occurrence of neurological or cardiopulmonary events in the early postoperative phase to re-define the monitoring algorithm.

Data acquisition was conducted as a single-center retrospective analysis. Patients undergoing elective craniotomy were included in this study.

206 consecutive patients were included in our study. Mean patient age was 60.7 years (18 to 61) and 114 (55.3%) patients were female. 63 (30.6%) patients underwent microsurgical extra-axial tumor resection, 131 (64.6%) intra-axial tumor resection, 16 (7.7%) neurovascular surgery, 48 (23.8%) procedures were infratentorial. The mean ASA-score was 2.5 (0.56 SD). The vast majority (139, 67.5%) of patients was admitted to the ICU and 67 (32.5%) to the IMC unit. During the first 24 hours, 32 postoperative incidents occurred, including i) ongoing catecholamine therapy after surgery (n=2), ii) prolonged awakening (n=7), iii) postoperative seizures (n=3), iv) new temporary or permanent focal neurological deficits requiring imaging (n=17), v) postoperative delirium (n=4), vi) postoperative hemorrhage (n=5), vii) malignant brain swelling (n=2). However, 32 patients experienced a postoperative incident detected by close monitoring and requiring ICU monitoring/treatment and 7 patients experienced an incident requiring repeat surgery at a mean duration of 6.4 hours after surgery. 2 of these cases were very complex surgeries where ICU treatment would have been out of any question.

These data demand an improved assessment to identify patients at risk for postoperative deterioration and ICU monitoring. For the majority of cases a dense monitoring exceeding 6 hours seems not necessary. Considering comorbidity and surgery-associated complications to identify patients at risk, a more precise algorithm with an earlier transfer to the normal ward apart from the undisputed gold standard of ICU monitoring should be established.

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PERFORATING ARTERIES OF THE LEMNISCAL TRIGONE: A MICROSURGICAL NEUROANATOMIC DESCRIPTION

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Background: The perforating arteries in the dorsolateral zone of the midbrain play a crucial role in the functions of the brain stem. Their damage due to herniation, pathological lesions, or surgery, favored by the narrow tentorial incisura, can lead to hemorrhages or ischemia, and subsequently to severe consequences for the patient. Not much attention has been directed to the perforating arteries in the lemniscus in the literature. The present study aims at a detailed analysis of the microanatomy and the clinical implications of these vessels. We focused on the small vessels that penetrate the midbrain's dorsolateral surface, known as lemniscal trigone, to understand better their microanatomy and their functional importance in the clinical practice during the microsurgical approach to this area.

Methods: 44 alcohol-fixed postmortem human heads (87 hemispheres) without any pathological lesions provided the material for studying the perforating vessels and their origins around the dorsolateral midbrain using an operating microscope (OPMI 1 FC, Zeiss). Measurements of cali-bers and distances were taken using a digital caliper.

Results: An origin from the SCA could be found as 70.11% (in 61 specimens) and from the PCA as 27.58% (in 24 specimens) of the hemispheres. The origin from the posterior choroidal artery was found in 4.54% (in 1 specimen). No perforating branches were discovered in 8.04% (in 7 specimens).

Conclusions: Comprehensive understanding of the lemniscal trigone's perforating arteries is vital to avoid the brainstem infarction during removal of the midbrain tumors and vascular malformations.

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FEASIBILITY AND SAFETY OF TITANIUM-ENHANCED BIOCOMPATIBLE CALCIUM-PHOSPHATE IMPLANTS FOR CRANIOPLASTY

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Decompressive craniectomy (DC) is an effective procedure to treat elevated intracranial pressure conditions. Numerous materials and surgical techniques have been investigated to meet certain demanded key features, such as stability, surgical applicability, and biocompatibility. We aimed to evaluate the feasibility and safety of a recently introduced patient-specific titanium-enhanced biocompatible calcium-phosphate implant.

The medical records of 32 consecutive patients who underwent DC between January 1st 2020 and January 31st 2021 were reviewed. Demographic, clinical, and diagnostic data before and after the cranioplasty were collected. Descriptive statistical analysis was performed.

DC was performed in 32 consecutive patients, of whom two died while 16 of the remaining 30 later received a patient-specific calcium-phosphate implant for cranioplasty (CP). Of those receiving CP, 10 (62.5%) were female, 6 male (37.5%). The mean patient age was 54.8±16.4 years. Mean follow-up time from DC was 106.1±30.04 days. DC was performed due to SAH (43.75%), malignant middle cerebral artery (MCA) infarction (25%), traumatic brain injury (12.5%), or intracerebral hemorrhage (ICH) (18.75%). The mean time from DC to CP was 106.4±73.9 days. The median mRS at the time of CP was 5 (IQR 3-5). Overall, 4 procedure-related complications occurred; 2 epidural hematoma not necessitating revision surgery; and 2 patients suffered from seizures. No surgical site infection, meningitis or implant related complications (IRC) occurred in our cohort. Postoperative critical care was necessary for three patients (21.5%) if CP was performed as an elective procedure (mean ICU stay 1±0 days).

In the present study, a patient-specific titanium-enhanced biocompatible calcium-phosphate implant was used for CP in 16 consecutive patients. The absence of SSI and IRCs proves the feasibility and safety of the used implants. Thus, these implants offer an alternative to titanium or PMMA cranioplasty and may reduce the risk of surgical site complications.

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COVID NEUROSURGICAL PAN-IMPACT

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Humanity has long been plagued by several pandemics and historically surgeons have played a significant role in both investigation and response. Notable examples can be derived from Guy de Chauliac and John Hunter neurosurgical and epidemiological contributions for the ailments of the time. The covid 19 era we now all experience has challenged every aspect of human activity. As neurosurgeons, we therefore conducted a scoping review of covid and neurosurgery in MEDLINE, SCOPUS and COCHRANE LIBRARY. 3177 references were obtained and further refined according to criteria of english language, available abstract and human subjects. After exclusion of non relevant citations, the full reference was obtained for 372 articles and analyzed by 2 reviewers. The data comprised the plethora of medical writings from case reports, guidelines, surveys, observational studies, retrospective review (constituting the main body of evidence, 30%), randomized controlled trials, meta analysis. As would suit a pandemic, references stem from all continents, albeit with different scopes and concerns. A