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Neurosurgical Emergencies in a University Hospital in a Sub-Saharan African Country

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Abstract

Background: In sub-Saharan Africa, neurosurgical emergencies are a major public health concern due to their frequency, severity, and the lack of specialized resources. Traumatic causes represent up to 90% of cases, largely driven by road traffic accidents linked to motorcycle use and insufficient protective measures. Management guidelines mainly originate from high-income countries and are difficult to apply in low- and middle-income contexts. This study aimed to describe the epidemiological, clinical, and therapeutic profile of neurosurgical emergencies and to identify mortality-associated factors at the Emergency Department of Gabriel Touré University Hospital in Bamako, Mali. **Methods:** A prospective observational study was conducted from January 1 to December 31, 2021, at the Emergency Department of Gabriel Touré University Hospital, Mali's main tertiary referral center. All patients with CT-confirmed traumatic or non-traumatic neurosurgical lesions were included. Data were collected using a standardized form and analyzed with SPSS® 26. Associations were evaluated using Pearson's chi-square test with significance set at $p < 0.05$. **Results:** Among 19,215 admissions, 894 patients (4.6%) presented with neurosurgical emergencies. The mean age was 20 years, with a male-to-female ratio of 5.3. Traumatic etiologies accounted for 90.8% of cases, mainly road traffic accidents (64.4%), followed by falls (13.8%) and assaults (10.4%). Non-traumatic lesions, mostly vascular, represented 12%. The mean admission delay was 4 hours, with nearly half of patients transported by non-medical means. A GCS ≤ 8 was recorded in 13% of patients, 28.6% of whom presented with respiratory distress. CT most commonly showed subarachnoid

hemorrhage (28%), cerebral contusion (27.7%), and acute subdural hematoma (16%). Emergency neurosurgical intervention was required in 121 patients (13.5%), with 54.5% operated within 24 hours, though the average waiting time remained 12 hours. Overall mortality reached 21%. Mortality was significantly associated with vascular etiology ($p = 0.001$), initial loss of consciousness ($p < 0.0001$), neurological deficit ($p < 0.0001$), endotracheal intubation ($p < 0.0001$), and GCS ≤ 8 ($p < 0.0001$). **Conclusion:** Neurosurgical emergencies in Mali are largely due to traumatic brain injuries from road traffic accidents, predominantly affecting young men. Mortality remains high because of the lack of prehospital care, delayed admissions, and prolonged surgical wait times. Improving outcomes requires strengthening the neurotrauma care pathway, including medicalized prehospital transport, continuous imaging availability, and enhanced emergency surgical capacity.

Keywords

Neurosurgical Emergencies, Traumatic Brain Injury, Road Traffic Accidents, Sub-Saharan Africa, Mortality, Public Health

1. Introduction

Neurosurgical emergencies include all conditions affecting the central and peripheral nervous systems that require urgent intervention by a neurosurgeon. They may be traumatic or non-traumatic, with the former being largely predominant. In sub-Saharan Africa, these conditions represent a major public health issue due to their high frequency, severity, and the shortage of technical and human resources adapted to their management [1].

Studies from several African countries have shown that cranial and spinal traumas account for up to 90% of neurosurgical emergencies. Road traffic accidents are the leading cause, driven by widespread motorcycle use, poor road conditions, and non-compliance with traffic laws [2]-[4]. These accidents result in high morbidity and mortality, prolonged hospital stays, significant physical and psychological sequelae, and a heavy socioeconomic burden for patients and their families [5]-[7].

In low- and middle-income countries (LMICs), which host 82% of the world's population, the burden of trauma is disproportionately high. Furthermore, best-practice guidelines are often derived from high-income countries, making them difficult to apply in resource-limited settings [4].

Non-traumatic neurosurgical emergencies, though less frequent, remain significant. They include cerebral hemorrhage, intracranial tumors, abscesses, hydrocephalus, and spinal cord compression [3].

At the Emergency Department (ED) of Gabriel Touré University Hospital, their management faces several challenges—inadequate infrastructure, delayed access to urgent neurosurgical care, and limited specialist availability—often leading to delayed treatment and poor outcomes.

2. Objective

To describe the clinical characteristics and mortality-associated factors among patients admitted for neurosurgical emergencies at the ED of Gabriel Touré University Hospital in Bamako, Mali.

3. Patients and Methods

3.1. Study Design and Setting

This was a prospective, descriptive, and analytical study conducted from January 1 to December 31, 2021, at the ED of Gabriel Touré University Hospital (CHU), located in Bamako, the capital of Mali, with about two million inhabitants. Mali, a vast sub-Saharan African country (1.24 million km^2), remains one of the poorest nations according to the United Nations Development Programme (UNDP).

The Malian health system is pyramidally structured: community health centers (CSCom) form the base, followed by district-level referral centers (CSRef), regional hospitals, and four university hospitals, all based in Bamako. The CHU Gabriel Touré serves as a national tertiary referral hospital for medical and surgical emergencies. In the absence of a structured prehospital system, it receives nearly all life-threatening emergencies from Bamako and the surrounding regions.

The hospital has 498 beds, including 8 in intensive care. Its ED can accommodate up to 25 patients simultaneously, averaging 60 visits per day, and operates 24/7. Staffing includes one attending general practitioner, four senior medical students, and two nursing teams of five nurses each. The ED primarily handles adult medical-surgical emergencies, excluding pediatric and obstetric cases. Trauma cases represent roughly 70% of all admissions, mainly due to road traffic accidents.

3.2. Inclusion Criteria

All patients of any age with suspected cerebral or spinal injury confirmed by computed tomography (CT), whether traumatic or non-traumatic.

3.3. Exclusion Criteria

- Neurosurgical cases managed outside the CHU Gabriel Touré;
- Non-neurological surgical emergencies;
- Patients deceased before arrival or before undergoing CT imaging.

3.4. Data Collection and Analysis

Data were collected using a standardized anonymous form based on medical records, after approval from hospital authorities. Variables included demographic data, clinical presentation, CT findings, treatment, and outcome. Data were analyzed with SPSS® version 26.0. Qualitative variables were expressed as frequencies and percentages, and quantitative variables as mean ± standard deviation. Associations between variables were tested using Pearson's Chi-square test, with significance at $p < 0.05$.

3.5. Ethical Considerations

The study adhered to the principles of the Declaration of Helsinki. Confidentiality was maintained, informed consent obtained, and ethical approval granted by the CHU Gabriel Touré Ethics Committee.

4. Results

During the study period, 19,215 patients were admitted to the Emergency Department (ED), among whom 894 presented with a neurosurgical emergency, representing 4.6% of all consultations.

Among these patients, 39 (4.36%) were under three years of age. The mean age was 20 years (range: 16 - 25 years), with a male-to-female ratio of 5.3:1.

Road traffic accidents were the leading cause of trauma (64.4%), followed by falls from height (13.8%), assaults (10.4%), and landslides (8%). A total of 33.8% of patients were admitted as secondary transfers. Non-traumatic mechanisms accounted for 12% of cases.

The most frequently used means of transport for admission were private vehicles with Personal vehicle 48.5%, Taxi 30.6%, Emergency medical ambulance 15.7%. The average time to admission was 4 hours for 344 patients (38.5%) residing within a 100 km radius.

Traumatic lesions accounted for 90.8% of cases, vascular lesions for 8%, and tumoral, infectious, or degenerative lesions for 1.2%.

The Glasgow Coma Scale (GCS) score on admission was ≤8 in 13% of cases and between 9 and 12 in 39.8%. Altered consciousness was associated with respiratory distress in 28.6% of cases.

The observed focal neurological signs included: miosis (n = 76), anisocoria (n = 51), mydriasis (n = 29), pyramidal syndrome (n = 45), aphasia (n = 23), spinal cord compression syndrome (n = 22), intracranial hypertension syndrome (n = 14), sublesional syndrome (n = 11), lesional syndrome (n = 9), decerebrate rigidity (n = 8), spinal shock (n = 7), sphincter disorders (n = 7), and dysarthria (n = 6).

Associated general signs were: arterial hypertension (n = 97), fever (n = 57), hypotension (n = 54), and bradycardia (n = 34).

Extracranial lesions included: scalp wounds (n = 245), eyelid edema (n = 139), soft tissue wounds/bruises (n = 206), limb fractures (n = 68), otorrhagia (n = 66), epistaxis (n = 66), depressed skull fractures (n = 38), facial trauma (n = 33), thoraco-pulmonary injuries (n = 30), frontal edema (n = 31), and otoliquorrhea (n = 6).

Brain CT scans revealed the following main lesions: subarachnoid hemorrhage (n = 252), contusional hemorrhagic edema (n = 248), pneumocephalus (n = 152), acute subdural hematoma (n = 144), extradural hematoma (n = 77), and hemorrhagic stroke (n = 60). Spinal injuries were identified in 132 patients. The main diagnoses were: traumatic brain injury (n = 561), multiple trauma (n = 112), spinal cord injury (n = 107), hemorrhagic stroke (n = 66), and degenerative disc disease (n = 14) (see **Figure 1**).

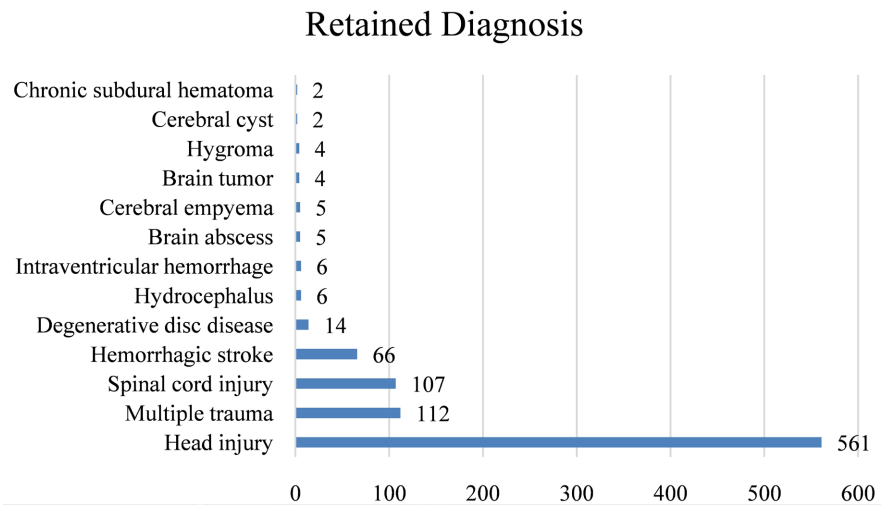

Figure 1. Retained diagnosis.

During hospitalization, 53 patients (5.9%) developed malaria with a positive thick blood smear.

A total of 121 patients underwent emergency neurosurgical intervention, 54.5% of them within the first 24 hours after admission. However, a minimum average delay of 12 hours was observed between admission and surgery, regardless of the degree of urgency. Emergency surgical procedures performed are shown in **Figure 2**.

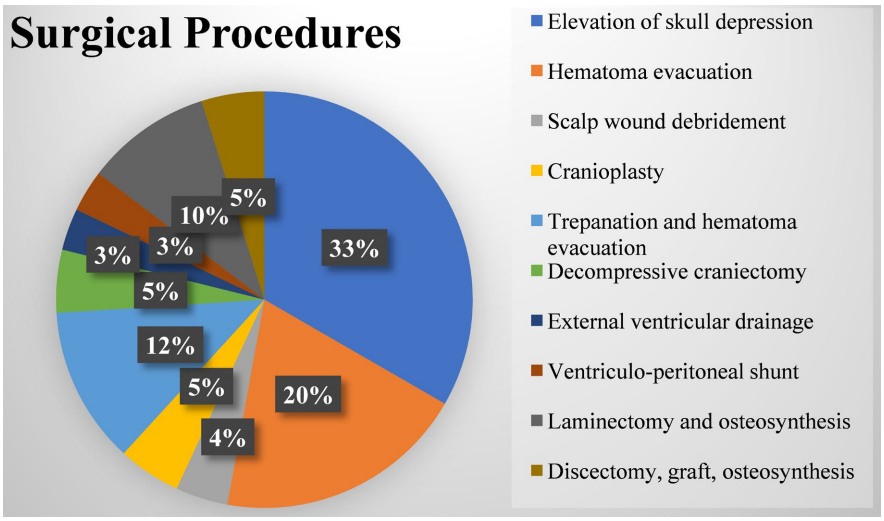

Figure 2. Surgical procedures.

Medical management included neuro-sedation with midazolam and fentanyl (13.7%, n = 123), mechanical ventilation (14.5%, n = 130), antibiotic therapy (37.4%, n = 335), red blood cell transfusion (2.9%, n = 12), osmotherapy (2%, n = 17), anticonvulsant therapy (6%, n = 54), and antihypertensive treatment (9%, n = 80).

The average length of stay in the ED was 24 hours, ranging from 6 hours to 93 days.

After the acute phase, 48% of patients were transferred to inpatient wards, 23% were discharged home directly from the ED, and 7.2% (n = 65) left against medical advice.

The overall case fatality rate among this cohort of neurotrauma patients was 21%. The associated risk factors are summarized in Table 1.

Table 1. Risk factors associated with mortality among patients with neurosurgical emergencies (n = 894).

Risk Factors	Deaths (n)	Survivors (n)	Total (n)	χ^2 (df)	p-value
Vascular etiology	38	32	70	$\chi^2 = 58.323$ (df = 5)	p = 0.001
Initial loss of consciousness	169	507	676	$\chi^2 = 24.764$ (df = 1)	p < 0.0001
Neurological deficit	45	114	159	$\chi^2 = 24.687$ (df = 6)	p < 0.0001
Orotracheal intubation on admission	97	33	130	$\chi^2 = 260.918$ (df = 1)	p < 0.0001
Glasgow Coma Scale ≤ 8	63	49	112	$\chi^2 = 160.30$ (df = 3)	p < 0.0001

Legend: χ^2—Chi-square test; df—degrees of freedom; p-value—significance threshold fixed at 0.05.

5. Discussion

This study highlights the high frequency of neurosurgical emergencies at the CHU Gabriel Touré, representing 4.6% of all ED visits, with trauma accounting for 90.8% of cases—findings consistent with previous studies from sub-Saharan Africa [1] [6] [8] [9].

Road traffic accidents remain the leading cause of neurosurgical injuries, a direct consequence of poor road conditions, non-compliance with traffic regulations, and a new phenomenon related to the widespread use of motorcycles without protective gear as a means of public transport ("Moto-Taxi"). These factors are consistently reported in low- and middle-income countries (LMICs), where the risk of severe traumatic brain injury is three times higher than in high-income countries [4] [10]-[13].

5.1. Admission Delay and Access to Care

The mean admission delay of 4 hours observed in our series remains a major concern. Prehospital delays and the lack of coordination in medical transport are key determinants of poor outcomes [9] [13]. In addition, an initial unavoidable delay of 12 hours was noted in our study between admission and surgery. In the Global Neurotrauma Outcomes Study [9], the median time to surgery often exceeded 6 hours in countries with a low Human Development Index (HDI), contributing to high in-hospital mortality. This delay appears to be an unresolved constraint for many teams; it averaged 20 hours in the study by Mignon du Toit *et al.* in South Africa [2] and a median of 10 hours in a Malaysian study [14]. Studies by Clark *et al.* [9] and Beucler *et al.* [15] have shown that a surgical delay of more than 4 hours significantly increases mortality among patients with severe traumatic brain injury. These authors also emphasize the importance of training general surgeons in emergency decompression procedures when a neurosurgeon is not immedi-

ately available, a strategy that has already been successfully implemented in the Philippines and several African countries. We should also note the systematic performance of a brain scan within one hour of admission and the lack of availability of an operating room exclusively reserved for neurosurgical emergencies are two key recommendations that are particularly difficult to implement in your context and explain the reasons related to available resources.

5.2. Prognostic Factors and Mortality

The overall case fatality rate of 21% observed in our cohort was higher than that reported in the Ethiopian study (10.3%) [16] [17] but lower than that found by Bahloul in Tunisia (29%) [18]. The factors significantly associated with death in our study—vascular etiology, initial loss of consciousness, neurological deficit, intubation upon admission, and Glasgow Coma Scale score ≤ 8—align with internationally recognized prognostic criteria [1] [9].

Orotracheal intubation, frequently performed in patients with neurological distress, appears to be a marker of severity rather than a causal factor of mortality. Vascular etiology highlights the major therapeutic challenges posed by hemorrhagic strokes in resource-limited settings.

5.3. Public Health Implications and Perspectives

The findings of our study, consistent with the work of The Lancet Global Health Commission on Global Surgery and the Global Neurotrauma Outcomes Study [9], underscore the need for systemic strengthening of emergency neurosurgical care in countries with low Human Development Index (HDI).

This entails:

- Developing a prehospital care network equipped for the transport of patients with traumatic brain injury;
- Ensuring continuous availability of imaging services (24/7 CT scanning);
- Training general surgeons in the initial management of neurosurgical emergencies;
- Integrating neurotrauma care into national surgical and anesthesia plans, in accordance with the Peshawar declaration for low- and middle-income countries [19].

5.4. Study Limitations

Our study was conducted in a single center; however, the authors believe that the findings are applicable to other urban healthcare facilities of comparable level, facing similar resource constraints.

Moreover, missing data for patients unknown to the healthcare system and without accompanying persons, discharges against medical advice, and the lack of downstream follow-up from the emergency department limit short-term prognostic analysis. We acknowledge that excluding patients who died before arriving at the hospital or before undergoing a CT scan constitutes a significant selection

bias, leading to an underestimation of the true mortality rate. Indeed, the most severe cases, undocumented due to a lack of imaging or initial management, are not captured in our analysis, thus artificially reducing the number of deaths observed among neurosurgical emergencies.

6. Conclusions

Neurosurgical emergencies remain predominantly caused by traumatic brain injuries resulting from road traffic accidents. Despite efforts to improve care, mortality remains high, exacerbated by delays in admission and access to neurosurgical services.

These findings call for an organizational reform of the neurotrauma care system in Mali.

Conflicts of Interest

The authors declare no conflicts of interest related to this article.

Authors' Contributions

Study conception and protocol design: AA, MM, DTM, DDM
Data collection and interpretation: AA, KA, GA, SD, SA,
Manuscript drafting: AA, MM, DTM
Manuscript revision: CM, SK, DB, DD, DAS
All authors read and approved the final manuscript.

References

[1] Alihonou, T., Quenum, K., Padonou, A., Amossou, F. and Dossou, F. (2020) Neurosurgical Emergencies at a Tertiary Referral Center in a Sub-Saharan African Country. *Journal of Neurosciences in Rural Practice*, **11**, 407-410. https://doi.org/10.1055/s-0040-1709354

[2] Ikwuegbuenyi, C.A., Zolo, Y. and Abu-Bonsrah, N. (2022) Strengthening Neurosurgical Care for Patients with Severe Traumatic Brain Injury. *The Lancet Neurology*, **21**, 870. https://doi.org/10.1016/s1474-4422(22)00344-1

[3] Feigin, V.L., Abate, M.D., Abate, Y.H., Abd ElHafeez, S., Abd-Allah, F., Abdelalim, A., *et al.* (2024) Global, Regional, and National Burden of Stroke and Its Risk Factors, 1990-2021: A Systematic Analysis for the Global Burden of Disease Study 2021. *The Lancet Neurology*, **23**, 973-1003. https://doi.org/10.1016/s1474-4422(24)00369-7

[4] du Toit, M., van Hoving, D.J., Tamba, A., O'Meara, R.M. and Hendrikse, C. (2025) Traumatic Brain Injuries in a District Level Emergency Department in Cape Town: Describing Patients' Journey from Arrival to CT Scan and Neurosurgery. *BMC Emergency Medicine*, **25**, Article No. 123. https://doi.org/10.1186/s12873-025-01277-x

[5] Budohoski, K.P., Ngerageza, J.G., Austard, B., Fuller, A., Galler, R., Haglund, M., *et al.* (2018) Neurosurgery in East Africa: Innovations. *World Neurosurgery*, **113**, 436-452. https://doi.org/10.1016/j.wneu.2018.01.085

[6] Kyu, H.H., Abate, D., Abate, K.H., Abay, S.M., Abbafati, C., Abbasi, N., *et al.* (2018) Global, Regional, and National Disability-Adjusted Life-Years (Dalys) for 359 Diseases and Injuries and Healthy Life Expectancy (HALE) for 195 Countries and Territories, 1990-2017: A Systematic Analysis for the Global Burden of Disease Study 2017.

The Lancet, **392**, 1859-1922. https://doi.org/10.1016/s0140-6736(18)32335-3

[7] Amdisa, D., Workneh, N., Alemu, L., Tilahun, G., Jibat, N. and Amme, S. (2025) Road Traffic Injury Characteristics, Severity, and Management Outcome among Victims Treated at the Emergency Department of Jimma Medical Center, Jimma, Ethiopia, 2024. *Ethiopian Journal of Health Sciences*, **35**, 199-204. https://doi.org/10.4314/ejhs.v35i3.8

[8] Mulugeta, H., Zewdie, A., Getachew, T. and Deressa, W. (2024) Injury Epidemiology and Emergency Department Length of Stay in Trauma Hospital in Addis Ababa, Ethiopia. *PLOS ONE*, **19**, e0309962. https://doi.org/10.1371/journal.pone.0309962

[9] Clark, D., Joannides, A., Adeleye, A.O., Bajamal, A.H., Bashford, T., Biluts, H., *et al.* (2022) Casemix, Management, and Mortality of Patients Receiving Emergency Neurosurgery for Traumatic Brain Injury in the Global Neurotrauma Outcomes Study: A Prospective Observational Cohort Study. *The Lancet Neurology*, **21**, 438-449. https://doi.org/10.1016/s1474-4422(22)00037-0

[10] Laeke, T., Tirsit, A., Kassahun, A., Sahlu, A., Debebe, T., Yesehak, B., *et al.* (2021) Prospective Study of Surgery for Traumatic Brain Injury in Addis Ababa, Ethiopia: Trauma Causes, Injury Types, and Clinical Presentation. *World Neurosurgery*, **149**, e460-e468. https://doi.org/10.1016/j.wneu.2021.02.003

[11] Dewan, M.C., Rattani, A., Gupta, S., Baticulon, R.E., Hung, Y., Punchak, M., *et al.* (2019) Estimating the Global Incidence of Traumatic Brain Injury. *Journal of Neurosurgery*, **130**, 1080-1097. https://doi.org/10.3171/2017.10.jns17352

[12] Boniface, R., Museru, L., Kiloloma, O. and Munthali, V. (2016) Factors Associated with Road Traffic Injuries in Tanzania. *Pan African Medical Journal*, **23**, Article 46. https://doi.org/10.11604/pamj.2016.23.46.7487

[13] Gupta, S., Iv, V., Sam, N., Vuthy, D., Klaric, K., Shrime, M.G., *et al.* (2017) Impact of Helmet Use on Severity of Epidural Hematomas in Cambodia. *World Neurosurgery*, **100**, 267-270. https://doi.org/10.1016/j.wneu.2016.12.104

[14] Chockalingam, K., A Rahman, N.A., Idris, Z., Theophilus, S.C., Abdullah, J.M., Izaini Ghani, A.R., *et al.* (2023) Door-To-Skin Time in Patient Undergoing Emergency Trauma Craniotomy. *Malaysian Journal of Medical Sciences*, **30**, 71-84. https://doi.org/10.21315/mjms2023.30.4.7

[15] Beucler, N. and Dagain, A. (2022) Letter to the Editor. Decompressive Craniectomy: The Simpler, the Better. *Journal of Neurosurgery*, **136**, 1814-1815. https://doi.org/10.3171/2021.12.jns212947

[16] Landes, M., Venugopal, R., Berman, S., Heffernan, S., Maskalyk, J. and Azazh, A. (2017) Epidemiology, Clinical Characteristics and Outcomes of Head Injured Patients in an Ethiopian Emergency Centre. *African Journal of Emergency Medicine*, **7**, 130-134. https://doi.org/10.1016/j.afjem.2017.04.001

[17] Hagos, A., Tedla, F., Tadele, A. and Zewdie, A. (2022) Pattern and Outcome of Traumatic Brain Injury, Addis Ababa, Ethiopia: A Cross-Sectional Hospital-Based Study. *Ethiopian Journal of Health Sciences*, **32**, 343-350. https://doi.org/10.4314/ejhs.v32i2.15

[18] Bahloul, M., Chelly, H., Ben Hmida, M., Ben Hamida, C., Ksibi, H., Kallel, H., *et al.* (2004) Prognosis of Traumatic Head Injury in South Tunisia: A Multivariate Analysis of 437 Cases. *The Journal of Trauma: Injury, Infection, and Critical Care*, **57**, 255-261. https://doi.org/10.1097/01.ta.0000083004.35231.1e

[19] Khan, T., Khattak, A.F., Park, K.B., Rosseau, G., Qazi, M. and Khan, A.S. (2025) The Future of Global Neurosurgery and the Peshawar Declaration. *WFNS Journal*, **2**, e103-e108. https://doi.org/10.1055/a-2713-5650

Abbreviations

CHU: Centre Hospitalier Universitaire (University Teaching Hospital)
CSCom: Centre de Santé Communautaire (Community Health Center)
CSRef: Centre de Santé de Référence (District Referral Health Center)
HDI: Human Developpent Index
LMICs: Low- and Middle-Income Countries
UNDP: United Nations Development Programme