



The availability, access, challenges and advancements in neurosurgical care in Africa: a mini review

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Abstract

The availability and accessibility of neurosurgical care across Africa remains limited despite recent advancements. Overall, Africa accounts for 15% of the global neurosurgical disease burden but has access to less than 1% of neurosurgeons globally. While the number of neurosurgeons has increased in recent decades, huge workforce shortages remain, with the region facing the second-largest neurosurgical deficit. Access to adequate facilities and equipment is also lacking. Barriers like poverty, conflicts, and distance from care centres negatively impact patients' ability to access services. However, training programs like the World Federation of Neurosurgical Societies Rabat Training Center have contributed to building local capacity. Use of technologies like neuro-endoscopy is expanding access to more cost-effective interventions for conditions such as hydrocephalus. Undergraduate medical education is also seeing a rise in African students interested in neurosurgery. Despite these advancements, workforce shortfalls, inadequate infrastructure, and challenges posed by geopolitical instability continue to hinder the provision of comprehensive neurosurgical care. Limited research and funding discourage experienced surgeons from practicing in their home countries. Increased international collaboration, support for education, and tackling of structural issues are needed to continue strengthening Africa's neurosurgical capacity and reducing the disease burden. This narrative review aims to provide an overview of the current state of neurosurgery on the continent, highlight achievements, and identify persisting challenges.

Keywords: Africa, Care, Health Services Accessibility, Neurosurgery, Neurosurgeons

Introduction

Neurosurgery is a specialized field of surgery focusing on treating illnesses and malfunctions related to the brain and spinal cord. Neurosurgical care in Africa is at a critical juncture, faced with unique challenges and opportunities. While grappling with a

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HIGHLIGHTS

- Neurosurgery is a specialized field of surgery focusing on treating illnesses and malfunctions related to the brain and spinal cord.
- The availability and accessibility of neurosurgical care across Africa remains limited despite recent advancements.
- Although Africa accounts for 15% of the global volume of neurosurgical disease, African hospitals and healthcare networks have access to less than 1% of the neurosurgeon community.
- Healthcare and neurosurgical care are particularly scarce in sub-Saharan Africa due to long periods of imperialism, civil war, poverty, and famines that have plagued the area.

significant burden of neurosurgical diseases, the continent also contends with a profound scarcity of specialized medical resources^[1]. The Lancet Commission on Global Surgery has highlighted these challenges, emphasizing the urgent need for equitable access to surgical care worldwide^[2]. This dichotomy is accentuated by Africa's diverse health landscape, encompassing a wide range of neurosurgical conditions from trauma to congenital anomalies against a backdrop of varying socio-economic contexts^[3]. Recent years, however, have witnessed significant advancements in surgical training, technology adoption, and international collaboration efforts across Africa, offering a beacon of progress in this vital healthcare field^[4].

Despite these advancements, critical challenges persist, including workforce shortages, infrastructural deficits, and uneven distribution of neurosurgical services^[5]. These issues are further compounded by historical legacies, educational barriers, and the vast geographical expanse of the continent, often serving populations in remote areas^[6]. The interplay of these factors necessitates a comprehensive evaluation to understand the current state of neurosurgery in Africa and identify areas requiring focused interventions^[7].

Therefore, this review aims to provide a detailed analysis of the neurosurgical landscape in Africa, synthesizing advancements and ongoing challenges. It seeks to inform future strategies and policy decisions, aiming to enhance the delivery of neurosurgical care and address the critical healthcare needs of African populations.

Main text

Workforce development and training challenges

The neurosurgical workforce in Africa faces a critical challenge, characterized by a stark inadequacy in its capacity to meet the continent's needs. A mere fraction of the global neurosurgeon community, less than 1%, is tasked with addressing ~15% of the global neurosurgical disease burden^[8]. The neurosurgical workforce deficit remains a significant challenge, ranking as the second highest globally^[3]. In East Africa there is currently one neurosurgeon per 9 million people, while in the US the ratio is 1:62 500^[9]. The shortage of qualified neurosurgical personnel—from neurosurgeons to specialized nursing staff and anesthesiologists^[4]—in conjunction with an overwhelming patient workload, creates a scenario where the demands far exceed the available capacity.^[10] This mismatch leads to prolonged waiting times for surgeries, increases the risk of complications, and often results in suboptimal patient outcomes.

This imbalance is profoundly pronounced in sub-Saharan Africa, a region where historical complexities, including the aftermath of colonialism and ongoing socio-political turmoil, have contributed to a healthcare landscape that struggles to provide adequate neurosurgical services^[9]. Moreover, this region experiences a significant barrier in the form of limited exposure of medical students to neurosurgery^[11], resulting in a reduced pipeline of future neurosurgeons.

There is a positive trend of an increase in the neurosurgical workforce. Ukachukwu *et al.*^[8] predicts that at the current growth rate of 7.03% per annum, Africa is on course to have 3418 neurosurgeons by 2030. This anticipated increase is essential in addressing the current deficit in specialized neurosurgical care. One of the most notable successes is the establishment of the World Federation of Neurological Societies' (WFNS) Rabat Training Center (RTC) in Morocco^[12]. This centre has played a critical role in training over 50 neurosurgical trainees from Sub-Saharan Africa, a region previously grappling with an acute shortage of specialized neurosurgical expertise^[12,13]. This achievement represents a significant stride in building a competent neurosurgical workforce within the continent.

However, the distribution of these professionals is uneven, primarily concentrated in urban areas, leaving rural regions underserved^[14]. For example, in Kenya, the increase in neurosurgical personnel has not adequately addressed the service gaps in rural regions^[15], highlighting the persistent geographic and

socio-economic barriers in accessing neurosurgery across the continent. Additionally, the geographical distribution of neurosurgical training opportunities across the continent presents another layer of complexity. The distribution of neurosurgeons in Africa is most concentrated in southern and northern regions^[16]. Training centres and opportunities are disproportionately concentrated in these regions. This uneven distribution results in certain areas, particularly rural and underserved regions, being left with minimal to no access to neurosurgical training and mentorship^[8]. Continuous medical education is crucial in a field as dynamic and rapidly evolving as neurosurgery, where new techniques and technologies are constantly being developed. The absence of such opportunities means that healthcare professionals in these regions struggle to keep abreast of the latest advancements in neurosurgical care, which in turn affects the quality of care provided to patients.

Despite recent efforts that have led to an increase in the number of neurosurgeons^[1], the region still grapples with a significant gap in terms of experienced mentors and trainers. The study conducted by *Kanmounye et al.*^[17] highlights this issue, revealing that only 29% of aspiring African neurosurgeons had access to a mentor. This lack of mentorship is not a trivial concern, as the guidance provided by experienced neurosurgeons is crucial for the development of surgical skills, clinical decision-making, and the overall professional growth of trainees. The mentor-mentee relationship in the medical field, particularly in a specialized and skill-intensive area like neurosurgery, is pivotal for the transfer of tacit knowledge, skills, and professional values. The implications of this mentorship deficit are manifold. Without adequate guidance, the emerging neurosurgical workforce may find itself ill-equipped to handle the complex and varied challenges of neurosurgical cases in the African context. This shortfall further exacerbates the existing challenges posed by a lack of resources and infrastructure. The need for a comprehensive training program that not only increases the quantity but also enhances the quality of neurosurgical training in Africa is, therefore, of paramount importance. An encouraging trend is the growing interest in neurosurgery among medical students in Africa. There has been a reported 7% increase in the number of final-year medical students expressing a keen interest in this specialty^[18]. This surge in interest is critical for addressing the future demand for neurosurgeons.

Infrastructure and resource challenges

The infrastructure underpinning neurosurgical care in various African regions is severely lacking and critically under-resourced. A case study illustrating these challenges is Zanzibar, Tanzania. Here, the Neurosurgery Education and Development Institute (NEDI) was established to foster the growth of neurosurgery^[19]. However, the initiative faced hurdles such as poor infrastructure for treatments and the absence of basic materials. This paucity of resources extends across several dimensions, profoundly impacting the capacity to deliver effective and quality neurosurgical care^[20]. Hospitals and medical centres in these regions frequently face an acute shortage of essential materials, ranging from basic consumables like surgical gloves and radiography film to more complex neurosurgical equipment. These shortages are not mere inconveniences; they represent significant barriers to performing even the most routine neurosurgical procedures. However, there have been technological advancements in

treatment methods, as exemplified by the shift in Kenya from the use of temporary shunt systems to the more advanced neuro-endoscopic ventriculostomy for treating hydrocephalus^[21]. This advancement not only represents a technological leap but also offers a more cost-effective and efficient treatment modality, benefiting both patients and healthcare systems.

The inadequacy of physical infrastructure is another pressing issue. Many medical facilities in these regions lack dedicated neurosurgical operating rooms, appropriate intensive care units^[22], and even reliable electricity and water supply, which are fundamental for conducting safe and successful surgeries. The absence of state-of-the-art operating theatres equipped with essential neurosurgical tools such as operating microscopes, neuro-navigation systems, and advanced imaging modalities further exacerbates the challenges faced by neurosurgeons in these settings. Some regions, such as Egypt, have shown considerable progress, housing a significant portion of the continent's neurosurgeons and sufficient resources to support them^[23]. Additionally, the WFNS has contributed significantly through the donation of neurosurgical equipment to Low- and Middle-Income Countries (LMICs), many of which are African nations. The period from 2000 to 2016 saw the donation of over 100 vital pieces of neurosurgical equipment^[24], markedly enhancing the region's medical capabilities. However, this progress contrasts starkly with the situation in countries facing geopolitical instability, like Mali, Sudan, and Libya, where ongoing conflicts severely disrupt healthcare systems^[25].

The lack of adequate infrastructure and resources also hinders the ability to conduct essential research and clinical trials in neurosurgery^[26]. Research is vital not only for advancing medical knowledge but also for understanding the specific neurosurgical needs and challenges unique to the African context. Without the capacity to engage in research, there is a missed opportunity to develop context-specific strategies and interventions that could significantly improve neurosurgical outcomes in the region.

Socio-cultural and geopolitical influences

The provision and effectiveness of neurosurgical care in Africa are profoundly influenced by an intricate web of socio-cultural and geopolitical factors. These elements, often deeply ingrained and historically rooted, play a significant role in shaping healthcare practices, patient behaviours, and overall healthcare delivery systems.

In countries like Mali, Sudan, and Libya, the landscape of neurosurgical care is heavily impacted by ongoing conflicts and political instability^[27]. These geopolitical upheavals not only disrupt the direct delivery of healthcare services but also lead to broader socio-economic consequences that adversely affect healthcare systems. One of the most significant impacts of such instability is the phenomenon of 'brain drain,' where skilled medical professionals, including neurosurgeons, migrate to more stable regions in search of better opportunities and working conditions. This migration results in a severe depletion of much-needed medical expertise in regions that are already struggling with limited healthcare resources.

Furthermore, cultural perceptions and beliefs play a pivotal role in healthcare decision-making in many African communities. For instance, in Nigeria, the healthcare choices of certain Christian groups are heavily influenced by religious beliefs, sometimes leading to a preference for faith-based healing

practices over conventional medical interventions^[28]. Such cultural nuances significantly impact the utilization of neurosurgical services, with patients often resorting to traditional healers or delaying seeking medical care until conditions become critical.

The influence of socio-cultural factors extends beyond patient decisions and affects the entire healthcare ecosystem, including the types of ailments presented, patient compliance with treatment regimens, and the perceived efficacy of modern medical interventions. In some cases, cultural stigmas associated with certain neurosurgical conditions, such as epilepsy or mental health disorders, can lead to social isolation or reluctance to seek treatment, further complicating the provision of care^[29].

Additionally, the diversity of languages and dialects across the continent poses a communication challenge in the medical setting, potentially leading to misunderstandings or misinterpretations of medical advice and treatment plans. This linguistic diversity necessitates a culturally sensitive approach to patient communication and education, ensuring that patients fully understand their conditions and the proposed interventions.

Geopolitical factors also influence the allocation of resources and the prioritization of healthcare needs. In regions experiencing political turmoil or economic challenges, healthcare budgets may be constrained, limiting the ability to invest in necessary neurosurgical infrastructure, training, and equipment.

Conclusion

The review of neurosurgical care in Africa highlights a landscape marked by significant challenges, including workforce shortages, infrastructural deficits, and cultural and geopolitical barriers. However, the progress made through educational improvements, technological advancements, and increased international collaboration offers a beacon of hope. Addressing the multifaceted challenges in neurosurgical care in Africa requires sustained efforts in training, infrastructure development, and a nuanced understanding of the socio-cultural and geopolitical context. Collaborative strategies, both local and international, are essential for enhancing neurosurgical care and meeting the healthcare needs of the African population. The review of neurosurgical care in Africa underscores a landscape fraught with significant challenges, ranging from acute workforce shortages and infrastructural deficits to complex socio-cultural and geopolitical influences. The urgency to address these issues cannot be overstated, as they critically impede the ability to provide adequate neurosurgical care to a population disproportionately burdened with neurosurgical diseases.

The first and foremost recommendation is the strengthening of workforce development. This can be achieved through expanding neurosurgery training programs, incorporating mentorship and fellowship opportunities, and fostering partnerships with international neurosurgical bodies for knowledge exchange and capacity building. Efforts must also be directed towards retaining trained neurosurgeons within the continent, which could involve improving working conditions, offering competitive remunerations, and providing avenues for professional growth.

In terms of infrastructure, there is a pressing need for investment in medical facilities and equipment. This investment should not only focus on urban centres but also aim to reach underserved and rural areas. Partnerships with global health organizations and private sector stakeholders could be pivotal in facilitating the

acquisition of modern neurosurgical equipment and the development of suitable healthcare infrastructure.

Addressing socio-cultural and geopolitical challenges requires a multi-pronged approach. Cultural competence training for healthcare providers can ensure sensitive and effective patient communication. Additionally, community outreach programs can play a crucial role in educating the public about neurosurgical conditions and treatments, dispelling myths, and promoting early medical intervention. In regions affected by conflict and political instability, concerted efforts by governmental and non-governmental organizations are needed to stabilize healthcare systems and ensure the continuous provision of medical services.

Finally, research and data collection specific to the African context should be prioritized. Local and regional neurosurgical research can provide insights into the unique challenges and needs of the population, informing more effective and context-specific healthcare strategies.

Tackling the myriad challenges facing neurosurgical care in Africa requires a concerted, collaborative, and strategic effort. It involves not only addressing immediate healthcare delivery issues but also building a robust and sustainable neurosurgical ecosystem that can effectively serve the continent's present and future needs. The international medical community, along with local governments and organizations, must work together to implement these recommendations, ensuring that neurosurgical care in Africa is accessible, equitable, and of high quality.

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Author contribution

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The authors declare that there no conflict of interest.

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