



The first EANS vascular and skull base hands-on course in East Africa: Review from the global and humanitarian neurosurgical committee initiative

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ABSTRACT

Introduction: Cerebrovascular pathologies in East Africa have a poorly known prevalence and incidence. The treatment remains sparse. When they apply, microneurosurgical techniques are prioritized over endovascular procedures due to lack of resources. Considering an increasing number of neurosurgeons in East Africa, the EANS Global Humanitarian Committee (GHC) has endorsed the creation of the Vascular and Skull base Hands-on Neurosurgery Course.

Research question: What are essential elements to extend knowledge to sub-Saharan neurosurgeons on cerebrovascular pathologies?

Material and methods: In November 2023 was held the first course in collaboration with the Muhimbili Orthopaedic Institute (MOI) in Dar es Salaam, Tanzania. The course consisted of lectures from international and local faculty in the morning with surgical cases in the afternoon. Plus/delta type of feedback was obtained at the end. Challenges and proposed improvement based on comments are reported.

Results: The course lasted over five days and each day had a different theme of neurovascular or skull base neurosurgery. There was a total of 32 presenting faculty and ten surgical cases. For this first edition, a total of 39 healthcare workers were in attendance. The participants felt that the hands-on portion was very useful (56%) and wished to have more cases for more exposure. Comments from the plus/delta feedback emphasized on having in-person faculty rather than virtually.

Discussion and conclusion: The first edition of the EANS Vascular and Skull base Hands-on Neurosurgery Course in East Africa successfully run in Dar es Salaam. Subsequent editions should focus on more targeted in-person lectures better adapted to LMICs.

1. Introduction

Cerebrovascular pathologies in East Africa and African countries in general have a poorly known prevalence and incidence. For instance, only 33 publications pertaining to ruptured cerebral aneurysms were found in the literature according to a 2021 scoping review (Tetinou et al., 2021) Click or tap here to enter text. These publications represent a minority of African countries mainly in West Africa, Kenya, and South Africa. In Tanzania, a low-middle income country (LMIC) with a population of approximately 68 million (Worldometer) Click or tap here to enter text., which is bigger than most European countries, the prevalence of cerebral aneurysms, arteriovenous malformations, or cavernomata remains unknown.

Despite new technologies in endovascular, microneurosurgical techniques are still the preferred technique to treat aneurysms in Africa (Tetinou et al., 2021). This is a contrast with most Western countries where endovascular procedures have gained priority and become established. Nevertheless, in recent years, a few African countries have improved on their technology to provide advanced care to these patients affected by neurovascular conditions. Angio-suites are now available in

countries such as Kenya, Rwanda or Tanzania to perform diagnostic digital subtraction angiography (DSA) and sometimes, embolization and coiling depending on the availability of consumables (Embolization, 2023).

A need has therefore been identified for developing the training in neurovascular and skull base surgery, especially as the number of neurosurgeons in the country has increased significantly over the recent years from two neurosurgeons in 1990 to twenty-two in 2023 (Waterkeyn et al., 2023a). Considering these gaps in neurosurgical knowledge and service provision, the EANS Global and Humanitarian Neurosurgery Committee (GHC) recently endorsed a mission for helping increase the accessibility of various nuanced neurovascular and skull base skills to neurosurgeons in Tanzania.

Modeling on a global neurosurgery course that has been ongoing for more than ten years in the country with the Weill-Cornell-MOI collaboration through the Tanzania Neurosurgery Project (Tanzania Neurosurgery Project), the idea was been to build a twinning program between the Neurosurgery Department at the Muhimbili Orthopaedic Institute (MOI) and the Medical University Innsbruck (Waterkeyn et al., 2023b).

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base Hands-on Neurosurgery Course in East Africa with the goal to help in the creation of future cerebrovascular courses that can become sustainable and adapted for LMICs in a context of healthcare system growth. Challenges and successes, as well as lessons learned, are reported as a tool to help others wanting to pursue similar endeavours.

2. Material and methods

In November 2023, after several months of preparation, the EANS GHC was able to run the first EANS Vascular and Skull base Hands-on Neurosurgery Course in East Africa in collaboration with the Muhimbili Orthopaedic Institute (MOI) in Dar es Salaam, Tanzania. The course lasted over five days.

2.1. Organization

The idea for the course was promoted through the EANS GHC in July 2023 as one GHC member (OP) was familiar with the environment and facilities at MOI through a longstanding collaboration and recognized a need for further training in neurovascular subspecialty. The support from the EANS President (AKD) and the chair of the GHC (LR) was forthcoming and important in successfully bringing the project to life. An organizing committee was created, crucially including three local neurosurgeons in Tanzania (N.B.R., A.K. & L.L.M.), one fellow neurosurgeon (M.C.) affiliated with Weill-Cornell Neurosurgery Project in Tanzania, and two neurosurgeons from Austria (O.P. & C.P.) involved in the EANS.

Monthly Zoom meetings were organized and became weekly once the course dates came closer. These meetings were dealing with the logistics of the course and the resources available at the host hospital. A checklist of the various items needed to be ready at the host hospital was made for reference to future editions of the course (Supplementary material). The host country had an organizing committee with neurosurgeons and included nurses and critical care doctors.

2.2. Course design

An educational program was designed by EANS neurosurgeons (O.P., C.P. and M.T.) and reviewed by the EANS GHC, focusing on vascular and/or skull base neurosurgery (Supplementary material). Input for the chosen topics and the program were received from the organizing committee in Tanzania based on an informal needs assessment. The course was intended to be hybrid with in-person plus online lectures, and broadcast of live surgery for Tanzanian medical students and residents. Each day consisted of morning lectures followed by neurosurgical operations in the afternoon. The topics for the lectures were as follows: 1) Foundations and Basics, 2) Vascular Pathologies & Management, 3) Skull Base Surgery Essentials, 4) Skill Building & Multidisciplinary Collaborations, and 5) The Way Forward. The faculty speakers were given the task to prepare a presentation as to “how I do it”, relating to their own surgical expertise. The course was registered through the Medical Council of Tanganyika website for Continuous Professional Development (CPD) certification of the participants.

2.3. Surgical cases

The surgical cases were chosen by the local neurosurgery team at MOI after thorough discussion with the EANS team. The list of potential cases was presented to the EANS delegation through a Zoom meeting and the trainees at MOI introduced the patients’ imaging and clinical presentation. The cases were then decided based on feasibility of surgery within the facility at MOI, potential benefits from the surgery to the patients, best teaching opportunity, and availability of consumables if needed (e.g. endovascular consumables). Of note, all preselected participants were fully informed of their roles in the educational context, the potential benefits, and the risks involved. A thorough preoperative

discussion with a special focus on a patient selection was executed in each of these cases.

2.4. Participants

Attendance to the course was prioritized to East African neurosurgeons with a strong interest in vascular and skull base neurosurgery, but resident trainees were also welcomed as well as nurses. The course publicity went through WhatsApp messaging and the College of Surgeons of East, Central, and Southern Africa (COSECSA) website. Posters were designed to advertise the course (Fig. 1) with a link to the registration form. The course was free to attend.

2.5. Feedback

Prior to the course, a feedback questionnaire was designed for daily sessions. The technique of plus/delta feedback was used as being a well described and easy method for giving feedback in simulation settings (Motola et al., 2013). At the end of the week, final questions were asked for overall commentary of the course. Since this first experience was a pilot course, feedback was deemed essential to inform future course organisation.

3. Results

3.1. Faculty attendance

The faculty speakers (Table 1) consisted of 21 EANS neurosurgeons, three neurosurgeons from USA, two neurosurgeons from Kenya, two local neurosurgeons and one cardiologist from Tanzania, one neurologist-interventionist from USA, one intensive care unit nurse and one neuroanesthesiologist both from Austria. The international faculty speakers were responsible for the cost related to their own traveling.

3.2. Participants/attendance

There was a total of 44 registrations made through the registration link. Twenty-six registrations were from Tanzania, eight from Kenya, seven from Uganda, and one from Malawi. The final course attendance (Table 1) comprised 39 healthcare workers, with 25 that were pre-registered and 14 that registered on site. Unfortunately, only one neurosurgeon from Kenya and one from Uganda were able to join despite the pre-registration of many.

3.3. Surgical cases and simulation models

Throughout the week, ten patients were operated (Table 4). There were four cases of vascular pathologies (two aneurysm clipping surgeries, one cavernoma, one arteriovenous malformation (AVM)), three cases of pituitary adenoma operated via a transsphenoidal approach, one skull base tumor (planum sphenoidale meningioma), and two cerebral diagnostic angiographies (DSA). Worthy of note, there was a list of twenty patients that had been optimized for potential surgery, but some of those patients deteriorated prior to the course and the surgical option was felt to be more harmful. These patients, given the rather adverse natural course of many cerebrovascular diseases, were not surgically treated, a reminder of the reality in many LMIC regions. Three neurosurgical cases that required the use of a microscope (aneurysm clipping and AVM surgeries) were successfully broadcasted and narrated by one of the EANS neurosurgeons through a Zoom link (Fig. 2). In addition, one of the neuro-interventionists present during the course had brought simulation models for angiography and catheterization. The simulation station was successfully running for all five days of the course in a separate room of the operating theatre of the hospital.



Fig. 1. A) Publicity poster sent to potential participants, B) Banner on the grounds of the Muhimbili Orthopaedic Institute hospital.

Table 1
Demographics of the course attendance.

Faculty	Number
Specialty	
Neurosurgeon	28
Neurologist	1
Anesthesiologist	1
Cardiologist	1
Nursing	1
Representing countries	
Within EANS	23
Tanzania	3
Kenya	2
India	1
USA	3
In-person talks	18
Virtual talks	19
Participants	
Overall (day 1)	39
Representing countries	
Tanzania	37
Kenya	1
Uganda	1

3.4. Feedback after the course

At the end of the course, feedback responses came from 18 respondents (46%). From the final feedback assessment (Table 2), the majority of respondents felt that the number of lectures was adequate (41%) or very adequate (41%). The usefulness of the hands-on sessions was rated as very useful by 56% of people, but most people (44%) were neutral as to whether the course met their expectations. Finally, 35% of respondents felt that the course was adapted to LMICs as expected. Comments from the plus/delta feedback evaluation for each of the five daily topics were also collected and summarized (Table 3).

4. Discussion

The course had a very good attendance in the first three of five days, especially since it was restricted at first to more senior neurosurgeons with a main interest in neurovascular and skull base surgery. Unfortunately, throughout the week, attendance to lectures decreased in size which can be shown by the number of 18 respondents over 39 with the feedback form. The feedback form was given in paper at the end of the course to the participants present in the conference room. Having done it

Table 2
Overall course feedback assessment.

Questions	Likert-scale score				
	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
What was the number of didactic sessions like? ^a (n = 17)	5.9	0.0	11.8	41.2	41.2
How would you rate the hands-on session in terms of usefulness? ^b (n = 18)	0.0	0.0	5.6	38.9	55.6
Did the course meet your expectations regarding the content presented? ^c (n = 18)	0.0	0.0	44.4	27.8	27.8
Did the meeting meet your expectations regarding the adaptability of the cases presented for LMICs? ^c (n = 17)	0.0	5.9	35.3	41.2	17.6
How was your level of comfortability with skull base pathologies prior to the course? ^d (n = 18)	0.0	22.2	27.8	44.4	5.6
How was your level of comfortability with neurovascular pathologies prior to the course? ^d (n = 18)	0.0	27.8	38.9	22.2	11.1

Likert-scale legend for each question.

^a (1 = very inadequate, 2 = inadequate, 3 = neutral, 4 = adequate, 5 = very adequate).

^b (1 = not useful at all, 2 = not useful, 3 = neutral, 4 = useful, 5 = very useful).

^c (1 = much less than expected, 2 = less than expected, 3 = as expected, 4 = more than expected, 5 = much more than expected).

^d (1 = very uncomfortable, 2 = uncomfortable, 3 = neutral, 4 = comfortable, 5 = very comfortable).

electronically could have led to a lower response rate based on previous experience, but the evidence is mixed (Moss, 2002) Click or tap here to enter text. Despite that the course was opened to all vascular interested neurosurgeons from sub-Saharan countries, the logistics behind traveling and the lack of financial support might have deterred some participants to travel all the way to Dar es Salaam, Tanzania. Nonetheless, the feedback comments were in favor that more neurosurgeons should have been invited and more publicity should have been done around the course. Obviously, as a first edition, it is always more challenging to convince people to join a new event, as word of mouth for its pertinence is not yet feasible.

Other challenges that were faced during the week related to technology issues. The Wi-Fi was not available to all participants in the conference room because it needed to be highly functional for the hybrid format of the lectures. All the Zoom-based lectures were delivered well

Table 3

Plus/delta daily feedback comments.

Sessions	One positive thing	One thing you would change	Any other comments
Day 1 (Foundations and Basics)	<i>"The practical session how to approach pituitary macroadenoma transsphenoidal (ENT + neurosurgeons team)"</i> <i>"The proper use of anesthesia drugs on neurovascular surgery based on the use of neuroprotection drugs"</i> <i>"Excellent range of topics from faculty"</i>	<i>"Review the anatomy and the way to go about it before real OR time"</i> <i>"Try to get faculty to come and ignore those who want to talk online unless adding something educational to the course. Ask good teachers not those high up in societies"</i> <i>"Increase number of participants to widely increase knowledge to more people"</i> <i>"IT improvements and punctuality"</i> <i>"More research on low resource settings"</i> <i>"Add more cases to the lectures"</i> <i>"Some concepts were too advanced"</i>	<i>"More cases → increase exposure + experience"</i> <i>"The hands-on teaching programme is very useful to keep neurosurgeons understand the skills and knowledge on how to do the effective neurovascular and skull base surgery"</i> <i>"Try to temper/stop faculty from taking over cases to support local surgeons to complete case"</i> <i>"More discussion in case presentations about approaches/techniques/plans during lectures"</i> <i>"The programme should be continuous for better outcome"</i> <i>"What protocol they use for SAH treatment that can be adopted for our use"</i> <i>"Better time management to enable the residents to attend the theatre on time"</i> <i>"Good start, hope for the best on second course"</i> <i>"Practice on how to operate under the microscope; key!"</i>
Day 2 (Vascular Pathologies & Management)	<i>"The importance of maintaining CPP in SAH patient caused by ruptured aneurysm"</i> <i>"Learning from international faculty on how they work out vascular cases. Which cases to go for and which to conserve despite them having the appropriate instruments and good technology"</i> <i>"Understanding the African context in neurovascular pathologies and its challenges"</i>	<i>"To increase time of presentation"</i> <i>"Audience attendance were very few"</i> <i>"If they could all present live could be better"</i> <i>"More hands-on is great, we had one case today"</i> <i>"Increase number of local presentations with their experience"</i> <i>"Pre-op sessions should be daily"</i> <i>"More nursing involvement in future course"</i> <i>"The meeting started late. It would be better if the meeting begins on time as scheduled"</i>	<i>"Invite more people to attend the course"</i> <i>"Possible models for transsphenoidal practice before getting to patient"</i> <i>"Theatre sessions should start when completion of all presentations"</i> <i>"Have the first 2 days for lectures than the remaining 3 days for theatres"</i> <i>"Improve on Wi-Fi"</i>
Day 3 (Skull Base Surgery Essentials)	<i>"Learning cases of what to look for during re-dos"</i> <i>"Excellent sound quality, excellent zoom"</i>		
Day 4 (Skill Building & Multidisciplinary Collaborations)	<i>"The experience from senior neurosurgeons on how to look after complications was great lesson"</i> <i>"The use of lumbar drainage for brain relaxation"</i> <i>"Controlling of bleeding during surgery"</i>		
Day 5 (The Way Forward)	<i>"The promising future collaboration"</i> <i>"To know how the situation of neurosurgery is in Africa"</i> <i>"We should always be patient in conducting research"</i>		

Table 4

Description of surgical cases.

Cases	Number	Pathology	Age of patients (years)	Outcomes 6 weeks post-operative
Open vascular	4	Ruptured anterior communicating artery aneurysm	54	Severe vasospasm with ongoing GCS of 4
		Left parieto-occipital cavernoma	40	Well
		Trigeminal neuralgia	35	Developed V2 and V3 numbness and paralysis respectively immediately. Now getting better
Endovascular	2	Right posterior communicating aneurysm*	49	Developed left sided weakness
		Left parietal arteriovenous malformation	37	Well
		Right posterior communicating aneurysm*	49	Developed left sided weakness (same patient as above)
Transsphenoidal	3	Pituitary adenoma GH-secreting	18	Low hemoglobin and required transfusion
		Pituitary adenoma non-secreting	35	Well
		Residual pituitary adenoma non-secreting	66	Well
Skull base	1	Planum sphenoidale meningioma	61	Diabetes insipidus resolved after 2 days

without any interruption. However, the microphone interference was difficult to manage within the room to enable a live conversation with Zoom presenters. Interestingly, these difficulties have been reported in the 2023 Global Neurosurgery course report as well (Shayo et al., 2023) Click or tap here to enter text. A hybrid format did allow for more international faculty to feature their work and share their knowledge on some topics, but keeping one's attention to a presentation over Zoom is slightly more difficult; also, fewer opportunities for mentorship present themselves (Guetter et al., 2022) Click or tap here to enter text.

The hands-on part of the course included surgical cases operated by teams of paired international faculty and local neurosurgeons. The preparation logistics were demanding as expected. The clinical presentation of neurovascular pathologies was always acute, and it was difficult to find cases that were considered elective ahead of time. A list of seventeen patients that were admitted had been prepared by the residents and faculty at MOI. However, most of these patients did not get their surgery done during that week based on surgical criteria and feasibility for the course. This created a backlog in surgical cases once the course was over. It is a tricky way to navigate through surgical cases that would be adequate and enriching for a course once surgeons are dealing with people's lives. Importantly, incorporating ethical

considerations into the framework of live surgery courses, such as the inaugural EANS Vascular and Skull Base Hands-on Course in East Africa, necessitates a meticulous approach to patient selection, autonomy, and follow-up. This paradigm must be deeply embedded both in the methodological design and the discussion of outcomes within such courses. The selection process for surgical candidates, whereby numerous patients had been pre-identified yet only a subset received treatment, underscores the need for transparent and equitable criteria that prioritize patient welfare above educational objectives. To this end, establishing a rigorous, ethically grounded selection mechanism—guided by the principles of beneficence, non-maleficence, and justice—is paramount. This entails not only the assessment of clinical appropriateness and potential for educational value but also consideration of the patients' informed consent and expectations for treatment.

Patient autonomy emerges as a cornerstone of ethical live surgery courses, demanding that all participants are fully informed of their roles in the educational context, the potential benefits, and the risks involved. This transparency extends to the assurance of comprehensive follow-up care, ensuring that the educational benefit to healthcare professionals does not overshadow the primary goal of patient health and well-being. Moreover, the inclusion of ethical discussions within both the



Fig. 2. Dr. Rebeca Majige and Dr. Boaz Yonah observe during an aneurysm clipping surgery, while Dr. Christian Preuss narrates the surgery via a live broadcast.

methodological planning and reflective analysis of such courses acts as a bulwark against criticism, positioning patient welfare at the heart of surgical education. Addressing these ethical dimensions enriches the narrative of surgical missions, transforming them into exemplars of global health equity and mutual respect between high-income and low-income healthcare settings.

This initiative from the EANS GHC comes at a time of healthcare growth in various neurosurgical programs on the African continent. The escalating need for localized neurosurgical education in Africa constitutes a pivotal component of the broader strategy to enhance healthcare outcomes within the continent (Mogere, 2023). The inaugural EANS Vascular and Skull Base Hands-on Neurosurgery Course in East Africa underscores a transformative approach towards this goal, recognizing the critical importance of embedding such educational initiatives within the region. Some successful collaborations with North American institutions have been existing at MOI already such as the Weill-Cornell Tanzania Neurosurgery Project created almost fifteen years ago; and the Neuro-Oncology Symposium in collaboration with the University of Colorado now at its third edition (Ormond et al., 2018). Global Neurosurgery is a topic “en vogue” and publications about it have been more than ever over the past few years (Weiss et al., 2020). It is important to consider how these courses can all be complementary with each other. Indeed, with the various subspecialties, they could still all work with retrieval practice from a neurosurgical concept to another as part of a learning continuum (Donker et al., 2022).

A critical aspect of analyzing course attendance trends, particularly in global neurosurgical training, is understanding the underlying barriers that lead to discrepancies between pre-registration and actual attendance. The limited participation of pre-registered neurosurgeons from Kenya and Uganda, despite initial interest, raises important

considerations regarding logistical, financial, and systemic challenges. Potential factors contributing to this discrepancy may include travel restrictions, institutional support deficits, last-minute clinical obligations, and funding constraints—common challenges in global surgical education. Addressing these issues in future program planning could involve targeted funding assistance, strategic scheduling to accommodate clinical demands, and enhanced coordination with local institutions to ensure the participation of key stakeholders. Identifying these barriers and sharing lessons learned will be instrumental in improving access and retention in similar capacity-building initiatives across low- and middle-income countries.

The rationale for concentrating these educational resources in Africa stems from several key considerations, primarily the observation that physicians trained within their local context are significantly more likely to continue their practice in the same locality. This tendency not only aids in mitigating the brain drain phenomenon, prevalent in many developing regions, but also ensures that the investment in education yields long-term benefits for the local healthcare system. Moreover, the adaptability of training to local conditions, including the prevalent cerebrovascular pathologies and resource constraints, ensures that the acquired skills are directly applicable and immediately beneficial to patient care. The successful execution of the course at the Muhimbili Orthopaedic Institute (MOI) in Dar es Salaam, Tanzania, demonstrates the feasibility and efficacy of such localized training programs. It also highlights the indispensable role of collaboration between international experts and local faculty in fostering professional development and enhancing the capacity of local healthcare systems to address complex neurosurgical conditions.

4.1. Lessons learned

The positive feedback from participants, emphasizing the utility of hands-on training and the preference for in-person faculty engagement, further validates the necessity for continued and expanded neurosurgical education within Africa. It is imperative that future iterations of this course, and similar initiatives, prioritize direct, on-the-ground training that is tailored to the specific needs and circumstances of the region. Also, as seen in the feedback remarks collected from the participants, having more interactive discussions to share experiences with the visiting faculty needs to be a focus for future courses. This strategic target not only supports the professional development of local healthcare workers but also contributes to building a resilient, self-sustaining neurosurgical infrastructure capable of addressing the unique challenges faced by the African continent. Ultimately, enhancing attendance requires addressing financial and logistical barriers through targeted funding, flexible scheduling, and stronger institutional collaboration.

The establishment of the EANS Vascular and Skull Base Hands-on Neurosurgery Course in East Africa represents a significant step forward in the global and humanitarian effort to elevate neurosurgical care within the region. The ongoing commitment to this initiative, with an emphasis on enhancing local training and supporting the professional growth of local faculty, is crucial for ensuring that Africa continues to develop a robust, locally informed, and globally connected neurosurgical community.

5. Conclusion

The First EANS Vascular and Skull Base Hands-on Course in Dar es Salaam was proven to be a successful event despite the challenges encountered. Adjustments on operative cases, refinement of the educational program to align with the feedback received, and improvement of the facilities can only enhance a second edition of the course.

Declaration of competing interest

The authors declare that they have no known competing financial

interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.bas.2025.104210>.

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