



An Ethiopian Training Program in Neurosurgery with Norwegian Support

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After a 4-year planning period, a joint Ethiopian/Norwegian training program in neurosurgery was started in June 2006. The collaborating partners were Addis Ababa University; Department of Surgery, Tikur Anbessa Specialized Hospital; University of Bergen; Haukeland University Hospital; and Myungsung Christian Medical Center, a Korean missionary hospital in Addis Ababa, Ethiopia. A memorandum of understanding was signed at dean/chief executive officer levels. Although other initiatives have been involved in supporting neurosurgery in Addis Ababa during the same period, this institutionally founded program has been the main external contributor to neurosurgical capacity building through the education of 21 Ethiopian neurosurgeons, and in supporting a sustainable environment for neurosurgical training within a network of 5 centers in Addis Ababa. This article gives an account of the strategies underlying the program planning, the history of the program, and on the experience gained by it. Finally, ethical problems and challenges encountered in the program are discussed.

INTRODUCTION

Surgical disciplines have fallen short in health priority issues in many low-income countries (LICs).¹⁻⁴ This is now being increasingly acknowledged. The World Health Organization has documented a severe shortage of surgical service worldwide. This affects elective and emergency procedures, where the

rapidly increasing trauma scenario in LICs is of particular importance. Within the field of trauma, neurotrauma is a particular challenge because of its large impact on the individual victims, their families, and society, but epidemiologic data from LICs are in general missing.⁵⁻⁷

The College of Surgeons of East, Central and Southern Africa recently published a survey of surgical capacity in their region, showing an overall rate of 0.53 surgeons per 100,000 population.⁸ This is a severe shortcoming of the Lancet Commission target of 10 surgeons.⁹ Ethiopia has a population of approximately 99.5 million. To reach a neurosurgery specialist density comparable with the world average in 2000 (1 per 250,000), approximately 400 neurosurgeons would be required.¹⁰ In comparison, there are approximately 100 neurosurgeons serving the 5 million population of Norway, giving a ratio of 1:50,000.

Because of the insufficient capacity within surgical disciplines in many LICs, numerous colleagues participate in volunteer service, either individually, through organizations, or through agreements at institutional levels.¹¹ The outcomes of such missions, albeit well meant, may range from being directly harmful to making a measurable difference to the better.^{12,13} To raise the level of surgical competence, one has to focus on training, which requires close collaboration over many years. When building competence in neurosurgery in the scenario of a LIC where resources largely fail to fulfil the needs, special care must be taken. One must train new consultants not only how to treat patients, but also how to teach neurosurgery to new residents. To cover the future neurosurgical needs in LICs, every new specialist must take responsibility for training several other new specialists by passing on and improving knowledge, therefore participating in a cascade of training and distribution of knowledge.

Key words

- Education
- Neurosurgery
- Sub-Saharan
- Training

Abbreviations and Acronyms

AAU: Addis Ababa University
FIENS: Foundation for International Education of Neurosurgeons
ICU: Intensive care unit
LIC: Low-income country
MCM: Myungsung Christian Medical Center
TASH: Tikur Anbessa Specialized Hospital
UoB: University of Bergen

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This article gives an account of the experience gained through a project supporting the establishment of an educational program for neurosurgery at Addis Ababa University (AAU).

EARLY YEARS OF ETHIOPIAN NEUROSURGERY

To our knowledge, neurosurgical procedures were not carried out in Ethiopia until the late 1960s, and details about the initiating phase are missing.

In 1970, a Bulgarian neurosurgical resident, Dr. Chaba, started working in Black Lion Hospital. Despite limited training, he made advances, for instance by diagnosing intracranial meningiomas by carotid angiography. He operated on intracranial tumors and neurotrauma. A professor in general surgery, Asrat Weldeyes, became the founder of Ethiopian surgery as he started a post-graduate training program for surgeons at AAU. He operated on spine trauma cases.

The first 2 Ethiopian neurosurgeons, Dr. Tadios Munie and Dr. Zenebe Gedlie Damtie, started practicing at Tikur Anbessa Specialized Hospital (TASH), Addis Ababa, Ethiopia, in 1990 and 1991 after having received their education in Bristol, England, and Havana, Cuba. These 2, only for short periods supported by colleagues from abroad and for some years accompanied by a third Ethiopian, Dr. Birhanu, were the only neurosurgeons serving the entire country for many years, a considerable burden both to the hospital and the neurosurgeons. The trauma care was very primitive, and there was no formal intensive care unit (ICU). The practice at TASH did not include educating neurosurgeons, and there was no formal plan to solve the increasing demand for neurosurgical service in the country.

PROGRAM INITIATION AND IDEA

About 2 decades ago, the faculty at the Department of Surgery at TASH made several attempts to establish neurosurgical training, but these failed because of a lack of staff and resources. In December 2000, Dr. Zenebe sent an e-mail to the senior author, who was head of the Department of Neurosurgery at Haukeland University Hospital, Bergen, Norway, asking for assistance to start a neurosurgery training program in Ethiopia. The proposal was received with interest. It became clear that Ethiopia was at the lower extreme of specialist density. At the time, 3 neurosurgeons, all trained abroad, were left with the impossible task of serving approximately 75 million people.

In Ethiopia, surgery has traditionally received a low priority in health care; for instance, only very few cases with head injuries after traffic collisions were treated; however, their numbers rose rapidly. For most patients with hydrocephalus, spina bifida, and benign tumors, many who might benefit considerably from neurosurgical treatment, there was no treatment available. Thus, it was concluded that building competence in neurosurgery was feasible and highly required in Ethiopia. It was agreed that the major part of the education should take place locally because it has repeatedly been shown that students trained abroad fail to return to their home countries after graduation. Thus, we decided to tailor the practice to the facilities available in the host country. This meant that the training had to be based on low-technology principles. For this reason, we welcomed the contribution of

teachers in the later years of their careers, who knew the old tricks of the trade.

We considered it necessary that the candidates were exposed to up-to-date neurosurgery. Therefore, we included into their program a period of 6 months of training at the Department of Neurosurgery, Haukeland University Hospital, Bergen. During their stay, the candidates, 2–3 at the time, followed the daily routines of the department, such as outpatient clinics, rounds, and radiology and morning meetings. They were given short courses in neuroradiology, neuropathology, and intensive care, and they followed our residents during duties. They were allowed to scrub in and assist during procedures, but they did not work as operating surgeons. The aim of the program was to provide Norwegian support at least until there was a sufficient number of Ethiopian consultants who could teach new residents.

DEVELOPMENT AND COURSE

The first fact-finding trip from Bergen to Addis Ababa took place in January 2002. After 4 years of planning and numerous visits, an agreement on a neurosurgical training program was signed between AAU, University of Bergen (UoB), Myungsung Medical Center (MCM), and the Ethiopian Ministry of Health in March 2006.

Curriculum development for the 5-year neurosurgical training was spearheaded by the then Chair of the Surgery Department, Dr. Mesfin Minas. The curriculum includes 5 years of training in neurosurgery. Some time is allotted for training in related disciplines, such as anesthesiology and neuroradiology. The candidates keep a logbook of their procedures and sit 1 early examination of neurology, neuroanatomy, neuroradiology, neurophysiology, and neuropathology after 1 year of training. At the end of training, the candidates go through written examinations followed by a practical examination where their clinical skills are reviewed. In addition, they write and present a thesis, which is usually a study of cases operated for a specific diagnosis in the department. An international board of examiners are the reviewers at the final examination. The curriculum is mainly adopted from that of the College of Surgeons of East, Central and Southern Africa, with some modification to suit the local practice.

Two hospitals were chosen as training sites: TASH and a newly constructed Korean missionary hospital, Myungsung Christian Medical Center (MCM) (Table 1). According to the agreement, AAU had the formal responsibility of curriculum and certifying new specialists, and UoB, and later Haukeland University Hospital, supported the program financially and by supplying the program with a continuous line of teachers for the training at MCM. The residents in the program alternated between the hospitals every 3 months. Initially, the visiting teachers' effort was concentrated at MCM, because at that time it had the best facilities for training and offered free accommodation for volunteering doctors. Members of Foundation for International Education of Neurosurgeons (FIENS) had visited TASH before the training program started and increased their contribution to the training, through regular visits since 2006.¹⁴

The teachers supervised and trained the candidates in their daily practice, including morning meetings, outpatient clinics,

Table 1. Properties of the 2 Teaching Hospitals at the Start of the Training Program

Hospital Properties	AAU	MCM
Financial setup	Governmental, university, approximately 600 beds	Private, charity cases accepted, 154 beds
Department/ward	Unit within department of surgery, no separate ward	No department, no separate ward
Outpatient clinic	Yes	Yes
OR equipment	Basic neurosurgical instruments	Basic neurosurgical instruments: microscope, c-arm, endoscope
OR staff	No trained neurosurgical OR nurses	1 OR nurse dedicated to neurosurgery, no formal training
Recovery or ICU beds/ventilators	0/0	16/2
Number of employed neurosurgery consultants	2	0
CT/MRI*	No	No

AAU, Addis Ababa University; MCM, Myungshung Christian Medical Center; OR, operating room; ICU, intensive care unit; CT, computed tomography; MRI, magnetic resonance imaging.
*All imaging done in private center outside the hospitals.

department rounds, and operative procedures. Many of them lectured on specific topics. For many years, the senior author gave a series of lectures meant to provide a basic course to new residents.

The first years of the program were particularly challenging because the Ethiopian participants were still in training and a continuous presence of consultants at MCM was necessary to maintain training at a professional level. A Norwegian neurosurgeon, Dr. G. Lende, who was raised in Ethiopia and who spoke the national language (Amharic), moved to Addis Ababa in 2004, shortly after finishing his training. He served as a teacher, first at MCM and later at TASH until January 2009. Thanks to his full-time presence and an international relay team of 21 volunteering specialists coming from Bulgaria (n = 1), Denmark (n = 2), Finland (n = 1), Hong Kong (n = 1), India (n = 2), Japan (n = 1), Norway (n = 8), Sweden (n = 3), United Kingdom (n = 1), and United States (n = 1), a continuous presence of qualified neurosurgeons was secured. The teachers were recruited by the senior author through various neurosurgical fora, by e-mail, and through a Web site. Many visited the program several times, with the senior author visiting a total of 57 times. Significant contributions to the training were given by supporting initiatives working in parallel with the program, in particular by members of the FIENS group. The first 3 specialists to graduate were Drs. Mersha Abebe, Abat Sahlu (both 2010), and Hagos Biluts (2011). They were all certified specialists in general surgery when they started their training and were given an additional 3 years training in neurosurgery before they qualified as certified specialists in surgery with a subspecialty in neurosurgery. These 3 doctors then took up teaching new residents and developing their own skills further in collaboration with experienced colleagues visiting from Norway, through FIENS, or from other places. The residents to follow were young medical doctors, recruited at an early stage of their career and graduating after 5 years of training as specialists in neurosurgery.

In the following years, theoretical, clinical, and practical surgical training has been given by Ethiopian teachers associated with AAU, teachers brought in by the Norwegian initiative, and by members of FIENS. In the years since 2011, education has

increasingly been given by Ethiopian neurosurgeons, with visiting doctors playing a less prominent role.

FINANCING

The teachers who travelled to Addis Ababa to participate in the training program were offered no salary, but free lodging and food. They travelled at their own costs, or had their travel expenses covered from Norway.

During the first phase, up to 2009, the senior author received travel grants equivalent of approximately \$72,000 (present rate) from the UoB, private sponsors, and The Norwegian Research Council. From 2010, the main sponsor was FK Norway, formerly

Table 2. Norwegian-Ethiopian Neurosurgery Staff Exchange Program, Annual Budget, and Number of Participants on 6-Month Exchange

Year	Amount	Ethiopian Participants	Norwegian Participants
2002–2009	\$60,000	0	0
2010	\$200,000	4	2
2011	\$390,000	5	2
2012	\$390,000	4	2
2013	\$390,000	5	4
2014	\$300,000	2	2
2015	\$490,000	5	2
Total	\$2,220,000	25	14

Altogether, 15 Ethiopian neurosurgical residents stayed for 6 months at the Department of Neurosurgery, Haukeland University Hospital. In addition, 10 Ethiopian and 14 Norwegian nurses within the disciplines of operating room, intensive care unit, or neurosurgery ward participated. During the early period, neurosurgical consultants from many different countries paid numerous 2–12 weeks' visits to Addis Ababa (see text for further details).

known as The Norwegian Peace Corps, an organization underlying The Norwegian Department of Foreign Affairs. In addition, UoB and Haukeland University Hospital both contributed. The average annual budget for the years 2010–2015 was approximately \$370,000, with volunteer work not included. This sum allowed for exchange of health personnel, nurses, consultants, and residents between Ethiopia and Norway (Table 2). Altogether, 15 Ethiopian residents stayed in Bergen for a period of 6 months to observe contemporary neurosurgical practice in a high-income country. Conversely, the support enabled Norwegian residents and consultants to visit Ethiopia, experiencing a disease panorama and health care conditions different from those at home. Approximately 10% of the annual budget was allocated to the purchase of equipment.

The Norwegian neurosurgeon, who for the first years of the program served permanently as a teacher at MCM, received support (salary and living expenses) from a private foundation (Braincare Ethiopia). In addition, this foundation paid salary, travel, and other expenses for an experienced Norwegian ward nurse, who taught neurosurgical nursing to the ward staff.

Equipment and consumables have been scarce, and the program has been dependent on donations from the supporting initiatives previously described. The World Federation of Neurosurgeons supported the initiative through their equipment program. Thus, we could buy craniotomy and spine trays and a World Federation of Neurosurgeons microscope at a favorable price. In addition, the private ReachAnother Foundation (<http://www.reachanother.org/>) has for many years financed a surgery campaign for spina bifida, and the International Federation for Spina Bifida and Hydrocephalus has continuously provided shunt materials (<http://www.ifglobal.org/>).

Table 3. Setup in Hospitals Involved in Neurosurgical Training in Addis Ababa in 2006 and at Present

Item	January 1, 2006	December 31, 2015
Hospitals offering neurosurgery training	0	5
OR equipment		
Microscopes	1	2
Endoscopes	1	3
C-arm	1	2
MRI	0	1
CT	0	1
Number of Ethiopian consultants in training hospitals	2	8
OR nurses formally trained in neurosurgery	0	0
ICU nurses formally trained in neurosurgery	0	0
Ventilators	2	16
OR, operating room; MRI, magnetic resonance imaging; CT, computed tomography; ICU, intensive care unit.		

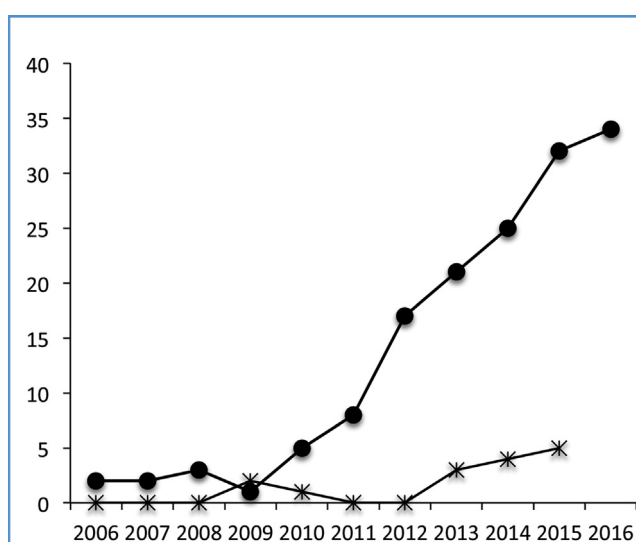


Figure 1. Number of new graduates (asterisks) and residents under education (circles) per year. A total of 15 graduates have completed their neurosurgical education. Out of these, 13 are serving in Ethiopian public hospitals. Two of the consultants have taken up practice in other Ethiopian cities. A total of 35 residents are under education.

PRESENT SITUATION

Because of the joint efforts previously described, and a gradual increase in governmental resources allocated to supporting surgical activity, there has been an escalation in public neurosurgical service in Addis Ababa within the last 10 years. At present, neurosurgical education is taking place in 5 different hospitals (Table 3). Consultants and residents rotate between these centers every 3–6 months. By November 2016 altogether 21 consultants have graduated, and an

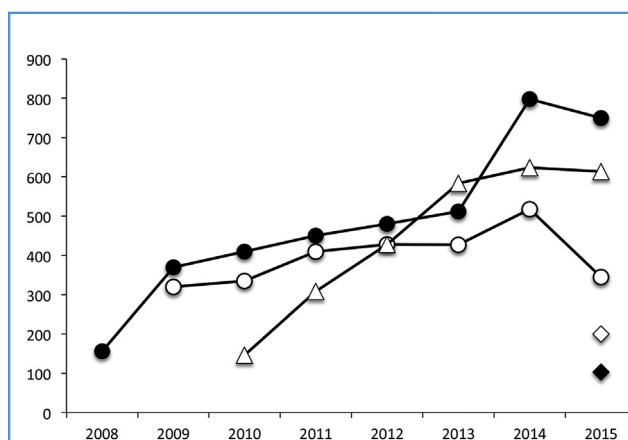


Figure 2. Number of procedures per hospital per year. Filled circles represent Tikkur Anbessa Specialized Hospital, open triangles represent Myungsung Medical Center, open circles represent Zewditu Memorial Hospital, filled diamonds represent Bethel Hospital, and open diamonds represent All Africa Leprosy, Tuberculosis and Rehabilitation Training Centre (ALERT) hospital (trauma center). The number of procedures has increased dramatically. In 2015, a total of 2111 procedures were carried out.

Table 4. Diagnoses in Patients Admitted for Surgery in 2015 in the 3 Main Hospitals: Tikur Anbessa Specialized Hospital, Zewditu Memorial Hospital, and Myung Sung Medical Center (N = 1714)

Diagnoses	Number of Patients	%
Intracranial tumors	171	10
Intracranial infections	64	3.7
Intraspinal tumors	45	2.6
Degenerative spine	69	4
Spina bifida	304	17.7
Encephalocele	36	2.1
Hydrocephalus	281	16.4
Trauma	744	43.4

increasing number of residents have been included (Figure 1). The number of procedures has risen dramatically from approximately 150 in 2008 up to more than 2000 in 2015 (Figure 2). In Table 4, the diagnostic categories of operated cases in 2015 are shown for the 3 largest public hospitals. An increasing number of consultants will graduate in coming years; neurosurgery has been established in 2 cities outside of Addis, and this expansion will continue. In addition, AAU is now training neurosurgical residents from Sub-Saharan countries; one candidate from Malawi is at present receiving his training there.

The training has led to a significant improvement of service, both regarding capacity and outcome. Despite the progress, the caseload/capacity imbalance brings up priority issues that are ethically challenging.¹⁵ Some examples are given as follows. Severe neurotrauma cases constitute approximately 50% of all cases, but the ICU capacity is low, and patients are discharged

home without rehabilitation. Many patients are diagnosed with benign tumors at a very advanced stage. For instance, a high proportion of patients with skull base tumors present with blindness. Patients with a magnetic resonance imaging diagnosis of a malignant brain tumor may receive low priority because patients with curable disease are prioritized. For patients with pituitary adenoma and progressive loss of vision, postoperative diabetes insipidus may not be treated because desmopressin is unavailable. Prioritizing patients given this scenario is difficult because many patients who might benefit from surgery elsewhere are less likely to do so. Evaluating benefit versus risk is particularly important. It is recognized that risks of poor outcomes are higher than what is reported in Western literature. Within the overwhelming proportion of cases, it may still be difficult to select those who according to sound clinical judgment may be anticipated to follow a favorable clinical course after surgery.

Some progress has also been made in research and management survey. A number of scientific articles have been published, and a database recording all neurosurgical cases, including in-hospital outcomes, was established in 2013 and is continuously maintained.¹⁶⁻²⁰

CONCLUSIONS

By the means of an international team of neurosurgeons, a moderate amount of financial resources, and Memorandum of Understandings between participating institutions in Addis Ababa and Bergen, a sustainable training program in neurosurgery was established in Ethiopia within a 10-year period. The early years of the program were challenging but successful thanks to dedicated teachers who repeatedly traveled to Ethiopia. After the initiating phase, a long-term collaboration followed where the locally trained specialists gradually took over the teaching. Others who plan to support surgical training in LICs may use this model to setup a program.

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