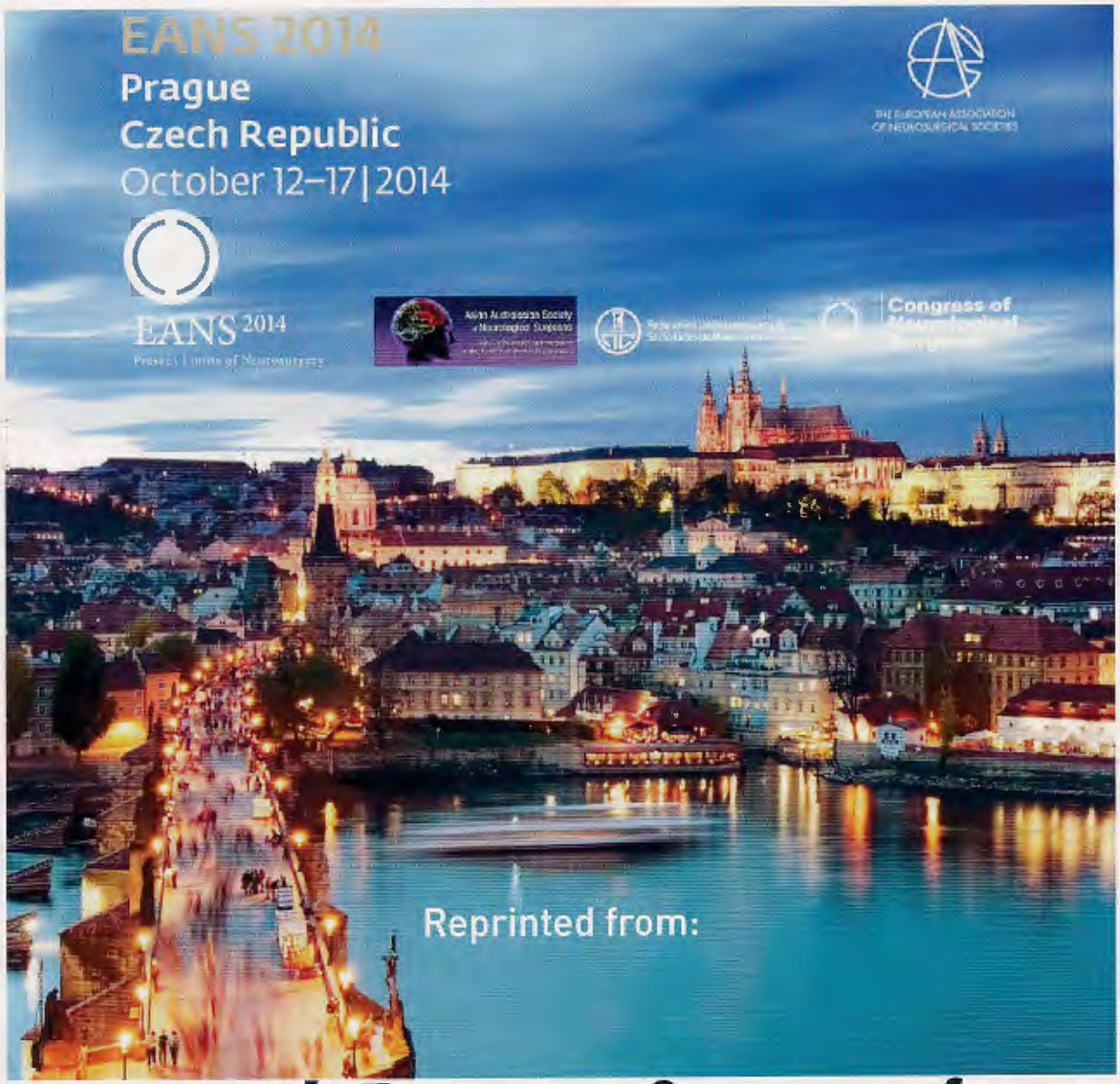

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Neurosurgery, Education and Development (NED) Foundation: Global Health and Humanitarian Neurosurgery.

Piquer J.[1], Llacer J.L., Riesgo P., Rovira V., Rodríguez R., Chisbert P., Moreno L., Girbes M.S.

Neuroscience Chair CEU-NISA CEU Universidad Cardenal Herrera Valencia Spain
[1]Neurosurgical Unit, Hospital Universitario de la Ribera, Alzira (Valencia), Spain
Email: jpiquer@hospital-ribera.com

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Neurosurgery Education and Development Foundation (NED) is registered in the Register of Foundations under No. 487, it meets good practice requirements for NGOs, and is audited by an external firm

Introduction

Hydrocephalus in Sub-Saharan Africa occurs mainly in infants. It is associated with infection, and estimates suggest that 100,000 newborns[1] will develop the illness during their first year[2-4]. Management of hydrocephalus in developing countries is challenging due to lack of resources and trained staff. Europe has roughly one neurosurgeon per 100,000 inhabitants, while in Africa one specialist takes care of more than 3 million people on average. Estimates indicate that less than 5% of children with hydrocephalus in Africa receive surgery each year; however, due to poor quality, the failure rate of shunt surgery performed with the resources available ranges from 25% to 50%[2, 3, 5, 6-8].

An alternative and minimally invasive treatment is endoscopic third ventriculostomy (ETV)[9-12]. It cures the disease in over 70% of cases[13], with a low rate of complications (about 5%), and normalises CSF dynamics[14].

Methods

Between 2006 and 2013, NED Foundation developed an educational and healthcare project aimed at establishing neuroendoscopy as an initial treatment for infant hydrocephalus in various Sub-Saharan countries. This project involved the acquisition of portable neuroendoscopic equipment, the Oi Handy-Pro, with a 0° autoclavable Hopkins II telescope[15], and the implementation of an educational program to train local staff.

Since August 2006, numerous NED medical missions have been organized. These included ETV training experiences in the form of conferences, seminars, hands-on courses and supervised surgeries in hospitals from East, Central and South Africa.

The objective of this report is to describe the results of this program between 2006 and 2013, and its unexpected outcome: the launch of a subsequent project to develop neurosurgery in Africa.

Results

Over a period of seven years, 28 ETV workshops were held in 21 different hospitals during which 376 children with hydrocephalus received surgery using two mobile devices six-month follow-up was completed in only 84 cases. Most of these cases presented with a history of infection (56%), followed by hydrocephalus related to spina bifida (23%). Approximately one fifth (21%) had non-infectious hydrocephalus.

The program gave local staff, both neurosurgeons and nurses, specialized training in sterilization, neuroendoscopic procedures and equipment maintenance. Overall, 72 local surgeons (38 neurosurgeons and 34 resident clinicians) and 122 ward nurses have been trained with the same portable endoscopic system. This project stimulated the interest of local clinicians to train as neurosurgeons and drew the attention of the Kenya and Zanzibar health ministries, creating a new opportunity for the development of neurosurgery.

In this context, two parallel programs to develop neurosurgery in the Coast General Hospital in Mombasa (Kenya) and in the Mnazi Moja Hospital in Zanzibar have been established since 2009. These programs have been and are being organised by 49 volunteer neurosurgeons mainly from Spain and other European, American and African hospitals during monthly expeditions.

Between 2009 and 2013, thousands of patients have been seen in the framework of these programs, and a total of 360 neurosurgical interventions, apart from hydrocephalus, have been performed to treat other pathologies. In addition, 87 volunteers from eight other medical specialties are at present involved in the development of this project: nursing, intensive care, anaesthesia, radiology, traumatology internal medicine, paediatrics, otolaryngology, plastic surgery and obstetrics/gynaecology.

This impact received a lot of media attention throughout the region, and even the President of the Republic show an interest in develop Neurosurgery as leader speciality. As a result, the Zanzibar Ministry of Health signed an agreement to create a Neurosurgery and Neurocritical Care Institute at the Mnazi Mmoja Hospital.

The contract to build the Mnazi Mmoja Neuro NED Institute was signed in June 2013. The third phase of construction, financed by NED, was finalized in November 2014 (Figure 1).

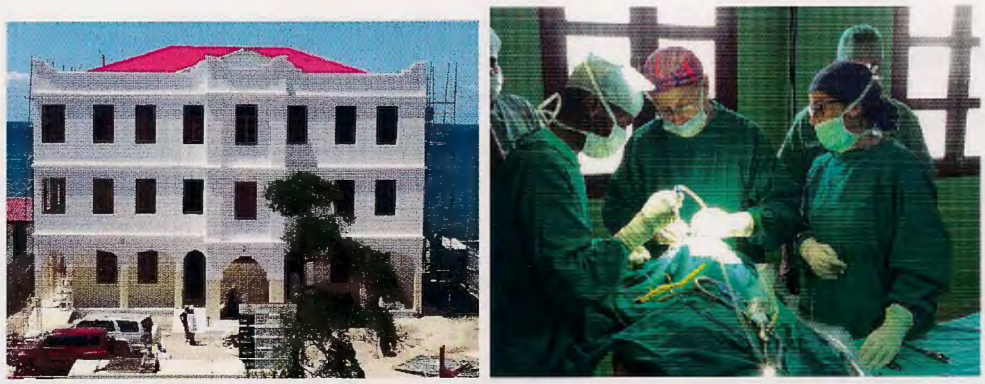

Figure 1a, *Mnazi Mmoja NED Institute by November 2014 (Zanzibar, Tanzania);* ***1b,*** *first surgery in a hydrocephalus child*

Discussion

Ventriculostomy of the third ventricle was described by Jarvis in 1949 as one of the most attractive options to treat hydrocephalus in developing countries[16]. At present, with the progress of endoscopy and neuroimaging, almost 70% of childhood hydrocephalus cases can be definitely solved with ETV [12, 17].

When we began our project, there were approximately 40 neurosurgeons in East Africa. Lack of such specialists in large rural areas created major challenges which demanded a novel approach. It was not feasible for our foundation, to offer expensive and non-portable neuroendoscopic equipment for the exclusive use of only one hospital, especially in the case of some African hospitals located in large cities in which there is a total clinical breakdown[5]. In addition, there is a high incidence of patients with hydrocephalus in rural areas who cannot travel[5, 18]. In this setting, a program of mobile endoscopy was designed[2-4]. This was a practical way of demonstrating that neurosurgery does not necessarily require sophisticated equipment, and that surgery can be successfully performed in the most impoverished regions with very promising results. Since we always combine supplies and equipment donation with training courses for the local staff, an educational program was developed concurrently, giving local surgeons more in-depth understanding of ventricle anatomy and allowing them to effectively resolve childhood hydrocephalus. These workshops[2,4] have helped train specialists, but have also revealed the neurosurgical needs of each region. As a result, one further step was taken in the development of this medical specialty in East Africa.

The new project, named Integral Development of Neurosurgery, focuses on improving the state of neurosurgery in East Africa. Among its objectives are strategies to promote contact and communication between African neurosurgeons and to convince local medical students, resident physicians and nurses that they can train as neurosurgeons[2,3]. The goal of this new program is to promote neurosurgery as a specialty in two hospitals in Tanzania and Kenya. The program is being developed almost exclusively by Spanish neurosurgeons through monthly expeditions, seeing thousands of patients, and performing over 70 operations annually.

We believe this an extremely useful, impactful initiative that has a great future. Furthermore, it has been implemented by a national neurosurgical community, and has recently been compared to a number of important projects developed by international societies[19].

To our knowledge, this is the first project of its kind in the world, the outstanding outcome of which will be the construction of the new Neurosurgery and Neurocritical Care Institute at the Mnazi Mmoja Hospital in collaboration with the Ministry of Health of Zanzibar. The role of this institute, that include two operating rooms, one intensive care unit, three wards and two examination rooms, is to be an international neurosurgical referent centre of the area that permit improve global health through neurosurgery, education and development.

The experience of these years, including visits to 21 hospitals in seven Sub-Saharan countries and organising 28 workshops, has dispelled the notion that the extreme complexity of neurosurgery makes it inappropriate for developing countries, where it would be performed by general surgeons and orthopaedists with an interest in neurologic cases, resulting in a poor outcome due to lack of training and inadequate equipment[18]. At present, the general consensus in the region is that neurosurgery is possible, can improve the general level of healthcare in any hospital where it is practiced, and can have a major impact on the development of other specialties. In this regard, the introduction of neurosurgery has had a great impact in many areas due to the need for various cooperative and logistical support systems to be developed and implemented.

Creating a neurosurgery service immediately raises the need for other related specialties to be developed concurrently: nursery, intensive care units, radiology, internal medicine, paediatrics, gynaecology, etc. The introduction of neurosurgery is a further step towards improving both specialist and general healthcare services in developing countries.

The international interest sparked by the system designed by the NED foundation[19] has had an unexpected and encouraging outcome. For instance, two regions from East and South Africa with major neurosurgical needs have become involved in implementing and developing the device, promising further positive results in the near future.

References

1. Warf BC, Alkire BC, Bhai S, et al. Costs and benefits of neurosurgical intervention for infant hydrocephalus in sub-Saharan Africa. *Journal of neurosurgery. Pediatrics.* Nov 2011;8(5):509-521.
2. Qureshi MM, Piquer J. Impact of a portable neuroendoscopic equipment system to provide an outreach service in Sub-Saharan Africa. *J Hydrocephalus.* 2009;1(1):11-14.
3. Qureshi MM, Piquer J, Young PH. Mobile endoscopy: a treatment and training model for childhood hydrocephalus. *World neurosurgery.* Feb 2013;79(2 Suppl):S24 e21-24.
4. Piquer J, Qureshi MM, Young PH. Impact of mobile endoscopy on neurosurgical development in East Africa. *World neurosurgery.* Apr 2010;73(4):280-284.
5. Noorani SK. *Complications of ventriculoperitoneal shunting seen at the Kenyatta National Hospital* [Dissertation]. Nairobi, Kenya: M. Med. (Surgery), University of Nairobi; 2004.
6. Aschoff A, Kremer P, Hashemi B, Kunze S. The scientific history of hydrocephalus and its treatment. *Neurosurg Rev.* Oct 1999;22(2-3):67-93; discussion 94-65.
7. Kulkarni AV, Drake JM, Lamberti-Pasculli M. Cerebrospinal fluid shunt infection: a prospective study of risk factors. *Journal of neurosurgery.* Feb 2001;94(2):195-201.
8. Sarguna P, Lakshmi V. Ventriculoperitoneal shunt infections. *Indian J Med Microbiol.* Jan 2006;24(1):52-54.
9. Cinalli G. Endoscopic Third Ventriculostomy. In: Cinalli G, Maixner WJ, Sainte-Rose C, eds. *Pediatric hydrocephalus.* Milano; New York: Springer; 2004:361-388.
10. Hopf NJ, Grunert P, Fries G, Resch KD, Perneczky A. Endoscopic third ventriculostomy: outcome analysis of 100 consecutive procedures. *Neurosurgery.* Apr 1999;44(4):795-804; discussion 804-796.
11. Kamalo P. Exit ventriculoperitoneal shunt; enter endoscopic third ventriculostomy (ETV): contemporary views on hydrocephalus and their implications on management. *Malawi Med J.* Sep 2013;25(3):78-82.
12. Warf BC. Neuroendoscopic management of hydrocephalus in African children. Results from 1000 ventriculoscopic procedures. *Childs Nervous System.* 2005;21:507.
13. Warf BC, Kulkarni AV. Intraoperative assessment of cerebral aqueduct patency and cisternal scarring: impact on success of endoscopic third ventriculostomy in 403 African children. *Journal of neurosurgery. Pediatrics.* Feb 2010;5(2):204-209.
14. Boulton M, Flessner M, Armstrong D, Hay J, Johnston M. Determination of volumetric cerebrospinal fluid absorption into extracranial lymphatics in sheep. *The American journal of physiology.* Jan 1998;274(1 Pt 2):R88-96.

15. Oi S, Samii A, Samii M. Frameless free-hand maneuvering of a small-diameter rigid-rod neuroendoscope with a working channel used during high-resolution imaging. Technical note. *Journal of neurosurgery.* Jan 2005;102(1 Suppl):113-118.
16. Jarvis JF. The treatment of hydrocephalus by third ventriculostomy. *East Afr Med J* 1949;26:204.
17. Warf BC. Comparison of endoscopic third ventriculostomy alone and combined with choroid plexus cauterization in infants younger than 1 year of age: a prospective study in 550 African children. *Journal of neurosurgery.* Dec 2005;103(6 Suppl):475-481.
18. Qureshi MM, Oluoch-Olunya D. History of neurosurgery in Kenya, East Africa. *World neurosurgery.* Apr 2010;73(4):261-263.
19. Dempsey RJ, Nakaji P. Foundation for International Education in Neurological Surgery (FIENS) Global Health and Neurosurgical Volunteerism. *Neurosurg.* 2013;73(6):1070-1071.