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East and Central African Journal of Surgery
Association of Surgeons of East Africa and College of Surgeons of East Central and Southern Africa
ISSN: 1024-297X EISSN: 2073-9990
Vol. 16, Num. 1, 2011, pp. 104-110

East and Central African Journal of Surgery, Vol. 16, No. 1, March/April, 2011, pp. 104-110

Pattern of Neurosurgical Procedures in Ethiopia: Experience from Two Major Neurosurgical Centres in Addis Ababa.

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Code Number: js11017

Background: In Ethiopia, the number of practicing neurosurgeons is very few and the pattern of neurosurgical diseases and operations is not well known.This study was aimed to define the patterns of neurosurgical diseases and the operative procedures commonly seen at two main neurosurgical hospitals in Ethiopia.
Patients and Methods: Case records of all patients operated for neurosurgical diseases between January 2007-December 2008 (2 years period) at the Tikur Anbessa University Hospital and Myungsung Christian Medical Center were retrospectively reviewed.
Results: A total of 1364 patients were operated during the study period with M: F ratio of 1.7:1. Pediatric patients comprised 37.6% of the cases. The three top diagnosis for pediatric patients were hydrocephalus in 35.5%, neural tube defects in 27.5%, and neuro-trauma in 9.7% while neuro-trauma (28.7%) chronic subdural hematomas (22.8%) and spine and spinal cord diseases (21.2%) were the top adult neurosurgical patients. Ventriculo-peritoneal shunting (32.2%), repair of neural tube defects (27.5%) and endoscopic third ventriculostomy were the three most common operative procedures for pediatric patients and burr holes (26.8%), laminectomy &/or discectomy (17.4%), and craniotomy and tumor extirpation (15.3) were the top three procedures.
Conclusions: Different types of neurosurgical diseases are present in Ethiopia but because of lack of both diagnostic and therapeutic facilities, the operative procedures are very limited. Shortage of trained neurosurgeons makes the condition worse. This study shows that the neurosurgical training hospitals need to have improved diagnostic and therapeutic facilities.

Introduction

In countries like Ethiopia, where the most common causes of uncontrolled massive morbidity and mortality are infectious disease like tuberculosis, malaria and HIV /AIDS, neurosurgical conditions may not be considered priority. The very high infant and maternal mortality rate as well pushes neurosurgery to the lowest strata of priority in the health care ladder[1]. Even among the surgical diseases, neurosurgery may also not be a number one surgical concern of developing countries where other basic surgical facilities including trauma and emergency are scarce. The current neurosurgical service in Ethiopia is extremely scarce and unavailable to the majority of the population at large and in particular for those who live in rural areas and far from the main cities. These centralized and scarce service also shoulders a number of problems such as lack of proper diagnostic and operative facilities, limited number of admission beds and lack of trained man power to name a few. It is also not surprising to see patients waiting for a long time before getting admitted for surgical care, hence most patients are admitted after the disease has advanced, and some are forced to seek referrals abroad. This kind of inadequate neurosurgical service provision is shared by other African countries, particularly central and eastern African countries[2,3].

Recognizing the above facts and problems, the Addis Ababa University, Medical Faculty has started a neurosurgery residency program. This program is launched with the assistance of different international organizations such as the Haukland University Hospital, Norway and Foundation for International Education in Neurological Surgery, FIENS. The main training is conducted in two hospitals, namely, Tikur Anbessa Hospital (TAH) the main teaching hospital and Myungsung Christian Medical Center, and affiliated charity hospital.

Till todate, base line data regarding the magnitude of neurosurgical problems and patterns of common neurosurgical procedures in Ethiopia are scarce and are not well documented and studied to show the real burden of the neurosurgical problems in the country. Cognizant of this, with the basic objective of determining the common neurological diagnoses which required surgical interventions and the patterns of neurosurgical procedures done in Ethiopia, we conducted a retrospective review of our two years experience at the two teaching centers.

Patients and Methods

This study was conducted on neurosurgical patients who were admitted to and operated at Tikur Anbessa Specialized Teaching Hospital (TASTH) and Myungsung Christian Medical Center (MCMC). These centers are the teaching hospitals for the neurosurgical residents, and they receive most of neurosurgical cases referred from all over the country. These hospitals have full time employee neurosurgeons and basic facilities to undergo neurosurgical operations. Each hospital has three neurosurgery operation days per week for elective cases and emergency cases can be operated any time of the day. All operations performed during January 2007 to December 2008 at these teaching hospitals were included. Data was obtained from the operation registration books and individual patient records. Information collected included the age and sex of patients, mode of operation, time and date of operation, pre-operateve diagnosis, intra-operative findings and the operation/procedure done. It also included whether the procedure was performed on emergency or elective basis.

The following operational definition was employed. All the diagnoses were classified into eleven categories and labeled with numbers as:

1. Hydrocephalus of any etiology,
2. Neural tube defects (NTD) which includes tethering of the cord, meningocele, myelomeningocele, lipomyelomeningocele, or encephalocele,
3. Brain tumors, cysts or vascular lesions , benign or malignant,
4. Neuro-trauma including all forms of head injury and/or spine and spinal cord injuries,
5. Spine and spinal cord disease, includes degenerative spine diseases and spine &/or spinal cord tumors,
6. Non-traumatic intra cranial hemorrhage and all spontaneous intracranial hemorrhage, like ruptured aneurysmal bleedings,
7. Tumors/cysts of scalp and skull,
8. CNS infection, this includes brain tuberculomas, Tb spondylites, brain abscesses and meningitis
9. Shunt/ETV failure or CSF leak of any type or cause,
10. Chronic subdural hematoma, traumatic or non-traumatic and
11. Other diagnosis, which includes infrequently diagnosed cases like carpal tunnel syndrome and so

Similarly the operative procedures were categorized and coded into twelve numbers as:

1. Ventriculo-peritoneal shunt (VP-shunt),
2. Endoscopic Third Ventriculostomy (ETV),
3. Repair of NTD,
4. Laminectomy &/discectomy,
5. Laminectomy & tumor extirpation,
6. Spine instrumentation for spine and spinal cord injuries,
7. Skull traction for cervical spine injury,
8. Burr hole to evacuate hematoma or abscess,
9. Craniotomy & hematoma evacuation for acute epidural or acute subdural hematomas or to do decompressive craiectomy,
10. Craniotomy & tumor extirpation,
11. Debridement & elevation of DSF and
12. All other procedures.

on.	

Data were entered in to a computer and analyzed using SSPS software (Statistical bPackage for Social Sciences) version 15.0.Frequencies tables ,percentages and graphs were used to summarize data (summary statistics).

Results

From January 1st 2007 to December 31st 2008, a total of 1364 neurosurgical patients were admitted and operated at the two neurosurgical teaching hospitals. A total of 861(63.1%) were males and 503(36.9%) were females, M: F ration being of 1.7:1. Their age ranged from a month old infant to eighty five years. The proportion of pediatric neurosurgical patients (fourteen years and below) was 513 (37.6%) while the remaining 851 (62.4%) were adults aged 14 and above (T able 1).

Seven hundred ninety four (58.2%) of the operations were elective, scheduled ahead of the operation date and 570 (41.8%) were emergency operations. Among procedures done on the adult patients, emergency operations (55%) were more common than the elective ones (45%), while elective operations were more frequently performed (81%) than emergency operations (19%) for pediatric neurosurgical patients. Neuro-trauma, hydrocephalus, CSDH, spine & spinal cord diseases, and brain tumors were the top five commonly diagnosed neurological conditions in all age groups while burr holes, ventriculo-peritoneal shunting, elevation of depressed skull fracture, craniotomy & extirpation of brain tumor, and laminectomy &/or discectomy are top five frequently done operations (Tables 2 and 3).

Table 1. Age/Sex Distribution of Neurological patients.

	Frequency	Percent
Sex Distribution	**861**	**63.1**
Male	585	68.7
Adults	276	53.8
Pediatrics	**503**	**36.9**
Female	266	31.3
Adults	237	46.2
Pediatrics		
Age Distribution		
Pediatric age (<15yrs)	**513**	**37.6**
Adult patients (≥15 yrs)	**851**	**62.4**

Table 2. Operative Diagnosis among Neurological Patients Operated.

Diagnosis	Male no (%)	Female no (%)	Total no (%)
Neuro-trauma	255 (18.7)	39 (2.9)	294 (21.6)
hydrocephalus	134 (9.8)	88 (6.5)	222 (16.3)
CSDH	146 (10.7)	51 (3.7)	197 (14.4)
Spine & S.C diseases	105 (7.7)	78 (5.7)	183 (13.4)
Brain tumors/cysts/vascular lesions	75 (5.5)	94 (6.9)	169 (12.4)
Neural tube defects	64 (4.7)	83 (6.1)	147 (10.8)
Shunt/ETV failure/CSF leaks	44 (3.2)	45 (3.3)	89 (6.5)
CNS infections	25 (1.8)	18 (1.3)	43 (3.1)
Tumors/cysts of scalp/skull	4 (0.3)	4 (0.3)	8 (0.6)
Non-traumatic IC hemorrhage	0 (0.0)	0 (0.0)	0 (0.0)
All other diagnosis	9 (0.7)	3 (0.2)	12 (0.9)
Total	**861 (63.1)**	**503(36.9)**	**1364(100.0)**

Table 3. Neurosurgical Procedures Done.

Surgical procedure	Male n (%)	Female n (%)	Total n (%)
Burr hole	178(13.0%)	61(4.5%)	239(17.5%)
VP-shunt & shunt revisions	118(8.7%)	78(5.7%)	196(14.4%)
Elevation & debridement of DSF	135(9.9%)	33(2.4%)	168(12.3%)
Craniotomy & tumor extirpation	73(5.4%)	92(6.7%)	165(12.1%)
Laminectomy &/ or discectomy	89(6.5%)	60(4.4%)	149(10.9%)
Repair of neural tube defects	62(4.5%)	83(6.1%)	145(10.6%)
Endoscopic third ventriculostomy	55(4.0%)	44(3.2%)	99(7.2%)
Craniotomy & hematoma evacuation	70(5.1%)	10(0.7%)	80(5.8%)
Laminectomy & tumor extirpation	21(1.5%)	18(1.3%)	39(2.8%)
Spine instrumentation	27(2.0%)	6(0.4%)	33(2.4%)
Skull traction	9(0.7%)	0(0.0%)	9(0.7%)
All other procedures	24(1.8%)	18(1.3%)	42(3.1%)
Total	**861(63.1%)**	**503(36.9%)**	**1364(100%)**

Table 4. Diagnosis of Paediatric Neurosurgical Patients Operated

Diagnosis	Frequency (N=513)	Percent (100%)
Hydrocephalus	182	35.5
NTD	141	27.5
BrainTumor /cysts and vascular lesions	35	6.8
Neurotrauma	50	9.7
Spine and S.C diseases	3	.6
Tumors/Cysts of scalp/skull	1	.2
CNS Infections	18	3.5
Shunt/ETV failures, CSF Leaks	77	15.0
CSDH	3	.6
All other diagnosis	3	.6

Table 5. Surgical procedure performed among pediatric neurosurgical patients.

Surgical Procedures	Frequency (N-513)	Percent (100%)
V.P shunt and Shunt revisions	165	32.2
ETV	82	16.0

Repair of NTD	141	27.5
Laminectomy &/or discectomy	1	.2
Laminectomy and tumor extirpation	3	.6
Spine Instrumentation	2	.4
Burr Hole	11	2.1
Craniotomy & hematoma evacuation	5	1.0
Craniotomy & tumor extirpation	35	6.8
Elevation of DSF, Wound debridement	51	9.9
All other diagnosis	17	3.3

Among the pediatric patients, hydrocephalus and neural tube defects are most frequently diagnosed conditions, followed by neuro-trauma and brain tumors, while Ventriculo-pritoneal shunt, repair of neural tube defects, endoscopic third ventriculoscopy and elevation of depressed skull fractures are routinely done operations (Table 4 and 5). The first four diagnoses neurosurgical conditions among adult patients were neuro-trauma, chronic subdural hematomas of any cause, spine &spinal cord diseases and brain tumors while burr hole, laminectomy &/or discectomy, craniotomy & tumor extirpation, and elevation of depressed skull fractures are the top four routinely done procedures for the adult neurosurgical patients(Table 6 and 7).

Table 6. Diagnoses among Adult Neurosurgical Patients Operated in Neurosurgical Teaching Hospitals, Ethiopia

Diagnosis	Frequency (N-851)	Percent (100%)
Hydrocephalus	40	4.7
NTD	6	. 7
BrainTumorscysts and vascular lesions	134	15.7
Neurotraumas	244	28.7
Spine and S.C diseases	180	21.2
Tumors/Cysts of scalp/skull	7	.8
CNS Infections	25	2.9
Shunt/ETV failures, CSF Leaks	12	1.4
CSDH	194	22.8
All other diagnosis	9	1.1

Table 7. Surgical procedure among adult neurosurgical patients operated.

Surgical Procedures	Frequency (N-851)	Percent (100%)
V.P shunt and Shunt revisions	31	3.6
ETV	17	2.0
Repair of NTD	4	.5
Laminectomy &/or discectomy	148	17.4
Laminectomy and tumor extirpation	36	4.2
Spine Instrumentation	31	3.6
Skull Traction	9	1.1
Burr Hole	228	26.8
Craniotomy & hematoma evacuation	75	8.8
Cranitomy & tumor extirpation	130	15.3
Elevation of DSF, Wound debridement	117	13.7
All other diagnosis	25	2.9

Discussion

This retrospective review of our two year neurosurgical practice and experience has showed some important facts, relevant to the neurosurgical training program and to the continuous development of neurosurgical service of the country. Pediatric patients are high in number, accounting to 37.6% of the whole neurosurgical patients, among which more than 50% were infants. The top three diagnoses of pediatric neurosurgical patients (hydrocephalus, neural tube defects and neuro- trauma) constitute more than seventy percent of the commonly diagnosed pathologies.

This is also reflected by the most commonly pediatric neurosurgical procedures performed in our practice which include insertion of ventriculo-peritoneal shunt, repair of neural tube defects and endoscopic third –ventriculostomy. This finding is consistent with reports from other developing countries particularly in Sub-Saharan African countries[4,5,6]. These diseases are mostly due to infections (meningitis/ventriculitis), intraventricular hemorrhage or congenital.

The study has also revealed the limited operative capacity of our neurosurgical service as demonstrated by the number of neurosurgical procedures over the two year period was only 1364. When calculated, this means there was only one operation performed per day at either of the two teaching hospitals. Even though there are four neurosurgeons and three operating days for electives and twenty four hours for emergency service, the number of operations is very small weighed against the very large number of patients in the waiting list. This may be explained by a number of reasons as is common problems in many developing African countries which include lack of appropriate diagnostic and operative equipments, shared operation tables with other surgical specialties and the health care system of the hospitals. Inefficient ward bed usage, poor operation time utilization and repeated cancellations may also play some role[10,11].

The other important point we could see from this study is the variety of the neurosurgical diseases. It included common congenital and infectious pediatric neurosurgical conditions, neuro-trauma, central nervous system tumors, degenerative spine diseases and CNS infections. This is similar to patterns reported from other African countries[2]. We did not see CNS aneurysms and other neurovascular pathologies as their diagnosis was not routinely made, probably because of lack of diagnostic facilities to do angiography.

The types of neurosurgical operations are also very variable but they are the routine general neurosurgical operations which includes insertion of ventriculo-peritoneal shunts, burr holes, craniotomy to evacuate hematomas or extirpate brain tumor and laminectomy/discectomy. Advanced neurosurgical operations, like trans-sphenoidal pituitary tumor resections, clipping of aneurysms and spine instrumentation were not practiced in the duration of the study. This shows us that modern neurosurgery service and practice is not well developed in Ethiopia. This fact is shared by many Sub-Saharan African countries where the numbers of trained neurosurgeons are few or non- existing and diagnostic facilities and equipments like CT scanners, MRI, operating microscope and facility for angiography are unavailable[2].

Our most common modality of treatment for the hydrocephalus is seen to be insertion of ventriculo-peritoneal shunt which has many draw backs on its own. Endoscopic third-ventricuolostomy is a relatively modern and safe way for treating hydrocephalus patients and we have practiced it infrequently. Repair of neural tube defects is our second most common pediatric neurosurgical which is significant and needs further study of its incidence and to work on its prevention aspects. Our neurosurgical practice and service for adults is dominated by neuro-trauma which constitute 28.7% of the neurosurgical diagnosis. The commonly practiced neurosurgical procedures are reflect the top four diagnosis, i.e Burr holes for Neuro-trauma and subdural hematomas, laminectomy and /or discectomy for spine and degenerative diseases and craniotomy and tumor extripaton fro neuro-trauma and tumors. Elevation of compound/simple depressed skull fractures was also routinely done. Neuro-trauma, particularly head injury, is seen to be the common emergency neurosurgical conditions in many African countries and other developed nations[7,8,9].

Conclusion

Similar to other developing African countries, the neurosurgical disease patterns in Ethiopia encompass all types of diagnosis including neuro-trauma, pediatric neurosurgical diseases, degenerative spine diseases, brain tumors and cysts, and variety of central nervous system infections. The surgical procedures practiced for neurosurgical diseases also reflect the routine neurosurgical procedures but advanced, endoscopic and sub-specialty procedures and not commonly practiced.

Recommendations

1. The training hospitals should be equipped with basic diagnostic facilities like computerized tomography scanners and magnetic resonance imaging, and angiography should be available.
2. Equipments like intra-operative image intensifiers, operating microscopes and power drills should be available so that the level of care is stepped up.
3. The nation needs to have at least one dedicated center of neuro-sciences and neurosurgical excellence where the neurosurgical service develop progressively to acceptable standard, train specialties in-country to satisfy the country's need of neurosurgeons.
4. We recommend future epidemiological and prospective clinical studies to study the outcome of treatment of the different neurosurgical diseases.

Acknowledgement

We are grateful to Dr. Assefa Seme and Dr Dereje Habte for their assistance in analysis of the data. We also wish to acknowledge Myungsung Christian Medical Center and Department of Surgery at the Black Lion Hospital for allowing us to use the hospital and patient data.

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