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NEUROLOGICAL DISORDERS IN RURAL AFRICA - A SYSTEMATIC APPROACH

TROUBLES NEUROLOGIQUES EN AFRIQUE RURALE - UNE APPROCHE SYSTEMATIQUE

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RESUME

Contexte/Objectifs
Les troubles neurologiques sont fréquents en Afrique sub-saharienne. Toutefois, à ce jour des études épidémiologiques sont rares. Les objectifs de notre étude étaient d'évaluer la prévalence des troubles neurologiques en milieu hospitalier dans un cadre rural Africain et de décrire la présentation de ces maladies en utilisant une approche systématique.

Méthodes
L'étude a été menée à l'Hôpital Haydom luthérienne dans le nord de la Tanzanie, région de Manyara. Dans une étude prospective sur une période de huit mois, tous les patients admis à l'hôpital ont été évalués par un neurologue (ASW).

Résultats
Sur 8676 admissions 740 patients (8.5%) ont reçu un diagnostic neurologique. Les troubles neurologiques les plus fréquents ont été les convulsions (26.6%) et les maladies infectieuses (18.1%). La mortalité globale de maladie neurologique a été de 21%. Des cas ont été regroupés en fonction de la certitude du diagnostic. Nous proposons trois grandes catégories de troubles neurologiques (groupe 1 = pas d'incertitudes diagnostiques; groupe 2 = incertitudes diagnostiques mineures; groupe 3 = incertitudes diagnostiques majeures) avec des implications en ce qui concerne la thérapie et le pronostic.

Conclusions
Les données ci-dessus soulignent que les maladies neurologiques contribuent fortement à la morbidité et la mortalité dans un hôpital rural en Afrique. Sur la base de présentations des troubles neurologiques observés nous proposons une approche systématique.

SUMMARY

Background/Objectives
Empirical knowledge suggests that neurological disorders are common in sub-Saharan Africa. However, to date prevalence studies are scarce. The aims of our study were to assess the hospital-based prevalence of neurological disorders in a rural African setting and to describe the pattern of disease by using a systematic approach.

Methods
The study was conducted at the Haydom Lutheran Hospital in northern Tanzania, Manyara region. Over a period of eight months all patients admitted to hospital were seen prospectively in consecutive order by a neurologist (ASW).

Results
Out of 8676 admissions 740 patients (8.5%) were given a neurological diagnosis. The most frequent neurological disorders were seizures (26.6%) and infectious diseases (18.1%). The overall mortality of neurological disease was 21%. Cases were grouped according to diagnostic certainty. We suggest three major categories for neurological disorders (group 1 = no diagnostic uncertainties; group 2 = minor diagnostic uncertainties; group 3 = major diagnostic uncertainties) with implications regarding therapy and prognosis.

Conclusions
The above data emphasizes that neurological disease contributes substantially to morbidity and mortality in a rural African hospital. Based on the observed pattern of neurological disorders we suggest a systematic approach

INTRODUCTION

Not much is known about the epidemiology, natural history, clinical pattern, aetiologies and treatment status of neurological disorders in developing countries. A study carried out in Mnero, southern Tanzania, showed that 10% of all inpatients of a rural hospital suffered from neurological diseases and a study conducted in a tertiary hospital in Dar es Salaam demonstrated that 13% of all newly admitted patients had neurological disorders [12, 18]. The most comprehensive work on neurological diseases in tropical Africa comes from Ibadan, a university hospital in Nigeria [13]. It describes the pattern of neurological diseases in a hospital population of 9600 patients over a period of 12 years. The most frequent neurological disorders were found to be infections of the nervous system with a prevalence of 8.3/1000 in the hospital population. Tetanus accounted for 20% of all neurological diseases and was by far the commonest neurological disorder, followed closely by meningitis with a prevalence of 6/1000. Epilepsy was the third commonest disease of the nervous system. The prevalence in the hospital population was 3.2/1000 [13]. Recent data from a Zambian study that investigated the pattern of neurological illnesses in a rural hospital confirmed the distribution of neurological diseases found by Osuntokun in Nigeria. The Zambian study, however, showed seizures of different origin to be the most frequent neurological disorder, followed by neuropathies, with infection of the central nervous system being on position number three [2].

The emphasis of the neurological disease spectrum seems to be on seizure disorders and infectious diseases of the central nervous system. Although the above studies clearly point out the areas where the burden of neurological disease lies, not much is being said about patients who present with clear neurological symptoms and/or signs, but cannot be diagnosed with certainty due to lack of appropriate tools. These cases are, according to the authors' experiences, as important as the clear-cut neurological cases when defining the prevalence of neurological disorders in developing countries. In this paper, we describe the pattern of neurological disease and suggest a systematic approach for neurological disorders, including those with diagnostic uncertainties, suitable for most mid size rural African hospitals.

METHODS

The hospital-based study was conducted at the Haydom Lutheran Hospital in northern Tanzania, Manyara region. Of 8676 admissions all patients with neurological signs and/or symptoms were seen prospectively in consecutive order by a specialist neurologist (ASW) over a period of eight months in 2003. This was also extended to referral cases, i.e. patients who developed neurological signs and/or symptoms during their admission in the wards, which were not necessarily present at the time of admission to the hospital. Neurological disorders also included confusion and/or impairment of consciousness. Patients were examined on admission and then followed up at regular intervals. All patients recruited during the study were put into clearly defined "diagnostic groups" (see below). Each patient was allocated to a "diagnostic group" only once. If the patient presented with different neurological disorders at the same time, he was classified according to the predominant neurological sign/symptom. If the patient was re-admitted because of the same neurological problem, he was recorded only once. If the patient was re-admitted because of a new neurological disorder, he was treated as if not having been admitted before.

Basic laboratory examinations, microbiology, cerebrospinal fluid (CSF) analysis and conventional x-ray were available, but there was no access to either sophisticated neuroimaging (computed tomography, magnetic resonance imaging, angiography) or proper electrophysiology. Also, HIV testing was not available as a routine test at the time of the study. Demographic information, medical history, results of physical examination on admission and at regular intervals during the period of admission, laboratory results and clinical outcome were documented in the medical records of all patients by the same doctor (ASW). Daily ward nursing notes on established patients were reviewed for identification of anyone who developed a neurological problem after initial hospitalization. The notes of eleven patients were missing, their diagnoses were however known. The approach to grouping the observed neurological disorders was different from the usual classification of neurological disorders in northern/western countries where diagnostic tools are at hand. Based on the experience gained during the study, we opted for a pragmatic way and chose a three-pronged approach. Group 1: disorders without diagnostic uncertainties based on a) medical history and clinical examination only (e.g. epilepsy, febrile seizures, rabies) or b) medical history and clinical examination together with confirmatory laboratory tests (e.g. cerebral malaria, meningitis); Group 2: syndromes that are known, but which remain with minor diagnostic uncertainties. Presumptive diagnoses may be reached, but for confirmation of diagnosis, subcategorisation and appropriate treatment more sophisticated tests would be necessary such L-dopa trial, electrophysiology, imaging etc. Group 3: syndromes that are unknown, thus representing major diagnostic uncertainties. They can however be described and grouped accordingly. Additional laboratory tests are not helpful (assuming that HIV testing is not available). Cases within this group are similar in terms of combination of their neurological signs and symptoms and show a similar spectrum regarding therapy and prognosis; the causative mechanisms remain unknown.

Diagnostic Criteria

Group 1 (no diagnostic uncertainties)
Diagnoses within this group (Table 2) were derived from current guidelines and standard textbooks of neurology, and thus will not be mentioned separately [1, 2, 5-7, 12-14, 16-22].

Group 2 (minor diagnostic uncertainties; presented in the order as they appear in Table 3)
Myelopathies, radiculopathies, plexopathies and polyneuropathies
In this group, patients were classified according to the site of the lesion as determined by neurological examination. Other results, clinical or from x-ray, were also considered. Four syndromes, i.e. myelopathy, radiculopathy, plexopathy and polyneuropathy or any combination thereof, were grouped together. If the cause was known, a "true diagnosis" would be established and the case put into group 1.

Seizures other than epilepsy and febrile convulsions
Here patients with seizures as a presenting complaint who did not meet the criteria for epilepsy or febrile convulsions were summarized. If the seizure(s) was (were) associated with intracranial infection or lesions, the patients were classified into the respective groups.

Non-infectious encephalopathies
To this group patients with acute or chronic non-infectious encephalopathy due to presumptive mechanisms were assigned. If the reason for the encephalopathy was unknown, patients were classified according to the

prominent neurological signs(s) into “acute confusional state unclassified”, “impairment of consciousness unclassified” or “obscure encephalopathy” (see group 3).

Cerebrovascular accident (CVA)
This included ischaemic cerebral disease as well as intracerebral haemorrhage. Without appropriate imaging it is difficult to differentiate CVA from cerebral masses. In the former, signs of infection are absent. The onset of neurology is acute and if there is progression, it usually develops fast. This is contrary to most space-occupying lesions which have a rather protracted course of disease.

Degenerative diseases
This group was divided into three subgroups: 1) extrapyramidal disorders, 2) cerebellar syndromes and 3) motor neuron disease [5, 14].

Dementia and mental retardation
The most prominent feature of this group was impairment of cognition unexplained by physical or neurological illness. This was either due to intellectual decline (dementia) or non-achievement of full mental capacities (mental retardation) [5, 14].

Paroxysmal events
Patients who qualified for this group either experienced syncopes, vertigo or neuralgias, or suffered from migraine [5, 14].

Space-occupying lesions
This is a difficult diagnosis in the absence of imaging. Patients with progressive focal neurological signs associated with signs/symptoms of increased intracranial pressure such as headache, nausea/vomiting, blurred vision, dizziness and ataxia etc, were allocated to this group. Progression usually is slow with some exceptions such as e.g. intracerebral abscesses or cerebral toxoplasmosis where a more rapid course of disease can be expected. In most of these cases, signs of infection/immunosuppression or neoplasma are present. Patients with focal neurological signs in the context of meningoencephalitis, i.e. the presence of meningism associated with focal neurology, were excluded, as were patients who developed neurological signs following a CVA (see above).

Myopathies
This group included patients suffering from muscle weakness and/or pain without any sensory impairment in the absence of signs/symptoms of peripheral neuropathies, radiculopathies or motor neuron disease, amongst others, that may account for their muscle weakness [5, 14]. Diagnoses were established clinically as we did not have access to electromyography.

Group 3 (major diagnostic uncertainties)
According to the circumstances in a rural African hospital we were left with a group of patients who did not fit any of the diagnostic criteria mentioned above. In syndromic terms, we were able to group them into three different categories.

Acute confusional state (ACS) unclassified
Patients grouped here had to fulfil the following diagnostic requirements: 1) the confusion is acute but reversible (unless systemic illness led to death) without major impairment of consciousness; 2) there is absence of persistent neurological signs/symptoms. If minor focal neurological signs/symptoms are present they should be reversible as the confusion tapers off. Signs/symptoms of systemic illness may be present; 3) the confusion is not caused by a “non-infectious encephalopathy” (these patients are summarized in group 2).

Impairment of consciousness (IOC) unclassified
Patients who qualified for this group presented with IOC alone without major neurological signs. The same criteria as for “acute confusional state unclassified“ are applied.

Obscure encephalopathies
Patients summarized in this group had to fulfil the following diagnostic criteria: 1) non-focal neurological signs are predominating; 2) there may be an association with acute confusion, impairment of consciousness, or dementia, however, these neurological signs are not to prevail; 3) even after careful evaluation no reason for the encephalopathy is found, thus it is labelled obscure.

Ethical clearance and data analysis
Ethical approval was obtained from the National Institute of Medical Research (NIMR) and the study was cleared by the Tanzania Commission for Science and Technology (COSTECH). Free and informed consent from the patients or, in case of children, their respective parents was also obtained. The data of all patients was put into a data bank using Microsoft Excel. The same program was used for calculations (e.g. mean age with standard deviation).

RESULTS

Hospital-based prevalence of neurological disorders
Seven hundred and forty patients with neurological disorders were admitted within approximately eight months. Not included were patients with head injuries presenting without neurological signs/symptoms, those with non-neurological backache and those with psychiatric disorders. In the same period of time, a total of 8676 patients were admitted. Thus the hospital-based prevalence of patients with neurological diseases was 85.29/1000 admissions. Demographic details are given in Table 1.

Classification of neurological disorders
The leading diagnostic group was group 1 (n=340) with disorders that were either diagnosed on clinical grounds alone or needed simple but widely available tests to confirm diagnosis. This was closely followed by group 2 (n=318). Although syndromic description of cases was possible, a satisfactory diagnosis in most cases could not be reached. The available tools were not appropriate to achieve diagnostic certainty. Eighty-two patients were allocated to group 3 consisting of syndromic cases which, contrary to group 2, did not fit any of the established neurological criteria. Cases were grouped according to their clinical presentation.

Group 1 (no diagnostic uncertainties)
As to the first group, the distribution of diagnoses is listed in Table 2. The two leading causes of neurological disease in that group were febrile seizures and meningitis. Most febrile convulsions were complex in nature (64%) with recurrent seizures, prolonged convulsion or ensuing neurological sequelae. In most meningitis cases, the causing organism remained unclear. Twenty-six percent were caused by Neisseria meningitidis, 19% by Streptococcus pneumoniae and 13% by Haemophilus influenzae. The latter proved to be multi-resistant. For the other disorders see Table 2.

Group 2 (minor diagnostic uncertainties)
Three hundred and eighteen patients could be allocated to group 2. Leading were lesions of the spinal cord and/or along sites of the originating nerve fibres resulting in myelopathies (33%), radiculopathies (18%), plexopathies (7%) and cauda equina compressions (5%). Polyneuropathies (PNP) made up for 31% and were caused by diabetes, alcohol as well as Isoniazid. Guillain-Barré syndrome (2%), a polyradiculoneuropathy, was also classified in that group. In 5% syndromes were combined.

Next came head injuries with neurological impairment ranging from temporary loss of consciousness to deep coma. Without cerebral computed tomography a definite diagnosis regarding the origin of the neurological signs could not be reached. Epileptic seizures which were neither classified as epilepsy nor as febrile convulsion made up for 15.4% of the cases of group 2. In most cases, causes remained unknown. The group of seizures was followed by the group of the non-infectious encephalopathies which consisted of a potpourri of presumptive causes as opposed to the obscure encephalopathies. The origin however was non-infectious and might be due to toxic agents (35%), metabolic (28%), hypoxic (14%) and nutritional (7%) disturbances. 16% remained undetermined.

Then came CVA and degenerative diseases with 10.4% and 6.6%, respectively. The latter was divided into movement disorders and motorneuron disease. Of the 21 patients eight had parkinsonism, three chorea minor, three isolated tremor syndromes, two isolated cerebellar syndromes and two patients had motorneuron disease. Single patients presented with generalised chorea and generalised dystonia due to unknown cause as well as a spasmodic torticollis. Further details of group 2 are given in Table 3. Whereas the origin of the dementia cases (58%) remained cryptogenic, mental retardation (42%) was mainly caused by intrauterine or intrapartum/postpartum complications. Presumptive causes for paroxysmal events were syncope (53%), neuralgias (35%), migraine (6%) and Ménière's disease (6%). The space-occupying lesions with 4.1% of group 2 were most likely due to brain metastases in two cases, HIV related toxoplasmosis in two cases and a bone eroding soft tissue tumor in one case. The origin of the other cases (n=8) remained unclear. 57% of the myopathies were due to tropical pyomyositis. The remaining three patients had muscle

wasting without obvious cause.

Group 3 (major diagnostic uncertainties)
Despite allowing for syndromic grouping in group 2, 11% of the neurological cases could not be allocated to any of the syndromes, indicating the dilemma of resource limited countries (Table 4). The criteria of group 3 were developed according to our observation that some of the cases seem to have a consistent pattern (see diagnostic criteria above). A subgroup of patients is middle aged presenting with either acute confusion or impaired consciousness. Neurological signs, if present, are not in the forefront. Lumbar puncture was performed in 16 of the 66 patients and revealed normal findings. On clinical grounds and with simple laboratory tests symptoms could not be explained, otherwise cases would have been put into the respective diagnostic groups. Syndromes were termed “acute confusional state unclassified” or “impairment of consciousness unclassified” (Table 4 and 5). The mortality in these patients was high with 17.5% and 42%, respectively, the hospital stay however seemed to be short (Table 5).
Another group is that of patients with mainly progressive encephalopathies, the reason of which remains unclear, thus the descriptive term “obscure” was added. In that group, generalised neurological signs such as increased muscle tone and symmetrically increased reflexes are predominating, focal neurological signs are however absent. Frontal release signs are often observed. Confusion and impairment of consciousness can be present, but are not prevailing in the beginning. Lumbar puncture was performed in 14 of the 16 patients and revealed normal findings. Simple laboratory tests were within normal range. These patients tended to be hospitalised for a long period, the expenses for most families were exorbitant and the mortality was high (Table 5).

DISCUSSION

This paper mainly aims at the overall description of neurological disease in a rural African Hospital. Thus single neurological disorders will not be discussed. They are however described in more detail in the result section above and are summarized in the tables.

Is neurology relevant in developing countries? Our own experience and that of other colleagues suggest that neurological disorders are underestimated and often overlooked in developing countries. Many neurological diseases are of acute onset and their course may be rapidly lethal, as is the case in cerebral malaria, meningitis and encephalitis [1, 7, 19, 22]. Early diagnosis and adequate treatment can prevent death in many of these cases. On the other hand many neurological illnesses are chronic, such as epilepsy, and represent a huge socioeconomic burden to the patients and their families [8-10, 15]. Early and adequate treatment may prevent chronicity or secondary damage and increase the patients’ and their families’ quality of life. The present study supports our previous experience that neurological disorders are frequent in developing countries. Of all 8676 admissions 8.5% were due to neurological disorders. Other African studies showed similar results. Osuntokun (1971) analysed neurological illnesses from 1957 - 1969 at the University College Hospital, Ibadan, Nigeria and calculated a minimum prevalence of neurological diseases in the hospital population of 4.2%, not including patients with acute head injury, traumatic paraplegia and febrile convulsions [13]. Schmutzhard and Aichner (1982) found that 10% of all patients attending the Voluntary Agency Hospital in Mnero, southern Tanzania, suffered from neurological diseases [18]. Another study from Tanzania, Dar es Salaam, conducted at the Muhimbili Medical Centre by Matuja and Makene (1989) showed that over a period of 12 months 13% of newly admitted patients had neurological diseases [12]. A retrospective study from Kwasa (1992) carried out in Kenya showed that neurological disorders made up for 7.5% of all medical conditions at the Kenyatta National Hospital [11].

In a Zambian hospital, Birbeck (2001) observed that 10% (186 patients) of the 1886 hospital admissions during a 13-week period were due to neurological diseases [2]. Interestingly, a recent study from two hospital sites in Ethiopia showed much higher hospital-based prevalences of 18% and 24.7%. Patients’ data were collected retrospectively, which may account for the difference in prevalence rates compared to the above studies [4]. Bearing in mind that in most studies in developing countries 10% of hospital admissions can be attributed to neurological disorders, a huge gap in terms of neurological care becomes evident when looking at the actual neurological services in African nations. Thirty-five of the 53 African nations have only few neurologists (1-4) or none at all [3]. Thus training of more neurologists who are familiar with the demands of resource poor settings seems to be crucial for the future health care of African countries. Also, teaching neurology in courses for clinical officers and medical assistants should become part of the curriculum. In our study, we found that neurological disorders not only contribute substantially to hospital morbidity but also to hospital mortality. 20% of all patients with a neurological diagnosis died in hospital. This compares to 21.8%

in a study on neurological diseases in Addis Ababa [4]. The average hospital stay was three weeks and patients paid on average 37 220 Tanzanian Shilling, which approximately amounts to US $ 37. This is more than what an average Tanzanian family earns in one month (income per capita: US $ 340 in 2005). This fact clearly emphasizes the socioeconomic burden of neurological disease with long hospital stay and huge financial expenses for the families. In the worst scenario, patients may remain disabled and depend on carers which, without social security, represents an additional burden for the already poverty stricken families. Thus, early recognition and early as well as effective treatment of neurological disease is of paramount importance.

Diagnosing neurological disease in resource poor settings Based on our working experience of many years within African neurological services, we have identified three major diagnostic groups according to the degree of diagnostic uncertainty (definitions see diagnostic criteria). Reassuringly, many patients (46%) could be diagnosed on clinical grounds alone or with the help of simple diagnostic tools, be it laboratory tests or x-ray examination. This is in accordance with findings from Addis Ababa where 42.9% of cases could be diagnosed with high certainty [4]. In 43% and 11% of our 740 patients minor and major diagnostic uncertainties remained, respectively. However, patients could be categorized according to syndromes, both known and unknown. If the clinical symptomatology was unknown a tentative syndromic description has been suggested, grouping together cases that clinically were similar.

Classifying neurological diseases in rural Africa is important in terms of diagnostic approach as well as therapy and prognosis. Diagnoses belonging to group 1 are important to recognize as early as possible in the disease process as often there are crucial therapeutic implications. It is of paramount importance that standard treatment regimes, often World Health Organization based, are adhered to. In the case of cerebral malaria and meningitis, there are clear diagnostic criteria [1, 22]. In most rural African hospitals, blood slide for malaria parasites are being performed and the core features of CSF can be analyzed. Recognition of diseases belonging to group 1 ideally leads to immediate life-saving treatment.

If diagnostic uncertainties remain such as in group 2, clinical skills are indispensable in order to make the right decision for further investigation and treatment. Referral to a tertiary medical centre may be necessary. The third diagnostic category (group 3) is that of “descriptive syndromic grouping”. Patients are summarized according to their most prominent symptoms/signs. These patients do not meet the criteria for any known neurological disorder, the diagnosis remains “obscure”. Serology (such as HIV) and/or imaging may give a clue, but in most rural African hospitals these are not at hand. In previous studies, these patients were classified as “miscellaneous” [13], and usually are not elaborated on any further, or they were excluded from analysis in the first place, underestimating the overall prevalence of neurological disease. In the age of sub-Saharan HIV epidemics, some of the patients of group 3, especially those with “obscure encephalopathies” may be assumed to suffer from HIV/AIDS related involvement of the central nervous system. When HIV testing became available, the area our study was conducted in was however identified as a low prevalence setting with prevalence of HIV in the general population of 1.8% [23]. Patients classifying for group 3 as a rule have a poor outcome with an on average 30% mortality in hospital. In our opinion, the only appropriate approach to these patients is early referral to tertiary health centres where proper medical work up and directed therapeutic approach is possible.

In summary, our study shows that neurological disorders are prevalent within a hospital population of rural Tanzania. Neurological disease is associated with high mortality, prolonged hospital stay and socioeconomic burden for the families. In our study, emphasis is put on a systematic approach suitable for a resource poor setting by grouping neurological disorders according to their diagnostic certainties.

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Table 1: Demographic details of patients with neurological disorders

No. of cases	740
Hospital-based prevalence per 1000	85.29
Age (years)	
Mean (SD)	26.4 (24.2)
Median	22.0
Range	1 day - 100
Gender	
Male	422 (57%)
Female	318 (43%)
Male/female ratio	1.3:1
Tribes	
Cushitic tribe	439 (59%)
Bantu tribes	183 (25%)
Nilotic tribe	76 (10%)
Unknown	42 (6%)
Hospital stay (days)	
Mean (SD)	21.6 (34.6)
Median	8.0
Range	0 - 249
Total costs (TSH)	
Mean (SD)	33 135 (36 975)
Median	20 950
Range	500 - 36 1500
Outcome	
Discharged	544 (74%)
Death	157 (21%)
Unknown	39 (5%)

SD: standard deviation, TSH:Tanzanian Shilling
1000 TSH = 1 US - Dollar (at the time of the study)

Table 2: Group 1: neurological disorders without diagnostic uncertainties

	Case numbers	% within the diagnostic group	Hospital based prevalence
Febrile convulsions	83	24.4	9.57
Meningitis	74	21.8	8.53
Epilepsy	65	19.1	7.49
Cerebral malaria	50	14.7	5.76
Pott's disease	22	6.5	2.54
Spina bifida	14	4.1	1.61
Hydrocephalus	12	3.5	1.38
Rabies	8	2.4	0.92
Peripheral nerve injury	5	1.5	0.58
Bell's palsy	5	1.5	0.58
Tetanus	2	0.6	0.23
Total	340	100	39.18

Table 3: Group 2: neurological disorders with minor diagnostic uncertainties

	Case numbers	% within the diagnostic group	Hospital based prevalence
Myelo-/radiculo-/plexo-/polyneuropathy	61	19.2	7.03
Head trauma with neurological impairment	55	17.3	6.33
Seizures other than epilepsy and febrile convulsions	49	15.4	5.65
Non-infectious encephalopathies	43	13.5	4.96
Cerebrovascular accident	33	10.4	3.80
Degenerative diseases	21	6.6	2.42
Dementia/mental retardation	19	6.0	2.19
Paroxysmal events	17	5.4	1.96
Space-occupying lesion	13	4.1	1.50
Myopathies	7	2.2	0.81
Total	318	100	36.65

Table 4: Group 3: neurological disorders with major diagnostic uncertainties

	Case numbers	% within the diagnostic group	Hospital based prevalence
Acute confusional state	40	48.8	4.61
Impairment of consciousness	26	31.7	2.99
Obscure encephalopathy	16	19.5	1.84
Total	82	100	9.45

Table 5: Demographic details of patients with major diagnostic uncertainties

	Acute confusional state (n=40)	Impairment of consciousness (n=26)	Obscure encephalopathies (n=16)
Age (years)			
Mean (SD)	42.8 (27.1)	34.2 (23.6)	28.5 (22.6)
Median	35.0	29.0	29.5
Range	4 - 97	0.5 - 75	0.5 - 80
Gender			
Male	17 (42.5%)	16 (62%)	10 (62.5%)
Female	23 (57.5%)	10 (38%)	6 (37.5%)
Male/female ratio	0.7:1	1.6:1	1.7:1
Tribes			
Cushitic tribe	26 (65%)	12 (46%)	11 (69%)
Nilotic tribe	3 (7.5%)	6 (23%)	3 (19%)
Bantu tribes	6 (15%)	6 (23%)	1 (6%)
Unknown	5 (12.5%)	2 (8%)	1 (6%)
Hospital stay (days)			
Mean (SD)	15.3 (21.9)	6.7 (9.2)	61.1 (50.5)
Median	7.5	3.0	51.0
Days (Range)	1 - 121	0 - 37	2 - 146
Total costs (TSH)			
Mean (SD)	34 717 (25 561)	32 980 (36 903)	65 816 (51 031)
Median	30 000	24 090	52 500
Range	3000 - 103 400	1400 - 160 000	6700 - 180 500
Outcome			
Discharged	33 (82.5%)	15 (58%)	9 (56%)
Death	7 (17.5%)	11 (42%)	5 (31%)
Unknown	-	-	2 (13%)

SD: standard deviation, TSH:Tanzanian Shilling
1000 TSH = 1 US - Dollar (at the time of the study)

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