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Epidemiological patterns of head injury in a newly established neurosurgical service: one-year prospective study

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Summary

Head injury is a disease afflicting mainly young males, and road traffic accident is the most common aetiologic factor. This report evaluates the findings in a one-year prospective study done from April 21, 2006 – April 20, 2007 in the first year of services in one of Nigeria's new neurosurgical Centres, to establish the baseline epidemiological patterns of head injury. Data was collected using a questionnaire from the point of presentation till discharge of each head injury patient, and augmented with theatre and out-patient records, and analyzed. The Glasgow Coma and Outcome Scales were used for grading. Our Centre is a tertiary health facility that receives referrals from private, primary and secondary facilities. Of the 334 total patients treated, 210 (62.9%) had head injuries. Males were 158(75.2%), and 145(69%) resulted from road traffic accident, mostly from motorcycles. Fractures were mostly basal 86(41%), brain pathology was mostly cerebral contusion 74(35.2%), and treatment mostly non-operative 137(65.2%), with good outcome in 144(68.6%). Mortality was 40(19.1%). Trauma is the main reason for neurosurgical consultation in our Centre and the unsafe use of roads, especially with motorcycles, remains the major cause of head injury.

Keywords: *Brain, fractures, motorcycle, outcome, trauma.*

Résumé

La blessure du crane est une maladie plus fréquent au jeune homme et l'accident routier est le facteur étiologique le plus commun. Ce rapport étudie les valeurs dans une étude prospective d'un an du 21 Avril 2006 au 27 Avril 2007 dans un nouveau centre chirurgical tertiaire au Nigeria recevant des malades referrés des centres privés, primaires et secondaires dans le but d'établir les fréquences des données de base épidemiologique des blessures craniénes.Les données collectées sous forme de questionnaire au point de presentation jusqu'a la décharge de chaque patient et d'autres patients ayant eu des chirurgies étaient analysés. Sur un total de 334 patients traités, 210(62.9%) avaient des blessures aux cranes. Ils y avaient 158(75.2%) males et 145(69%) femelles résultaient d'accidents routiers, la plupart des motorcyclistes. Les fractures étaient plus de base (41%), la pathologie du cerveau était plus des occulsions cérebrales 74(35.2%), et de traitement non chirugicale 137(65.2%) avec de bon résultat chez 144 (68.6%). Le taux de mortalité était de 40(19.1%). En conclusion le traumatisme est une raison fondamentale de la consultation neurologique dans ce centre et du mauvais usage des routes spéciallement des motorcyclites reste une cause majeure de blessure de crane.

Introduction

Head injury is trauma to the brain and/or its coverings as a result of an externally applied mechanical force. Among trauma patients, head injury is the most frequent cause of death [1,2,3]. It is a disease of young male adults, affecting mostly those under the age of 45years [4,5]. Worldwide, road traffic accident (RTA) is the most common aetiologic factor, though in the paediatric age group, falls at home cause more head injuries [6,7,8]. Lately however, some reports from Nigeria have demonstrated a rising incidence of RTA in paediatric head injury [9,10].

Cultural and social practices influence the aetiology of head injury, for instance, in countries under war and social strife missile injuries appear to be more prevalent, and before the pre-eminence of road transportation, falls from mules and camels were significant in countries where beasts of burden were used for transportation [11,5].

In Nigeria, remarkable social changes in the past 25years, have led to an extensive urban migration to the more industrialized cities necessitated by an elaborate economic downturn, making the migrant population more prone to road traffic accidents [12]. The reason for these migrations is not far fetched; according to the 2006 United Nations Development Programme, UNDP, Nigeria with a total of 0.448

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points, ranked 159th out of 177 countries in the Human Development Index compared to the highest ranked Norway with 0.965 points. Our Gross Domestic Product per capita is US$1154, compared to the highest, Luxembourg US$69,961[13]. Nigerians, daily, are rushing around struggling for means of livelihood, fighting for survival.

From 2004 to 2006, neurosurgical services were established in 3 new centres in Nigeria. In one of these new centres, we undertook a prospective study of head injury within the first year of our services, to document our baseline epidemiological pattern and reference data amongst the patients, and compare our findings with published reports.

Materials and methods

Data were collected from every head injured patient from the point of admission into the hospital by our neurosurgical team, and each patient was followed up till discharge to the out-patient clinic, and data analysis was done. Patients aged 0-15years were considered as paediatric, and those older than 15years as adult. Head injury in this study includes trauma to both the brain and its coverings including scalp, skull and meninges. Grading of head injury was with the Glasgow Coma Scale (GCS): 3-8 severe, 9-12 moderate, and 13-15 mild head injury, respectively. Computerized Tomography was requested in patients who met the standard criteria viz. severe head injury, lateralizing signs, clinical features of basal skull fracture and open head injury, plain x-ray evidence of depressed skull fracture, suspected intracranial collections, recurrent seizures, persistently impaired level of consciousness despite full resuscitation, fluctuating level of consciousness or deterioration in consciousness after an initial improvement. Outcome was determined with the Glasgow Outcome Scale (GOS) evaluated serially from the time of discharge to follow-up in the out-patient clinic: GOS1 – death; 2 – persistent vegetative state; 3 – severe neurological deficits; 4 – moderate neurological deficits, 5 – minimal deficits / full recovery. "Undetermined" cases were those patients that had focal neurological deficits but did not have further work-up, or those that had work-up but opted for treatment outside our facility – religious houses, native medication from herbalists, alternative medicine from homeopathic care providers or other orthodox health care facilities – for various reasons and persuasions. The patients, recruited for this study, were only those managed by the neurosurgical team and did not include those managed and discharged by the Accident and Emergency or General Out-Patient Units. Patients that died immediately on arrival were not included in the study. Our centre is a tertiary health facility that receives referrals from three of Nigeria's six geopolitical zones from an area covering the entire South-East, parts of North-Central and parts of South-South zones. It is located in a sub-urban town with very bad, collapsed internal road networks that necessitate the use of motorcycles as an easier, faster and cheaper mode of intra-city commuting than motor vehicles. It is made up mainly of semi-literate traders and entrepreneurs, who fabricate, import and sell tools and machinery, with a lot of preference for petty trading warranting a lot of road movements.

Results

Of the 334 patients treated in the first year of our services, head injury and its complications accounted for 210(62.9%). There was associated spinal injury in 13(6.19%) cases.

Of the 210 cases of head injury, males were 158(75.2%) and females 52(24.8%), giving a male:female ratio of 3:1. The paediatric age group was 52(24.8%) and adults 158(75.2%). The age distribution is shown in table 1.

Table 1: Age distribution of the head injury cases

Age range(years)	No.	%
0 – 15	52	24.7
>15 – 40	91	43.3
>40 – 60	44	21
>60	23	11
Total	210	100

Road traffic accident was the aetiologic factor in 145(69%), fall 44(21%), missile/falling object 11(5.24%) and assault 10(4.76%) of the cases. Of the 145 cases of RTA, 94(44.8%) were from motorcycle, and 51(24.2%) motor vehicular accidents.

Table 2: Injury grading using Glasgow Coma Score (GCS)

Injury grade	No.	%
Mild	144	68.6
Moderate	26	12.4
Severe	40	19.0
Total	210	100

Mild head injury was 144(68.6%), followed by severe 40 (19.1%) and moderate 26(12.4%). There were associated scalp injuries in 65(31%); and skull fractures in 106(50.5%) out of which 86(41%) were basal, 13(6.19%) depressed, and 7(3.33%) linear. Definitive diagnosis was made with clinical features and skull x-rays in 165(78.6%), and Computerized Tomography (CT) in 45(21.4%).

Table 3: Treatment modalities employed

Treatment	No	%
Non-operative	137	65.2
Operative	54	25.7
Craniectomy	12	5.71
Burr hole drainage	11	5.24
Craniotomy	10	4.76
Elevation/debridement	9	4.29
Exploratory burr holes	9	4.29
Scalp wound exploration	3	1.43
Undetermined	19	9.05
Total	210	100

Amongst those with traumatic brain injury, cerebral contusion was the most frequent pathology 74(35.2%), followed by cerebral concussion 59(28.1%), chronic subdural haematoma 13(6.19%), acute extradural haematoma 9(4.29%), subarachnoid haemorrhage 4(1.91%) and intracerebral haematoma 2(0.95%). With only 45 cases evaluated by CT the rest of the diagnosis were made either intra-operatively after exploration, or clinically – whereby neurological deficits that resolve within 72 hours are regarded as concussion and persisting deficits beyond 72hours, or clearly focal deficits are regarded as contusion. There were 17(8.1%) undetermined cases, and amongst the diagnosed cases, some had more than one pathology, each.

Treatment was non-operative in 137(65.2%), and operative in 54(25.7%), while 19(9.05%) cases opted for treatment outside our facility. Of the operated cases, craniectomy was done in 12(5.71%), Burr hole drainage 11(5.24%), craniotomy 10(4.76%), elevation/debridement 9(4.29%) and scalp wound exploration 3(1.43%). There were 9(4.29%) cases of exploratory Burr holes, out of which 7(3.33%) gave a positive yield. Five of the explorations were subsequently extended to either craniotomy or craniectomy, while 2(0.95%) had combined craniotomy and craniectomy.

Outcome was good in 144(68.6%), moderate deficits 4(1.91%), severe deficits 2(0.95%), persistent vegetative state 1(0.48%), and death 40(19.1%). Amongst those with good outcome, 120(83.3%) had mild, 18(12.6%) had moderate and 6(4.17%) had severe head injuries.

Discussion

Head injury has remained a major cause of morbidity and mortality in the young adult male worldwide and our figures of 75.2% males, and 43.3% aged >15-40years very closely correlate with other reports [14,15,4]. The male:female ratio of 3:1 in this study, is similar to the finding by Muhammad, Bahloul, Thanni, and others, reporting that more males suffer head injury [16,14,15]. Also, the adult:paediatric ratio of 3:1 was noteworthy in showing the trend of more affliction of adults than children. Perhaps, the inclusion of cases with intracranial collections like chronic subdural haematoma, known to be prevalent in the elderly, could have contributed to our higher adult ratio.

Road traffic accident constituted the main aetiologic factor, accounting for 69%, followed by fall 21%, similar to the report of other workers [17,18,14,15,19]. In our sub-urban community which is basically a trading town requiring a lot of movement of human and material resources, with very few academic and training institutions, and with practically no recreational facilities, it was understandable that road traffic accident was the main cause of morbidity, whereas there were no sport-related or recreational injuries which in Greenberg's report constituted 10% of aetiologic factors [19]. On account of the dwindling means of livelihood and the resultant drop in standard of living, Nigerians spend their lives fighting for survival, not having time for recreation or holidays which they regard as luxury but which are known to promote the quality of life. Recreational injuries were not recorded in any of our cases during this study. This, indirectly, is an indictment on the social life of the average Nigerian, and also a direct statement on the dismal average life expectancy in our nation which has decreased from 51years in 1992 to 43.4years in 2004 [20]. Among the cases of road traffic accident, more remarkable was the fact that a major proportion of these 94(44.8%) resulted from motorcycle accidents, compared to 51(24.2%) from motor vehicles, giving a motorcycle:motor vehicle ratio of 1.8:1. This observation of high case incidence from motorcycles has recently been reported by Adogu,

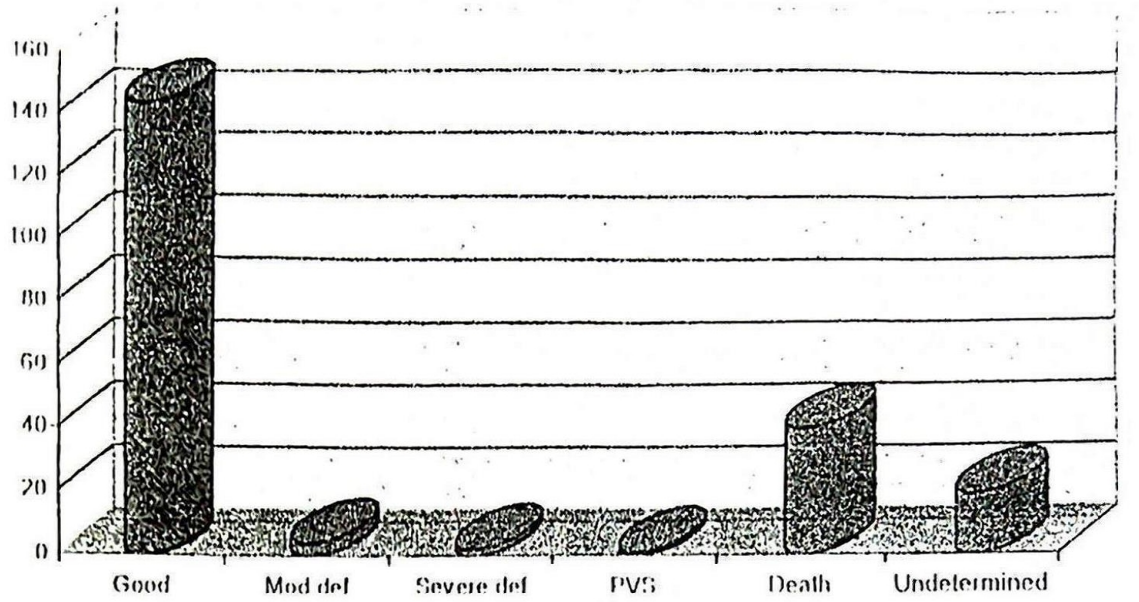

Fig. 1: Outcome from treatment of head injury in real numbers

Key:
PVS Persistent Vegetative State

Adesukanmi, and Oginni, *et al*, in their different series. They observed that commuting with motorcycles, whose riders are barely knowledgeable on the safe use of these machines, has become a major factor in road transportation and accidents in the country [10,21,22].

Most of our cases had mild head injury, and focal cerebral contusion was the most common traumatic brain injury, similar to reports by Csepregi and others [23,24,25,26,27]. There were associated skull fractures in 50.5% of our cases, but more interesting was the finding that a majority of these were basal fractures (86/106 or 41% of all our head injury cases), and not linear - calvarial. In the report by Ogunseinde, *et al*, most of their fracture cases were linear (17.4% of 419), while Greenberg reported 90% of paediatric skull fractures as linear [28,19]. The import of this is not clear to us except that most of our patients got knocked off their motorcycles, landing straight on the rough roads without any form of protection, as none of them wore crash helmets at the time of each accident. The other possibility, which appears unlikely, perhaps, is that these other previous reports had ignored the fact that the definitive diagnosis of basal skull fracture is better made from clinical features and plain skull radiography rather than Computerized Tomography (CT).

Clinical features and plain radiography were the mainstay of diagnosis in our service. This was due to the lack of CT facilities in our centre and the lack of funds on the part of the patients to afford such services from private facilities. This, we recognize, could have improved management and outcome.

Our low incidence of spinal injury of 6.2% is in keeping with historical reports that put the association of significant spinal injury with head injury at 4-5% [19].

Being predominantly mild injuries (68.6%), most of our cases were managed non-operatively (65.8%), and outcome was expectedly good in a majority of cases (68.6%). Majority, of those with good outcome, 120(83.3%), had mild head injury. However, the mortality rate of 19.1% appeared rather high, and most were males (14.3%), aged >15-40years 9.52%, and almost all were severely injured (13.3%). This finding, to a great extent, corroborates the reports by Bruns and Hauser and several others, that severity of brain injury influences outcome significantly [5,7,9,10,19]. Nonetheless, our fatalities were possibly contributed to by the various logistic problems attendant in a new setting such as ours, including the unavailability of ready CT services, and where most of the workers especially among the laboratory, emergency room, radiology and theatre units were still getting to understand the peculiar and intricate demands of head injury care; a trend which we expect to overcome in our subsequent series. It is quite interesting to note that nearly half of the fatal cases (8.57%) resulted from motorcycle accidents

alone. Ten (4.76%) deaths resulted from fall, 3.81% from motor vehicular accident, and 1.91% assault.

Conclusion

Head injury, mostly basal skull fracture, constitutes the main neurosurgical workload in our service, and road traffic accident, particularly from the unsafe use of motorcycles, was the major aetiologic factor. Stringent legislations need to be enacted and implemented to protect Nigerians from the carnage caused by motorcycles, and for procurement of modern facilities for optimal health care delivery.

References

1. Inter-agency Head Injury Task Force Reports. National Institute of Neurological Disorders and Stroke; National Institutes of Health, Bethesda, MD, 1989.
2. Kemp A, Sibert J. Childhood accidents:epidemiology, trends and prevention; Journal of Accident and Emergency Medicine 1997 Sep; 14:316-320.
3. Reed RL II. Resuscitation of multiply injured patient. In Wilkins RH, Rengachary SS [eds]. Neurosurgery 2nd ed; MacGraw-Hill, New York 1996.
4. National Centre for Health Statistics. Advance report of final mortality statistics 1985; Washington DC: US Government Printing Office, 1987.
5. Bruns J and Hauser WA. The epidemiology of traumatic brain injury: a review: Epilepsia 2003, 44 (Suppl 10):2-10.
6. Bruce DA. Pediatric head injury. In, Wilkins RH, Rengachary SS [eds], Neurosurgery 2nd Ed, McGraw-Hill New York 1996, pp2709-2715.
7. Ingebrigtsen T, Mortensen K, Romner B. The epidemiology of hospital - referred head injury in northern Norway; Neuroepidemiology 1998, 17:139-146.
8. Greenes DS and Schutzman SA. Infants with isolated skull fracture:what are their clinical characteristics and do they require hospitalization? Ann Emerg Med 1997 Sep, 30:253-259.
9. Odebode TO and Abubakar AM. Childhood head injury: causes, outcomes and outcome predictors: A Nigerian perspective, Pediatr Surg Int 2004 May, 20:348-352.
10. Adesukanmi AR, Oginni LM, Oyelami AO and Badru OS. Epidemiology of childhood injury; J Trauma 1998 Mar, 44:506-512.
11. Ansari S and Al Moutaery K. An unusual cause of depressed skull fracture:case report; Surg Neurol 1999 Dec, 52:638-640.
12. Nigerian Demographic Trends; Encyclopaedia Britannica.htm [online].
13. United Nations Development Programme, Human Development Indicators 2006 – Country Fact Sheets-Nigeria.htm.
14. Bahloul M, Chelly H, Ben Hmida M, Ben Hamida C, Ksibi H, Kallel H, Chaari A, Kassis M, Rekik N and Bouaziz M. Prognosis of traumatic head injury in South Tunisia: a multivariate analysis of 437 cases. J Trauma 2004; 57:255-261.
15. Thanni L. Evaluation of guidelines for skull radiography in head injury. Niger Postgrad Med J. 2003; 10:231-233.
16. Muhammad I. Management of head injuries at the ABU Hospital Zaria, East Afr Med J 1990 Jun; 67:447-451.
17. Kolenda H and Reparon C. Head Trauma. In, Palmer JD [ed], Manual of Neurosurgery, Churchill Livingstone, New York 1997, 501-582.
18. El-Shunnar KS. Head Trauma. In, Palmer JD [ed], Manual of Neurosurgery, Churchill Livingstone, New York 1997, 501-582.
19. Greenberg MS. Head trauma; Handbook of Neurosurgery 5th ed; Thieme, New York 2001; pp626-689.
20. Culturelink. Cultural Policy in Nigeria.htm; IMRO/Culturelink 1996.
21. Adogu OU and Ilika AL. Knowledge of and attitude towards road traffic codes among commercial motorcycle riders in Anambra State; Niger Postgrad Med J 2006 Dec, 13:297-300.
22. Oginni FO, Ugboko VI and Adewole RA. Knowledge, attitude and practice of Nigerian commercial motorcyclists in the use of crash helmet and other safety measures; Traffic Inj Prev 2007 Jun, 8:137-341.
23. Csepregi G, Buki A, Futo J, Sandor J, Gobl G and Doczi T. Management of patients admitted with severe head injury in Hungary in 2002, Orv Hetil 2007 Apr 29, 148:771-777.
24. Flannagan PP and Bailes JE. Neurological Injury in Athletes. Contemp Neurosurg, 20:1-7.
25. Adams JH, Gennarelli TA and Graham DI. Brain damage in non-missile head injury: observations in man and subhuman primates; In Smith W, Cavanagh JB [eds]. Recent advances in neuropathology; Churchill Livingstone, Edinburgh, 1982 pp165-190.

26. Gennarelli TA. Head injury in man and experimental animals: clinical aspects; Acta Neurochir [Wien] Suppl 1983; 32:1-13.
27. Foulkes M, Eisenberg HM, Jane JA, *et al.* The Traumatic Coma Data Bank: Design, methods and baseline characteristics. J Neurosurg 1991; 75:S8-S13.
28. Ogunseyinde AO, Obajimi MO and Ogundare SM. Radiological evaluation of head trauma by Computer Tomography in Ibadan, Nigeria, West Afr J Med 1999 Jan-Mar, 18:33-38.

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