Original article

Indian Journal of Neurotrauma (IJNT)
2011, Vol. 8, No. 1, pp. 1-6

Inter-hospital transfer for neurosurgical management of mild head injury in a developing country: A needless use of scarce resources?

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Abstract: Some authorities in the world's industrialized nations now believe that the care of patients with mild (and even some moderate) head injury (MiHI) in general is an unnecessary additional burden on their already over-tasked neurosurgical workforce. There is a high rate of inter-hospital transfer for neurosurgical evaluation of cases of MiHI in Nigeria, an African developing country. This may be needless in many cases. We therefore conducted a prospective in-hospital cohort study of cases of MiHI managed in a new neurosurgical service in a Nigerian university teaching hospital over an 8-month period. Clinical and in-hospital outcome characteristics of the cases were analysed and presented in descriptive statistics. Subgroup analysis was then carried out between cases presenting directly post-trauma in our unit and those referred to us for neurosurgical management from other health facilities. Inferences were made based on the chi-squared test and the 2-tailed t-test, and the significant level was set at $p < 0.05$. Eighty-four cases of MiHI were analysed, 72 males, 12 females. The causative trauma was road traffic related in 65.5%, and 25.0% had other extracranial injuries. The admission GCS was 14 or 15 in 93%. Seventy percent of the cases were referred from other (including tertiary) medical facilities. With mean length of stay of 6.15 days, the over-all in-hospital good vs poor outcome rates were 97.6 vs 2.4% on the dichotomised GOS. There was no significant difference ($p > 0.10$) between the two subgroups with respect to either the post treatment in-hospital outcome variables, or in their clinical determinants.

Majority of the cases of mild head injury that were so treated in this study population did not need the inter-hospital transfer for neurosurgical management. Large studies are needed to determine the clinicopathologic indices predictive of the few cases that may be an exception to this assumption.

Keywords: developing country; mild head injury; neurosurgical referral.

INTRODUCTION

The sheer number of the yearly incidence of head injuries (HI) is now known to be overwhelming even to the well developed trauma care systems of the industrialised nations[1-2]. For instance, there are 1.5 million new cases of HI each year in the US and approximately 90% of these are mild head injuries (MiHI) [2-3]. Yet, in spite of their luxurious supply of neurosurgeons relative to many of the world's low-middle income countries (LMIC) [4-5], concerns about this overwhelming burden of HI have raised the question of whether the care of the majority of cases of MiHI (and even many cases of moderate and severe HI) is not really a needless drain on the functional availability of the neurosurgical workforce of America and the Western European countries[6-7].

This question is even more imperative in the LMIC. In the face of gross under-supply and or actual non-availability in many instances of a neurosurgical workforce, head injury is actually more rampant in these regions and usually constitutes a large fraction of the neurosurgical workload[4, 8]. Nonetheless, majority of these cases also have only MiHI and their management outcomes in many of the LMIC have been found to be comparable with, if not actually better than, outcomes in the industrialised nations[9-10]. An earlier study by us in which the majority had only MiHI showed that a high percentage of our head injury cohort had been seen in other medical facilities, including other tertiary health centres, before their inter-hospital referral to us for neurosurgical management[9].

This is a prospective cross-sectional study with an attempt to answer the question of whether much of this

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neurosurgical referral was needful in the cases of MiHI. It is hypothesised that inter-hospital transfer for neurosurgical consultation and management would be unnecessary for the majority of MiHI in our neurosurgical resource-poor practice setting of a developing country, Nigeria.

MATERIALS AND METHODS

Information on the cases of MiHI was extracted from our prospectively gathered data base of HI managed in the neurosurgery unit of the Lagos State University Teaching Hospital, Ikeja, Nigeria between May and December 2005. The recruit of the study subjects was halted when the principal investigator proceeded on a 2-year fellowship programme abroad. The data already gathered was then later analysed with the SPSS version 14 worksheet (SPSS Inc, Chicago Illinois).

We determined the gender and age distribution, cause of trauma, first medical contact apart from our hospital and the duration of time spent there, time from accident to arrival in our unit, the Glasgow Coma Scale (GCS) score on admission and presence / distribution of major extracranial systemic injury. We also observed for the in-hospital presence of some outcome determinants including presence and duration of loss of consciousness (LOC), derangements in systemic blood pressure, fever, and pupillary asymmetry. Outcome variables were the need for and the type of definitive neurosurgical interventions, length of hospital stay, and outcome at discharge from the hospital using the Glasgow Outcome Scale (GOS).

Descriptive statistical analysis was by frequency distribution and percentages for categorical variables, and mean (standard deviation) for continuous variables. Subgroup inferential statistical analysis was then done between the cases that presented de novo to our neurosurgical unit from the scene of accidents compared with those that had been seen in other health facilities before inter-hospital referral for our neurosurgical management. Categorical variables were explored with the Pearson's chi-squared test while continuous variables were analysed with the 2-tailed t-test. The level of statistical significance was set at a p-value of less than or equal to 0.05.

RESULTS

Eighty-five cases of MiHI were documented by us in this study period. One case with incomplete data was excluded from this analysis. The remaining 84 cases consisted of 72 males (86%) and 12 females (14%), male/female ratio of 6 to1. The age range was 1 to 80 years, with mean of 27.17(17.03) years. The cause of trauma was road traffic related in 55 cases (65.5%); the other causes were falls, assaults and gunshot injury in 29 (34.5%). Major extracranial systemic injury was present in 21 cases (25%) involving the long bones/pelvis, spine, chest and abdomen.

25 cases (about 30%) were moved directly post-trauma to our unit whilst the remaining 59 (70%) had reported to other health facilities before their inter-hospital transfer to out unit for neurosurgical management. Of these 59 cases involving inter-hospital transfer, 23 (39%) had been seen in either district general or other tertiary medical centres. The mean duration of stay in these initial health facilities was 19.65(30.74) hours and the mean time from trauma to presentation in our unit for this cohort was 52.05(67.38) hours compared with the same time of 13.74(13.98) hours for the cases moved directly to our unit ($p < 0.001$)

DETERMINANTS OF OUTCOME

The GCS on admission was 15 and 14 respectively in 39 cases (46.5%) each, and 13 in 6 cases. There was presence of LOC in 69 cases (82.1%) with mean duration of LOC being 14.78(17.85) hours. Fever, pupillary asymmetry, and systemic BP derangements were respectively documented in only 4 (4.8%) cases each.

Two patients (2.4%) with associated major systemic injuries had poor outcome on the dichotomised GOS (1 death, mortality rate 1.2%, and 1 case with severe deficit). The rest made good recovery at discharge from the hospital including 60.7% in normal status and 36.9% with moderate deficit (that is 97.6% good outcome on dichotomised GOS). The mean length of hospital stay was 6.15(8.56) days and, 65 cases (77.4%) were discharged within a week.

Subgroup analysis

Based on clinical evaluation and the findings on cranial computed tomography (CT) scanning (obtained in only 13 of the 46 (28.3%) cases in whom it was requested), neurosurgical operations were performed in only 5 cases. These happened to be among the patients that had been referred from other health facilities. This represented 8.5% of this subgroup or 6.0% of the whole MiHI cohort in this study. The neurosurgical procedures

included craniotomy and evacuation of intracranial mass lesions in 2 cases (2.4%) and craniectomy /elevation of open depressed skull fractures in 3 cases (3.6%). One of the two cases that had craniotomy for evacuation of intracranial mass lesions had significant epidural haematoma; while the other case had a large 6 by 5cm traumatic intracerebral haematoma. None of them had other systemic injury. This subgroup difference in the surgical intervention rates however did not reach statistical significance (p value, Fisher's exact test, 0. 16)

When cases of MiHI presenting directly to our unit were compared with those that had first presented elsewhere, the mean time to discharge from hospital, 7.10(10.90) vs 5.76(7.48) days, showed no significant difference (p >0.05). The difference in the good vs poor outcome (dichotomised GOS) rates was not significant either, 100/0% vs 97/3% (p >0.1). In the same vein, only systemic BP derangement among the clinical determinants of outcome analysed revealed significant difference (p <0.05) in the rates of occurrence between the two groups, Table 1. The clinical significance of this difference in the occurrence of the systemic BP derangement is not apparent to us. And the fact that the presence of associated major extracranial systemic injury nearly significantly worsened outcome (p= 0.06) was the only other noteworthy finding in this analysis, Table 2.

DISCUSSION

This is a hospital based prospective study of mild head injury, MiHI, in a metropolitan neurosurgical unit in Nigeria, a developing African nation. The main thrust of this work was to determine the reason for and the necessity of inter-hospital transfer for neurosurgical care in this cohort of patients. The one definite necessity for this transfer identified in this study appears to be only the presence of open depressed skull fracture as seen in 3.6% cases or cranial CT documented evidence of intracranial mass lesions in 2.4%. Otherwise, following what essentially had required no specific neurosurgical intervention in the majority (94%) of the cases, the in-hospital outcome was very good. About 98% made good recovery following in-hospital care that was less than a week in close to 80% of the cases. Yet some 70% of these cases of MiHI had received initial care in other health facilities, including some other tertiary and university hospitals, with a mean length of stay in these other units of about 20 hours before they were referred, inter-hospital, for our neurosurgical management.

Table 1: Determinants of outcome compared between the two subgroups of mild head injury based on first medical contact

Variable	First medical contact our unit (%)	First medical contact other hospitals (%)	P value (Fisher's exact test)
Loss of consciousness			
Present	23 (92.00)	46 (78.00)	>0.10
Absent	2 (8.00)	13 (22.00)	
Fever			
Present	1 (4.00)	3 (5.10)	>0. 10
Absent	24 (96. 00)	56 (94. 90)	
Blood pressure derangement			
Present	4 (16. 00)	0 (0.00)	0.007
Absent	21 (84.00)	69 (100.00)	
Systemic injury			
Present	7 (28.00)	14 (23.70)	>0.10
Absent	18 (72.00)	45 (76.30)	
Pupillary asymmetry			
Present	1 (4.00)	3 (5.10)	>0.10
Absent	24 (96.00)	56 (94.90)	

Table 2: Extracranial systemic injury and outcome from mild head injury in Nigeria

Systemic injury	Good outcome	Poor outcome (%)	P value (Fisher's exact test)
Present	19 (90.5)	2 (9.5)	0.06
Absent	63 (100.0)	0 (0.0)	

Figures in parentheses are percentages

In the light of what is known globally about the care of MiHI and the peculiar constraints of the LMIC (including very low cranial CT scanning rate which was only 28% of the cases where it was needful in this series), it would appear to us that much of this inter-hospital transfer was really not needful.

The global picture

Head injury is indeed a global pandemic with such a big drain on health care resources that even the well funded health systems of the highly developed nations are already reeling under its imponderable weight[6, 10]. About 1.5 million cases of HI are recorded annually in the US, generating at least 1 million emergency room visits[2]. Four thousand new cases of HI occur yearly in Australia, and it is responsible for1 million hospital admissions per year in the European Union[3]. The picture is less clear in many of the LMIC. It is however known that HI is even a more untrammelled epidemic in these regions[3-4, 10-13].

One salutary offshoot of this grim statistics of HI however is the fact that majority of these new cases of HI are actually MiHI[1]. In fact, the mild-moderate-severe

ratio of HI in the EU has been put at 22:1.5:1[3]. In addition, not only does it usually turn out that only a very small, even statistically insignificant fraction of these need any specific neurosurgical intervention, a large percentage of the MiHI cases respond very well to short-stay hospital care even without any neurosurgical supervision of that care[1, 6, 14-15].

With these latter points in mind, and given the sheer number of the cases involved yearly as above, it is now already being strongly debated whether the American neurosurgical workforce (deemed, in spite of its enviable size, to be functionally overburdened) should not now be relieved of the extra workload of the care of MiHI. It is also being suggested that trauma surgeons and other cadres of physicians be credentialed / trained to take on this essential care [1, 6-7, 16].

These are compelling issues for debate in Nigeria and all of the LMIC with the extra-acute burden of HI as noted. On one hand and similar to the statistics from the industrialized nations discussed above, MiHI constitutes a great percentage of the burden of the regions' HI, and has very good outcome[10, 17]. It constituted 60% of our earlier study of HI in the same unit and had good vs poor outcome rates of 97.6 vs 2.4%.[9] It has actually been implied that mild and moderate HI may have better prognosis in the peculiar socio-cultural milieu of the LMIC[10].

On the other hand, neurosurgical services are so short in supply; indeed are virtually unknown in some parts of the LMIC [5, 18] that unregulated inter-hospital referral for neurosurgical care of MiHI in these regions may indeed be a needless use of such precious resources. Our study showed just such a high rate, 70%, of inter-hospital referral, sometimes across the same hazardous highway traffic terrains on which the index trauma was sustained. This is in agreement with the findings of other workers in similar practice environment as ours[11].

Finally, whereas the major assumption of this study is that the majority of cases of MiHI do not need inter-hospital transfer for neurosurgical management in the LMIC, it is somewhat noteworthy that the few cases that did need neurosurgical intervention in this analysis were actually amongst the referrals; hence they could be said to have actually benefitted from this referral. And the clinical significance of this fact (in spite of its statistical insignificance in our analysis) could not but be of great importance to the respective patients. It would have been beneficial therefore to determine the other clinicopathological features, apart from open depressed skull fractures, that may be predictive of such cases whose neurosurgical consultation would thus be imperative. This study failed to show any of such other predictive features probably due to the small number of the cases involved.

Consequently, larger, multicenter, studies may be necessary in the developing countries to clarify this clinically significant point. Many studies have tried to address this issue even in the industrialised nations[1, 19]. One practical, if not farfetched, solution to this problem in the meantime however might be a properly tooled health system that allows for telemedicine consultation with the regional neurosurgical centre for decision making in this regard[6-7, 20]. Such has been documented from South Africa[17]. Without doubt, increased utilization of cranial CT scanning in the initial evaluation of the head injured in many of these referring institutions would be a major initiative in this regard[3, 4, 9]. Another suggestion that has been made for the US is the training of non-neurosurgeons in the performance of some basic life saving neurosurgical trauma procedures like emergency burr holes and craniotomy[16]. If this is a needful proposition in places with coveted supply of neurosurgeons, it may be even more compelling in the LMIC in which many centres already manage HI in the absence of neurosurgeons[21-24].

CONCLUSION

The majority of cases of MiHI do not need inter-hospital transfer for neurosurgical management in the LIMC in many of which neurosurgical services are actually rare luxuries. Increased availability of cranial CT scanning capability in the near future in many of the secondary and tertiary hospitals for the initial evaluation of the head injured should help greatly in reducing the rate of inappropriate neurosurgical referral of MiHI.

There is need for large, multicenter studies to determine the clinicopathologic indices, apart from open depressed skull fracture, predictive of the small fraction of cases that may be an exception to this assumption. The training of non-neurosurgeons in the proper clinical evaluation/management of uncomplicated mild/moderate HI, and in the performance of some life saving basic neurosurgical trauma procedures may be a compelling proposition in the LMIC.

Declarations: There was no conflict of interest for us to declare concerning the execution of this clinical research work.

REFERENCES

1. Clement CM, Stiell IG, Schull MJ. et al. Clinical features of head injury patients presenting with a Glasgow Coma Scale score of 15 and who require neurosurgical intervention. *Ann Emerg Med* 2006; 48:245-51.
2. Zitnay GA, Zitnay KM, Povlishock JT, et al. Traumatic brain injury research priorities: the Conemaugh International Brain Injury Symposium. *J Neurotrauma* 2008; 25:1135-52.
3. Hyder AA, Wunderlich CA, Puvanachandra P, Gururaj G, Kobusingye OC. The impact of traumatic brain injuries: a global perspective. *NeuroRehabilitation* 2007; 22:341-53.
4. Basso A, Previgliano I, Duarte JM, Ferrari N. Advances in management of neurosurgical trauma in different continents. *World J Surg* 2001; 25:1174-8.
5. El Khamlichi A. African neurosurgery: current situation, priorities, and needs. *Neurosurgery* 2001; 48:1344-7.
6. Esposito TJ, Reed RL, 2nd, Gamelli RL, Luchette FA. Neurosurgical coverage: essential, desired, or irrelevant for good patient care and trauma center status. *Ann Surg* 2005; 242:364-70; discussion 70-4.
7. Huynh T, Jacobs DG, Dix S, Sing RF, Miles WS, Thomason MH. Utility of neurosurgical consultation for mild traumatic brain injury. *Am Surg* 2006; 72:1162-5.
8. Emejulu JK. Epidemiological patterns of head injury in a newly established neurosurgical service: one-year prospective study. *Afr J Med Med Sci* 2008; 37:383-8.
9. Adeleye AO, Olowookere KG, Olayemi OO. Clinico-epidemiological profiles and outcomes during first hospital admission of head injury patients in Ikeja, Nigeria. A prospective cohort study. *Neuroepidemiology* 2009; 32:136-41.
10. De Silva MJ, Roberts I, Perel P, et al. Patient outcome after traumatic brain injury in high-, middle- and low-income countries: analysis of data on 8927 patients in 46 countries. *Int J Epidemiol* 2009; 38:452-8.
11. Joshipura MK, Shah HS, Patel PR, Divatia PA, Desai PM. Trauma care systems in India. *Injury* 2003; 34:686-92.
12. Raja IA, Vohra AH, Ahmed M. Neurotrauma in Pakistan. *World J Surg* 2001; 25:1230-7.
13. Otieno T, Woodfield JC, Bird P, Hill AG. Trauma in rural Kenya. *Injury* 2004; 35:1228-33.
14. Eguare E, Tierney S, Barry MC, Grace PA. Management of head injury in a regional hospital. *Ir J Med Sci* 2000; 169:103-6.
15. Stranjalis G, Bouras T, Korfias S, et al. Outcome in 1,000 head injury hospital admissions: the Athens head trauma registry. *J Trauma* 2008; 65:789-93.
16. Esposito TJ, Luchette FA, Gamelli RL. Do we need neurosurgical coverage in the trauma center? *Adv Surg* 2006; 40:213-21.
17. Zulu BM, Mulaudzi TV, Madiba TE, Muckart DJ. Outcome of head injuries in general surgical units with an off-site neurosurgical service. *Injury* 2007; 38:576-83.
18. Ohaegbulam SC. Half a century of neurosurgery in Nigeria. *Afr J Med Med Sci* 2008; 37:293-302.
19. Thiruppathy SP, Muthukumar N. Mild head injury: revisited. *Acta Neurochir (Wien)* 2004; 146:1075-82.
20. Ashkenazi I, Haspel J, Alfici R, Kessel B, Khashan T, Oren M. Effect of teleradiology upon pattern of transfer of head injured patients from a rural general hospital to a neurosurgical referral centre. *Emerg Med J* 2007; 24:550-2.
21. Liko O, Chalau P, Rosenfeld JV, Watters DA. Head injuries in Papua New Guinea. *P N G Med J* 1996; 39:100-4.
22. Muhammad I. Management of head injuries at the Abu Hospital, Zaria. *East Afr Med J* 1990; 67:447-51.
23. Muyembe VM, Suleman N. Head injuries at a Provincial General Hospital in Kenya. *East Afr Med J* 1999; 76:200-5.
24. Thanni LO, Kehinde OA. Trauma at a Nigerian teaching hospital: pattern and docu-mentation of presentation. *Afr Health Sci* 2006; 6:104-7.