

IMPACT OF HELMET ADOPTION ON NEUROTRAUMA INCIDENCE IN MOTORCYCLE ACCIDENTS IN SOUTHEAST NIGERIA

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Abstract: Trauma, particularly neurotrauma encompassing cranio-spinal injuries, constitutes a significant global health burden, contributing substantially to morbidity and mortality rates, especially among young males. This abstract synthesizes evidence from various studies highlighting the prevalence and demographics of neurotrauma, underscoring its prominence as a leading cause of death among adults under 45 years of age.

A comprehensive review of the literature reveals that a substantial portion of head and spinal injuries occur in individuals under 30 years old, predominantly attributable to Road Traffic Accidents (RTAs). The male predominance in neurotrauma, with a male-to-female ratio of 1.7:1 for head injuries and 4:1 for spinal injuries, underscores the gender-specific risk factors associated with traumatic injuries.

Drawing on findings from Adesukanmi et al. (1998), Kemp and Sibert (1997), Solagberu et al. (2003), and other cited sources, this abstract emphasizes the urgent need for targeted interventions and preventive measures to address the burden of neurotrauma, particularly among young males.

Keywords: Trauma, neurotrauma, cranio-spinal injuries, Road Traffic Accidents, morbidity, mortality.

INTRODUCTION

Trauma is a major cause of morbidity and mortality worldwide, with neurotrauma (cranio-spinal trauma) accounting for a significant proportion of injuries in patients with multiple traumas, especially among the young males; it is also the most common cause of death in adults less than 45 years of age (Adesukanmi et al., 1998; IHITFR, 1989; Kemp and Sibert, 1997; Le et al., 2006; Reed, 1996; Solagberu et al., 2003). Over half of head and spinal injuries occur in the <30-year-olds, most of them resulting from Road Traffic Accidents (RTA), with a male: female ratio of 1.7:1 for head, and 4:1 for spinal injuries, respectively (Adeolu et al., 2005; Al-Fallouji, 1999; CDCP, 2001; Ingebrigsten et al., 1998; Kolenda and Reparón, 1997; Muhammad, 1990; NCHS, 1987).

The incidence rate of head injuries is far more than spinal injuries and, in most series, RTA is the leading cause of neurotrauma with motor

vehicular accidents accounting for most of the case (Adeolu et al., 2005; Adesukanmi et al., 1998; Nwadinigwe, 2004; Odebode and Abubakar, 2004; Solagberu, 2002). Some studies have, however, shown that falls are the predominant cause in extremes of age, that is, in the very young and in the very old patients (Ingebrigsten et al., 1998; Pandey et al., 2007).

The incidence and effects of trauma have decreased in some developed countries where appropriate traffic programmes and laws have been implemented, unlike in most developing countries (Adeolu et al., 2005; Falope, 1991).

In our centre, which is one of Nigeria's new neurosurgical centres (services were commenced in April 2006), we undertook a 30-month retrospective study of neurotrauma patients to evaluate the etiological patterns and thus, ascertain the impact of motorcycles, the most common mode of intra-city commuting in South-East Nigeria.

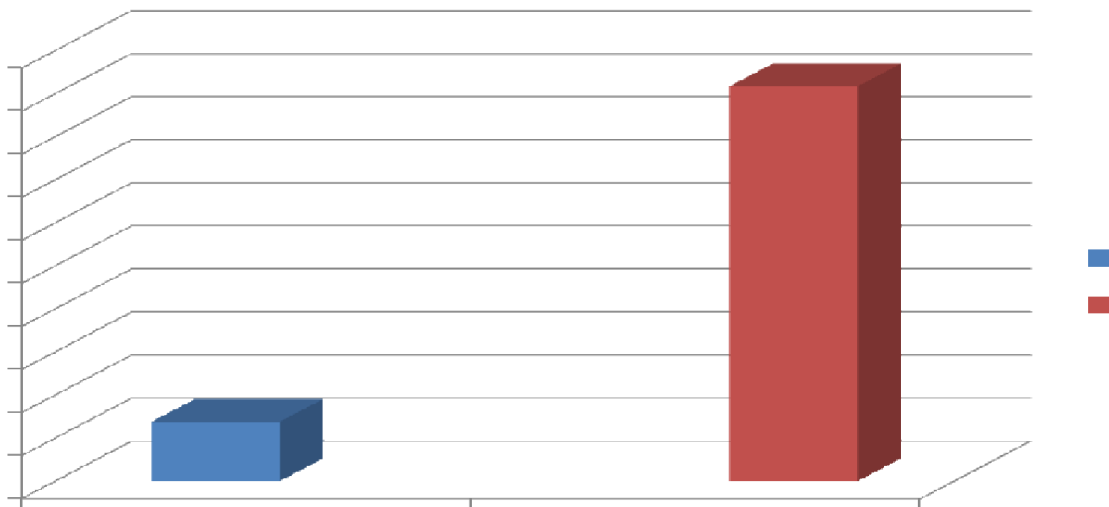


Figure 1. Aetiologic distribution of all neurological diseases.

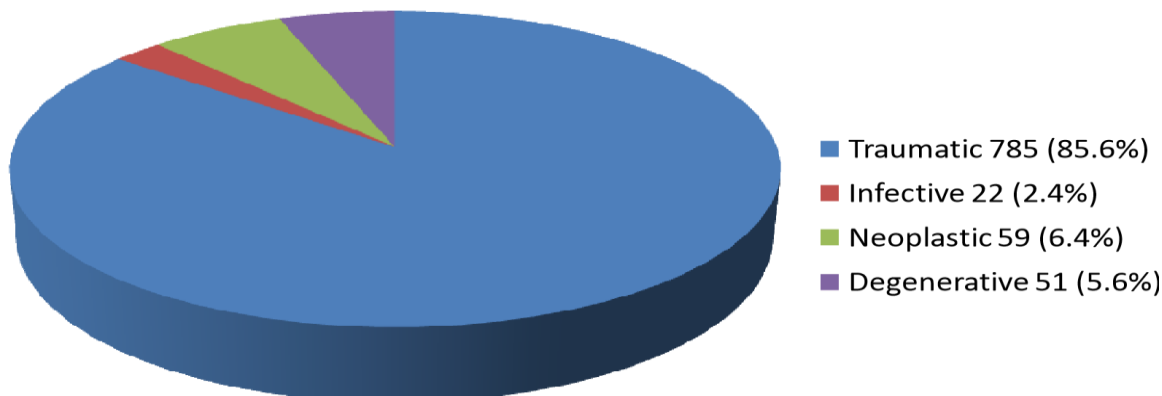


Figure 2. Aetiologic distribution of patients with acquired (non-congenital) diseases.

PATIENTS AND METHODS

This is a retrospective study of all consecutive neurotrauma patients from 21st April, 2006 to 20th October, 2008 (the first 30 months of service). The demographic data, etiologies and diagnoses were collected from the case notes with a structured proforma completed for each patient. Simple analysis of the data collated was subsequently done. Our locality, Nnewi, is a commercial town populated mostly by traders of machineries and accessories, with many bad road networks, necessitating the preferential use of motorcycles for commuting on account of high maintenance cost and difficult mobility with motor vehicles, due to the difficult terrain.

RESULTS

There were 1055 neurosurgery cases in our centre within the study period, with 138 congenital anomalies and 917 acquired diseases (Figure 1). Amongst those with acquired diseases, 785 (85.6%) were traumatic, 22 (2.4%) infective, 59 (6.4%) neoplastic, and 51 (5.6%) were degenerative (Figure 2). Majority of the neurotrauma cases, 748 (95.3%), had complete records with the remaining 37 (4.7%) patients excluded from the study because of incomplete records. The age distribution was 0-15years 144 (19.2%), >15-40 years 376 (50.30%), >40-60 years

148 (19.8%), and >60 years 80 (10.7%) as shown in Table 1. Majority were males 569 (76.1%) with a male: female ratio of 3.2:1 (Figure 3), and there were 658 (88%) cases of isolated head injury, and 61 (8.1%) cases of isolated spinal injury, giving a head:spinal injury ratio of 10.8:1. The rest, 29 (3.9%), were cases of concomitant head and spinal injuries.

Most cases in this study were from RTA 537 (71.8%), whereas falls accounted for 120 (16.0%), assaults 47 (6.3%), missiles 20 (2.7%), falling objects 11 (1.5%), acceleration/deceleration injuries 7 (0.9%), sports/recreational activities 3 (0.4%) and birth trauma 3 (0.4%) (Table 2). Amongst the 537 cases of RTA, 367 (68.3%) were from motorcycles, 169 (31.5%) motor vehicles and 1 (0.2%) from bicycle road traffic accident, resulting in a

motorcycle: motor vehicle ratio of 2.2:1 (Figure 4). None of the motorcycle victims, as usual, wore a protective helmet at the time of the accident (Figure 5).

Most of the isolated head injured cases 487 (65%), spinal injuries 53 (7%) and concomitant head and spinal injuries 19 (2.5%) were treated non-operatively; all cases of skull traction with Gardner-Wells' tongs were classified as non-operative treatment. Majority of the head injury cases 441 (59%) recovered to normal activities and function. While all cases of complete spinal cord injury 17 (2.3%) did not make any neurological gains from their initial injury, the rest with partial cord injury recovered to various levels of functional gains.

Mortality from head injury was 113 (15.1%), mostly from severe head injuries, that from spinal injury was 13 (1.7%), all from cervical spine injury; whereas the mortality from concomitant spinal and head injuries was 7

(0.9%), resulting in a combined mortality rate of 17.7% from all neurotrauma cases.

Table 1. Age distribution of neurotrauma cases.

<u>Age (yrs)</u>	<u>Number</u>	<u>Percentage (%)</u>
0 - 15	144	19.2
> 15 - 40	376	50.3
> 40 - 60	148	19.8
≥ 60	80	10.7
<u>Total</u>	<u>748</u>	<u>100</u>

DISCUSSION

The male preponderance and the peak age range in this study correlated with other published reports (Adeolu et al., 2005; Al-Fallouji 1999; CDCP, 2001; Ingebrigsten et al., 1998; Kolenda and Reparón, 1997; Muhammad, 1990; NCHS, 1987). The predominance of head injury in our neurotrauma cases also tallies with the universally reported patterns as head to spinal injury incident ratio in our series was 10.8:1 (Benzel and Larson, 1986; Ingebrigsten et al., 1998; Lindsay et al., 1992). Road traffic accident is the most common cause of neurotrauma as in other reports worldwide. However, in this study, motorcycles accounted for most of these accidents with the incident ratio of 2.2:1, unlike higher incidents from motor vehicles from most other reports. Our locality, Nnewi, is a commercial town with many bad road networks necessitating the preferential use of motorcycles over motor vehicles for commuting on account of high maintenance cost and difficult mobility with the latter, due to the difficult terrain.

Most of the head injury cases were mild injuries 69.3%, which explained the majority of cases with good outcome (67%), though all those that had good outcome were not solely, mildly injured. It is an established fact that the severity of head injury has an inverse relationship to outcome (Al-Fallouji, 1999; Greenberg, 2001). Also, among the cases of spinal injury, all the mortality was among those with cervical spinal injury and all complete injuries did not recover neurological function - both of these occurrences have also been widely reported in literature (IHITFR, 1989; Kemp and Sibert, 1997). The mortality rate of 17.7% was still high and could be related not only to the severity of injuries but also to the suboptimal care and inadequate facilities obtained in our new centre. With an improvement in these, the expectation is that the mortality rate would progressively decline.

Reasons for increased frequency of motorcycle related neurotrauma in developing communities like ours reported by other workers included bad road networks, careless road use by motorcyclists, poor knowledge of and non-compliance with traffic codes and safety measures such as the use of well-fitting crash helmets, inadequate formal training in the use of the motorcycle, and illiteracy. These earlier reports also suggested that overloading of motorcycles (in some instances as many as 4 persons commute on a small motorcycle at the same time, as in Figure 5), use of malfunctioning motorcycle parts, alcohol consumption, absence of road signs and lack of enforcement of traffic laws, have contributed to the increased frequency of this preventable epidemic [Adeolu et al., 2005; Adogu and Ilika, 2006; Kemp and Sibert, 1997; Kolenda and Reparón, 1997).

The government of Nigeria would, therefore, need to ensure that the enforcement of traffic laws, creation of good road networks, appropriate use of protective measures like crash helmets, and traffic enlightenment of motorcyclists, are made an urgent priority. The role of improved manpower and facilities in the hospitals is also paramount. These will significantly reduce the impact of motorcycles on our neurotrauma burden and save a great proportion of our youths from the debilitating premature morbidity and mortality of cranio-spinal trauma.

Conclusion

Neurotrauma from road traffic accidents, affecting mostly young males, was the most common neurosurgical fitting crash helmets in addition to construction of good condition seen in our neurosurgical services; and majority road networks, more stringent enforcement of traffic of our patients resulted from motorcycle accidents. regulations, education and attitudinal changes of motorAppropriate preventive measures like the use of well cyclists will significantly reduce the incidence.

Table 2. Aetiology of neurotrauma.

<u>Aetiology</u>	<u>Number of patients (Percentage)</u>
Road traffic accidents	537 (71.8%)
Falls	120 (16.0%)
Assaults	47 (6.3%)
Sports/ Recreational activities	3 (0.4%)
Missiles	20 (2.7%)
Falling objects	11 (1.5%)
Birth trauma	3 (0.4%)
Acceleration/Deceleration injuries	7 (0.9%)
<u>Total</u>	<u>748 (100.0%)</u>

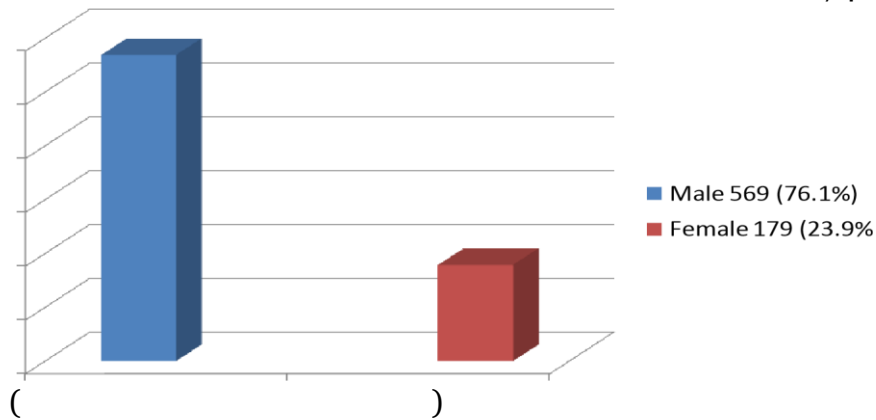
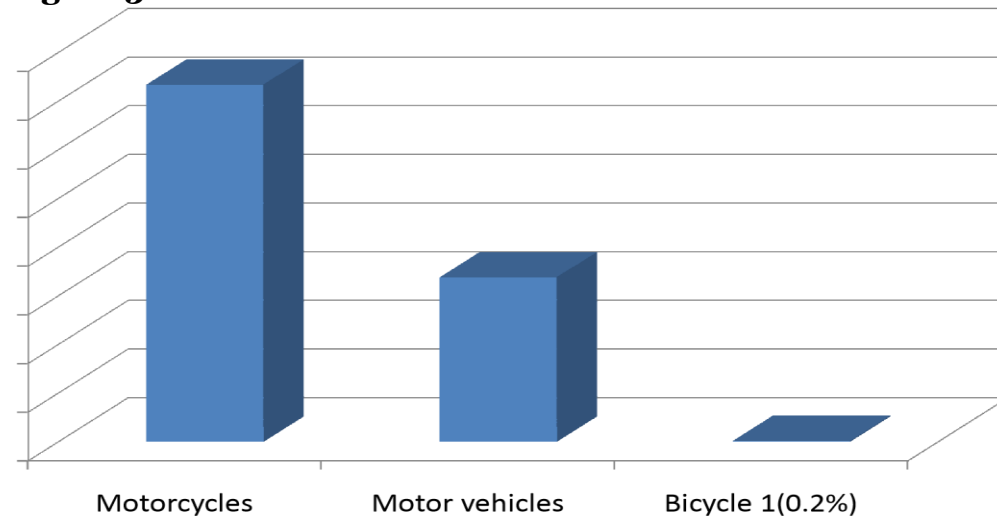
**Figure 3.** Sex distribution of neurotrauma cases.**Figure 4.** Types of road traffic accident.



Figure 5. Four passengers on a motorcycle on a highway without protective helmets – a typical scenario in South-East Nigeria.

REFERENCES

- Adeolu AA, Malomo AO, Shokunbi MT, Komolafe EO, Abiona TC (2005). Etiology of Head Injuries in Southwestern Nigeria: A Public Health Perspective. *The Internet J. Epidemiol.* 2(2). pub.com/journal/the_internet_journal_of_epidemiology/.
- Adesukanmi AR, Oginni LM, Oyelami AO, Badru OS (1998).
Epidemiology of childhood injury. *J. Trauma.* 44: 506-512.
- Adogu OU, Ilika AL (2006). Knowledge of and attitude towards road traffic codes among commercial motorcycle riders in Anambra State. *Niger Postgrad. Med. J.* 13: 297-300.
- Al-Fallouji MAR (1999). *Surgery of Trauma; Postgraduate Surgery 2nd ed; Butterworth Heinemann Oxford* pp. 332-355.
- Benzel EC, Larson SJ (1986). Functional recovery after decompressive operation for thoracic and lumbar spine fractures, *Neurosurgery* 19: 772-778.
- Centers for Disease Control and Prevention (CDCP) (2001), Spinal Cord Safety, USA, <http://www.cdc.gov-/safeusa/home/sci.htm>.
- Falope IA (1991). Motorcycle accidents in Nigeria. A new group at risk. *West Afr. J. Med.* 10: 187-189.
- Greenberg MS (2001). Head trauma; *Handbook of Neurosurgery 5th ed; Thieme, New York* pp. 626-689.
- Ingebrigsten T, Mortensen K, Romner B (1998). The epidemiology of hospital-referred head injury in Northern Norway. *Neuroepidemiology*; 17: 139-146.

- Interagency Head Injury Task Force Reports (IHITFR) (1989). National Institute of Neurological Disorders and Stroke; National Institutes of Health, Bethesda, MD.
- Kemp A, Sibert J (1997). Childhood accidents: epidemiology, trends and prevention; *J. Acc. Emerg. Med.* 14: 316-320.
- Kolenda H, Reparson C (1997). Head Trauma. In, Palmer JD (ed),
Manual of Neurosurgery, Churchill Livingstone, New York pp. 501-582.
- Le T, Bhushan V, Dierberg K, Grow RW (2006). Epidemiology and Preventive Medicine. First aid for the USMLE Step 2 CK: A student to student guide 5th ed, Mc Graw-Hill, New York 4: 103-112.
- Lindsay KW, Bone I, Callander R (1992). Spinal Trauma, Neurology and Neurosurgery Illustrated 2nd ed; 399-402.
- Maynard FM, Reynolds GG, Fountain S, Wilmot C, Hamilton R (1979). Neurological prognosis after traumatic quadriplegia: three-year experience of California Regional Spinal Cord Injury Care System, *J. Neurosurg.* 56: 699-705.
- Muhammad I (1990). Management of head injuries at the ABU Hospital Zaria, East Afr. Med. J. 67: 447-451.
- National Centre for Health Statistics (NCHS) (1987). Advance report of final mortality statistics. 1985; Washington DC: US Government Printing Office.
- Nwadinigwe CU, Iloabuchi TC, Nwabude IA (2004). Traumatic Spinal Cord injuries (SCI): a study of 104 cases. *Niger J. Med.* 13: 161-165.
- Odebode TO, Abubakar AM (2004). Childhood head injury: causes, outcome and outcome predictors. A Nigerian Perspective. *Pediatr Surg. Int.* 20: 348-352.
- Oginni FO, Ugboko VI, Adewole RA (2007). Knowledge, attitude, and practice of Nigerian commercial motorcyclists in the use of crash helmet and other safety measures. *Traffic Inj. Prev.* 8: 137-141.
- Pandey VK, Nigam V, Goyal TD, Chhabra HS (2007). Care of posttraumatic spinal cord injury patients in India: An analysis. *Indian J. Orthop.* 41: 295-299.
- Reed RL II (1996). Resuscitation of Multiply injured patient. In Wilkins RH, Rengachary SS (eds). *Neurosurgery* 2nd ed; MacGraw-Hill, New York pp. 2689-2697.
- Solagberu BA (2002). Spinal Cord Injuries in Nigeria. *West Afr. J. Med.* 21: 230-232.
- Solagberu BA, Adekanye AO, Ofoegbu CP, Udoffa US, Abdur-Rahman LO, Taiwo JO (2003). Epidemiology of trauma deaths. *West Afr. J. Med.* 22: 177-181.
- Wagner FC Jr, Chehrazai B (1982). Early decompression and neurological outcome in acute cervical spinal cord injuries, *J. Neurosurg.* 56: 699-705.