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Road Traffic Injuries Among Semi-Urban African Children: Assessment Of Severity With The Pediatric Trauma Score

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Citation

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Abstract

Background: In Africa, road traffic injuries (RTI) have become significant causes of childhood morbidity and mortality. Nevertheless, trauma severity scoring is rarely applied in the management.

Objectives: To evaluate the severity of childhood RTI using the Pediatric Trauma Score (PTS) in Ilesa; a semi-urban community in Southwest Nigeria.

Methodology: A 12-month prospective study of consecutive children with RTI seen at the Children Emergency Room (CHER) of the Wesley Guild Hospital. Information was obtained and analysed regarding the pattern of RTI, the PTS and outcome.
Results: A total of 263 children had RTI representing 8.0 percent of all CHER attendances. Pedestrians accounted for 60.8 percent cases. The mean PTS was 8.59 (± 2.85). Majority (63.5 percent) of the children sustained minor trauma (high PTS > 9). Statistically significant higher percentages of children who sustained major trauma (low PTS ≤ 8) were pedestrians, motorcycle victims, presented late, had penetrating, or multiple injuries, head injury, lost consciousness or convulsed. All 26 (9.9 percent) children who died following RTI (representing 17.6 percent of all CHER deaths) had low PTS (2.65 ± 3.02). All deaths were within 24 hours of RTI with no late deaths.
Conclusions: RTI pose significant health hazard to children in the community studied. The PTS showed good relationship to RTI outcome. Because of its simplicity and reliability in assessing trauma severity and prognosis, we advocate its use for the evaluation of childhood RTI.

INTRODUCTION

World over, road traffic injuries (RTI) are a major cause of misery, disability and death. [1] In Sub-Saharan Africa, with increasing vehicular traffic, RTI has become an immense health problem even among children. RTI constitutes a burden on under-funded and oversubscribed health services. [2, 3] The WHO has estimated many more childhood deaths from road crashes than from HIV infection.[4] However, the prominence of communicable diseases in the region masks this relative epidemiologic significance. [5]

A number of scoring systems have been developed to facilitate consistent trauma triage, severity evaluation, management and prognostication. [5, 6] These include the Injury Severity Score (ISS) the Abbreviated Injury Score (AIS) and the Revised Trauma Score (RTS). [5, 6] Adesunkanmi and co-workers [7] had earlier evaluated RTI among African children using the ISS. Unlike the ISS, the Pediatric Trauma Score (PTS) [8, 9] is exclusively used in children. It is reputably simple, consisting of six components (Table I). A score of +2, +1, or -1 is given to each variable and then added (range, -6 to 12). A PTS score of ≤ 8 indicates potentially major or severe trauma.

As roles in childhood emergency and ambulatory care continually escalate, it has become imperative that personnel in these departments understand and are able to assess the pattern and severity of RTI. Thus, this study was undertaken to assess severity of RTI using the PTS among children in the semi-urban Ijesa community of Southwest Nigeria. Hopefully, the information to be obtained will improve care of road crash victims and assist in formulating essential road traffic injury treatment strategy, particularly in this community. It was conducted at the Wesley Guild Hospital, Ilesa, a unit of the Obafemi Awolowo University Teaching Hospital and the main referral facility providing paediatric care for the semi-urban Ijesa community.[7]

METHODOLOGY

All children aged below 16 years seen at the CHER with RTI between August 1, 2002 and July 31, 2003 prospectively studied. History was obtained from the parents or other accompanying guardians, referral notes and the Police as necessary. Data obtained included age and sex of each child, mode of involvement, types of vehicles involved and injury – presentation (IP) interval. The IP interval was recorded as either within one hour of the RTI (early) or after one hour (late). Unconsciousness, convulsion and or ongoing revealed bleeding at presentation were documented.

To obtain the severity of the trauma based on the PTS, [8] the weight, airway patency, systolic blood pressure, central nervous system (CNS) status, presence or absence of open wounds and skeletal injury were documented as shown in Table I. A score of 8 or less (low PTS) was designated as major trauma and a score of 9 and above (high PTS) as minor trauma. The pattern of injuries was described based on anatomical regions: head, maxillo-facial, neck and spine, abdomen, chest, pelvis and limbs. The mechanism of the injuries was termed as either blunt or penetrating.[10,11,12] The eventual outcome of the patients was documented as discharged alive or died.

Data were analysed with the Student's't' test or the z test as applicable using the Computer program for epidemiologists (PEPI) Version 3.01. [13] 'p' values < 0.05 in two-tailed tests were accepted as statistically significant.

RESULTS

THE PATIENTS AND THE VEHICLES.

During the 12-month study period, 3,301 children were seen at the CHER, 263 (8.0%) had RTI from 206 road crashes. This excludes 2 children involved in car accidents which occurred within the confines of their compounds and not roads. The ages ranged from 3 months to 14 years with a mean (SD) of 7.9 (3.5) years. There were 147 (55.9%) boys and 116 (44.1%) girls, giving a male: female ratio of 1.3: 1. The overall mean PTS (SD) was 8.59 (2.85) but the girls had a lower value [7.69 (3.15)] than boys [9.31 (2.36)] with statistical significance ($t = 4.77$, $p < 0.001$). Details of the PTS are shown in Table II, the mode was 9, scored by 62 (23.6%) while 167 (63.5%) and 96 (36.5%) children had high (≥ 9) and low PTS (≤ 8) respectively.

One hundred and sixty (60.8%) children were injured as pedestrians and 103 (39.2%) as passengers. Pedestrians had a lower mean PTS (SD) of 8.77 (3.02) than the passengers [8.48 (2.73)], though without statistical significance ($t = 0.81$, $p = 0.421$). Twenty-eight (27.2%) of the passengers compared with 68 (42.5%) of the pedestrians had low PTS, hence, a significantly higher percentage of pedestrians than passengers sustained major trauma ($z = 2.39$, $p = 0.003$).

Motorcycles, cars, buses, trucks and pedal bicycles injured 132 (50.2%), 74 (28.1%), 52 (19.8%), 5 (1.9%) and no child respectively. The motorcycle-injured had a lower mean PTS (SD) of 7.93 (3.22) against 9.26 (2.24) for those injured by other vehicles types altogether, with statistical significance ($t = 3.89$, $p < 0.001$). Of the 132 motorcycle-injured, 59 (44.7%) and 73 (55.3%) children had low and high PTS respectively. Thus, 59 (61.5%) of all victims with low PTS had motorcycle injury. A significantly higher percentage of motorcycle-injured children had major trauma as against those injured by the other types of vehicles ($z = 2.64$, $p = 0.008$).

THE CLINICAL PRESENTATION, THE TYPES AND MECHANISMS OF INJURIES.

The IP interval ranged from 5 to 1, 020 minutes with the mean (SD) of 55.5 (68.9) minutes. However, 213 (81.0%) children presented early and 50 (19.0%) presented late. The late presenters had a lower and statistically significant mean PTS (SD) of 7.82 (3.61) as against 8.77 (2.62) for the early presenters. Though 8 (16.0%) late presenters versus 18 (8.5%) early presenters died, this higher percentage was not statistically significant ($z = 1.35$, $p = 0.178$).

However, 165 (62.7%) children were hospitalised. Their mean PTS (SD) was 7.82 (2.91) as against 9.89 (2.21) for the 98 (37.3%) managed without hospitalisation. Thus, children with RTI who required hospitalisation had lower and statistically significant PTS ($t = 6.06$, $p < 0.001$).

The mean PTS (SD) for the 81 (30.8%) children with single injuries was 10.28 (1.48) as against 7.84 (2.99) for the remaining 182 (69.2%) who had multiple injuries. Thus, children with multiple RTI as against single injuries had lower and statistically significant PTS ($t = 6.97$, $p < 0.001$). Also, 120 (75.0%) of the 160 pedestrians as opposed to 62 (60.2%) of the 103 passengers had multiple injuries. This higher percentage of pedestrians than passengers with multiple injuries was statistically significant (z = 2.40, p = 0.016).

Seventeen (6.5%) children had penetrating injuries with mean PTS (SD) of 1.41 (2.58) while 246 (93.5%) had only blunt injuries and mean PTS (SD) of 9.09 (2.10). Thus, children who sustained penetrating injuries had lower and statistically significant PTS than those with only blunt injuries (t = 14.36, p < 0.001). Also, all but one of the children with penetrating injuries died as against 10 (4.1%) with only blunt injuries. Hence, significantly many more deaths followed penetrating RTI than blunt injuries (z = 11.54, p < 0.001).

Table III shows details of the analysis of the means PTS (SD) by presence or absence of ongoing bleeding, unconsciousness, prolonged unconsciousness, and convulsions. Children who had any of these parameters had statistically significant and lower PTS than those without. Of the 83 (31.6%) children who presented with ongoing revealed haemorrhage, 13 (15.7%) required blood transfusion. Eventually, 12 (92.3%) of them died. Of the 93 (35.4%) children who lost consciousness, 66 (71.0%) were unconscious for less than 5 minutes and none died while among the remaining 27 (29.0%) who had prolonged unconsciousness for ≥ 5 minutes, 26 (96.3%) died. Thus, statistically, prolonged unconsciousness was associated with fatality (z = 9.14, p < 0.001).

All but one of the 24 (9.1%) children who convulsed either prior to or at presentation died as against 3 (1.3%) of the 239 children who had no convulsions. Thus, presence of convulsions was statistically associated with fatality (z = 14.44, p < 0.001).

Table IV shows details of comparative analysis of injury severity by PTS for the various body regions. The most commonly injured parts were the limbs, the head and the maxillo-facial regions in 87.1%, 43.3% and 10.6% cases respectively. Children with head, maxillofacial, abdominal and pelvic injuries had statistically significant lower PTS than those without these respective injuries. However, there was no statistically significant difference in the PTS regarding the presence or absence of chest, spine and limb injuries.

OUTCOME

The case fatality rate was 9.9% as 26 children (14 pedestrians and 12 passengers) died. This represents 17.6% of the 148 overall CHER deaths. The mean PTS (SD) was 2.65 (3.02) for children who died and 9.24 (1.93) for those who survived. Thus, the children who died had lower and statistically significant PTS (t = 15.49, p < 0.001). All those that died as against 70 (29.5%) of the 237 survivors had low PTS (z = 6.87, p < 0.001). From Table II, it can be seen that PTS ≤ 2, ≤ 6 and ≥ 7 were respectively associated with 100%, 36.0% and 3.8% mortality. Twenty (76.9%) of those that died were girls. Thus, significantly many more girls than boys had fatal outcome (z = 3.34, p = 0.001). Also, 23 (88.5%) of the deaths involved motorcycles.

All the children who died sustained multiple injuries and severe head injuries, 12 (46.2%) had severe bleeding with shock, 10 (38.5%) also sustained multiple limb fractures while 2 (7.7%) had intestinal protrusion from burst abdominal injuries. In all, 21 (80.8%), 4 (15.4%) and 1 (3.8%) deaths occurred respectively within 24 hours, between 24 and 48 hours and after 48 hours of the various road crashes. Within the first 24 hours, 3 (14.3%) deaths happened during the first hour, another 8 (38.1%) within 6 hours while 10 (47.6%) occurred between 6 and 24 hours. Late deaths were not recorded.

Figure 1

Table I: The Paediatric Trauma Score (PTS).

Components	+ 2	+ 1	− 1
1. Weight	> 20 kg	10 – 20 kg	< 10 kg
2. Airway patency	Normal	Maintainable	Unmaintainable
3. Systolic blood pressure	> 90 mmHg	90 – 50 mmHg	< 50 mmHg
4. CNS status	Awake	Obtunded/ loss of consciousness	Coma/ decerebrate
5. Open wound	None	Minor	Major/ penetrating
6. Skeletal injury	None	Closed fracture	Open/ multiple fractures

Figure 2

Table II: The PTS compared with the outcome.

PTS		№ (%) of children discharged alive	№ (%) of children who died	Total № (%) of all children with RTI
i.	-2	0	1 (0.4%)	1 (0.4%)
ii.	0	0	2 (0.8%)	2 (0.8%)
iii.	1	0	15 (5.7%)	15 (5.7%)
iv.	5	1 (0.4%)	0	1 (0.4%)
v.	6	31 (11.8%)	0	31 (11.8%)
vi.	7	22 (8.4%)	8 (3.0%)	30 (11.4%)
vii.	8	16 (6.0%)	0	16 (6.0%)
viii.	9	62 (23.6%)	0	62 (23.6%)
ix.	10	25 (9.5%)	0	25 (9.5%)
x.	11	50 (19.0%)	0	50 (19.0%)
xi.	12	30 (11.4%)	0	30 (11.4%)
Total		**237 (90.1%)**	**26 (9.9%)**	**263 (100%)**

Figure 3

Table III: Comparative analysis of the PTS with some RTI outcome variables.

Outcome variables	№ of children (%) of 263		Mean PTS (SD)		t score	P Value
	Variable present	Variable Absent	Variable present	Variable absent		
Ongoing bleeding	83 (31.6%)	180 (68.4%)	7.31 (3.62)	9.18 (2.18)	5.19	< 0.01
Unconsciousness	93 (35.4%)	170 (64.6%)	6.82 (3.19)	9.56 (2.09)	8.42	< 0.01
Prolonged unconsciousness	27 (10.3%)	66 (25.1%)	2.74 (2.99)	8.48 (1.03)	13.81	< 0.01
Convulsions	24 (9.1%)	239 (90.9%)	3.17 (2.88)	9.14 (2.20)	- 12.27	< 0.01

Figure 4

Table IV: Comparative analysis of the Means PTS by the body regions injured.

Body region	№ of children (%) of 263		Mean PTS (SD)		t score	P Value
	Region injured	Region not injured	Region injured	Region not injured		
Head	114 (43.3%)	149 (56.7%)	6.87 (3.00)	9.91 (1.85)	10.12	< 0.001
Maxillofacial	28 (10.6%)	235 (89.4%)	6.18 (1.31)	8.88 (2.85)	4.95	< 0.001
Spine	1 (0.4%)	262 (99.6%)	7.00 (0.00)	8.60 (2.85)	0.56	0.576
Chest	9 (3.4%)	254 (96.6%)	7.00 (0.00)	8.65 (2.88)	1.71	0.088
Abdomen	3 (1.1%)	260 (98.9%)	1.67 (4.73)	8.67 (2.73)	4.38	< 0.001
Pelvis	2 (0.8%)	261 (99.2%)	4.50 (9.19)	8.62 (2.78)	2.05	0.041
Limb	229 (87.1%)	34 (12.9%)	8.67 (2.98)	8.09 (1.71)	- 1.11	0.269

DISCUSSION

A higher rate of road traffic injuries (RTI) was observed in this study than previously documented from this same centre about a decade earlier.[7] Noteworthy sex differences were observed. Fewer girls than boys had RTI although girls suffered more severe and fatal injuries. Boys are generally more active and injury prone. However, plausibly boys are also more agile to such extents of being able to react more promptly to potential accident situations thereby lessening the impact, injury severity and outcome.

In the present study, most injuries seen were minor with a Pediatric Trauma Score (PTS) above 8. This is similar to the findings of Adesunkanmi and co. [7] Moore et al [14] had earlier reported similar observations by the Injury Severity Scale (ISS). The low PTS documented among pedestrians in this study is consistent with previous observations.[7, 10, 15]However, all the children who died had PTS scores less or equal to 8. PTS of less than 2 in this study was associated with 100 percent mortality. Tepas and co had reported that a PTS of less than 1 predicted more than 98 percent mortality. [8] In our study, 36 percent of children with a score of 6 or less died as against 28 percent in another study. [16]

Majority of the fatalities in the present study were severely head-injured. Many studies have shown head injury as a leading cause of death following road crashes in children.[7, 10, 15]In view of our results, children who convulsed or were unconscious, mainly if prolonged had low PTS with more fatal outcome. Head injury is thus common to many trauma scoring systems.[16, 17]

The fact that most of the deaths occurred within the first 24 hours of presentation reflects in part, the poor state of life support and resuscitation available in the present health system. It may also explain the absence of such complications as septicaemia and multiple organ failure. Many crash victims were brought into the hospital late, such that upon arrival 4.9 percent required blood transfusions. However, only 1 of the blood transfused victims survived. No victim was brought to the hospital by ambulances. In an ideal setting with good ambulatory care, blood and intravenous fluid transfusions would have commenced at the trauma site or while in transit.[18]

The high fatality rate in this study is an indication of indication of the enormity of the problem of childhood RTI in this community. Although the overall mortality in the present study is comparable with those seen in studies from other African countries,[19] it is much higher compared with studies from developed countries.[7, 19] There is no doubt that the hospital facilities, as they currently exist in many developing countries, are not adequate in quality and quantity, to improve the outcome of childhood RTI. The facilities and interventions necessary to improve survival for these children are very expensive and often unavailable.[7] The high hospital mortality mainly from head injuries, blood loss and penetrating injuries emphasises the need for co-ordinated pre-hospital resuscitation and evacuation services, together with an integrated in-hospital trauma team approach to management.[15]There is a need to establish an intensive care unit (ICU) in all hospitals. In view of our results, it is suggested that outcome in injuries should be improved by rapidly categorising all RTI by PTS and referring the low scorers to the ICU so that they can be targeted for better care and monitoring. At present in most systems, RTI victims are managed along with other patients in open ward, emergency or other in-patient wards.

Trauma triage ensures prompt patient categorisation and referral to better prepared centres which ultimately improves survival rates. [5, 6] Also, it will ultimately facilitate comparison of data and assessment of quality of care. This result did not just support the views of Kaufmann and co [9] that the PTS is a reliable index of trauma severity assessment in children, it also demonstrated its universal applicability. The rationale for a child-specific trauma scoring system is predicated on the fact that childhood response to physiologic derangement differs from adults. Hence, the application of adult physiologic measure to children often results in considerable inaccuracy.[6,8] Thus, in view of the consistency and simplicity of the PTS, we recommend it for all personnel involved in childhood ambulatory and emergency care.

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