

A review of traumatic limb injuries in children and implication for prevention

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Abstract

Background: *Musculoskeletal injuries are important aspects of traumatic injuries that need to be characterized better in order to map out appropriate preventive measures in developing countries.*

Method: *This is a retrospective study of all traumatic injuries to the limbs presenting at the Obafemi Awolowo University Teaching Hospitals Complex over a five year period*

Results: *570 of 643 (5.6% of all pediatric trauma cases) case notes were retrieved. There were 366 (64.2%) males and 204(35.8%) females with a mean age of 6.7 ± 3.8 years. Most injuries were sustained at home or on the way to or from school. Road crashes and falls are the two most common causes responsible for 50.5% and 41.4% respectively. Lower limb injuries were 4.8 times more common than upper limb injuries and fractures were the most common injury type. The femurs were injured in more than 50% of the cases. The tibia had the highest numbers of open fractures. 178 (31.2%) patients sustained skin injuries, majority of which were lacerations (79, 43.8%) and abrasions (30, 16.9%). There were 23 (4.0%) nerve and 13 (2.5%) tendon injuries. Associated other region injuries were to the head and the abdomen. Mortality rate was 1.8%, all deaths occurred in those with crash related injuries.*

Conclusion: *Musculoskeletal injuries remain a significant cause of hospitalization and morbidity in Nigeria. Preventive measures aimed at road crashes and falls should be instituted to reduce their incidence.*

Keywords: Paediatric, Limb, Injury, Trauma Prevention

Introduction

Worldwide, injuries are increasingly becoming a major health problem among children^{1,2}. In high income countries (HIC), injuries have risen to become the most common cause of death, accounting for almost 40% of death in the age group 1-14 years³. The problem is worse in low-to-middle income countries (LMIC), where traditionally, infectious diseases were regarded as the greatest disease burden and where injuries are increasingly being recognized as a very important cause of morbidity and mortality³. For example, the WHO has estimated that more children die from road crashes than from HIV infection in LMIC. Also, in 1998, the UNICEF estimated that 98% of all injury related deaths occurred in LMIC³.

Infants and children are not little adults; they are qualitatively different from adults in their behaviors, physical nature and biology. They are more vulnerable than adults to trauma². Most studies done on injuries from Nigeria had shown the limbs to be the most vulnerable body region to trauma^{1, 5-9}. The studies looked at injury epidemiology from the global perspective; few looked at the details of musculoskeletal injuries alone and to our knowledge, none had focused on musculoskeletal injuries in children. In this study, we sought to characterize the nature, distribution and the outcome of pediatric limb trauma at the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC), Ile-Ife. OAUTHC serves parts of the semi-urban and rural communities of Osun, Ekiti and Ondo states in southwest Nigeria. The findings from the study will help in identifying

risk factors and planning for appropriate preventive actions.

Method

The study was undertaken to document the pattern of limb injuries as they presented at the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC) Ile-Ife. The case notes of children aged from birth to 14 years seen with traumatic limb injuries over the five year period between January 1998 and December 2002 were retrieved from the medical records department. Burns injuries were not included. The following data were extracted from them: age, causes of injuries, month of presentation, laterality of the injuries, soft tissue injuries, long bone fractures, joint involvement, associated systemic injuries, admission status, duration of hospital stay, treatments and their outcomes. Outcomes are rated as satisfactory when patients had no complication from the trauma or its treatment as at the last clinic visit, unsatisfactory when patients had complications after a follow-up of at least two years, lost to follow-up, discharged against medical advice (DAMA), referred to other hospitals or dead¹⁰. The data was analysed with SPSS 11.5 software¹¹.

Results

Ages and sexes: Out of 11,465 patients who attended the pediatric emergency ward during the study period, 643 (5.6%) sustained traumatic injuries to the limbs. Five hundred and seventy (88.5%) case records were available for review. The ages ranged from one day to 14 years with a mean of 6.7 ± 3.8 years. There were 366 (64.2%) males and 204 (35.8%) females. Females were significantly older than males (7.3 years versus 6.5 years; $p=0.015$). A greater percentage of female patients were in the adolescent/school age group compared to males.

Mechanism of injury: There were 288 injuries due to motor cars, buses and trucks. Pedestrians were injured in 250 (43.9%) instances and vehicle occupants in 38 (6.7%). Motorcycle injuries accounted for 76 (13.3%) of

all crash related injuries consisting of 58 (10.1%) pedestrian and 18 (3.2%) occupant crashes. Other causes are falls (236, 41.4%), objects falling on patients (24, 4.2%), birth trauma (18, 3.2%) and gunshots (4, 0.7%). Table 1 is a cross tabulation of the mechanism of injury and the distribution of limb injuries. Sixty one percent of upper limb injuries were due to falls while about 50% of lower limb injuries were due to road crashes. Table 2 shows the mechanism of injury according to patients' age-groups. It shows that a greater proportion of injuries due to falls occurred in the younger age groups than those due to road crashes. Four of the patients who sustained injuries in a fall had pathological fractures secondary to bone cysts. Table 3 provides details of patients' activities at the time of injuries and the mechanism of injuries. The greatest proportion (41.5%) of injuries occurred while the patients were either at school or on their way to school. Ten of the cases of heavy objects falling on patients occurred when the wall of a school collapsed and fell on students in the classroom. Other heavy objects causing injuries include ladders, cement bags and tree branches. Most of the pedestrian accidents occurred while the patients were playing in the neighborhoods or when preschool and young school-aged children dashed across roads to pick up their balls and other playthings.

Musculoskeletal injuries: Fractures were the most common injury types. Table 4 shows that the femur is the most commonly fractured bone. Only 26 (4.7%) patients sustained multiple fractures, most often in road crashes. Open fractures were seen in 86 (16.3%) patients. The tibia has the largest number of open fractures, but the radius and ulna had the highest proportion of open fractures; 18 of the 20 patients with fractures of both radius and ulna had open fractures.

Skin injuries were the second most common form of injuries consisting of 79 (43.8%) lacerations, 30 (16.9%) abrasions, 27 (15.7%) bruises, 20 (11.2%) avulsions and 22 (12.4%) crush injuries.

Forty eight (8.5%) patients had dislocations, 20 (3.5%) were caused by falls, another 20 (3.5%) by pedestrian crashes while the remaining 8 (1.5%) were due to motorcycle/vehicle occupant crashes. The elbows, 14 (2.5%) were the most commonly dislocated joints followed by the Knee, 12 (2.1%); hip, 10 (1.8%); ankle, 10 (1.8%) and the foot 2 (0.4%). There were also 13 (2.3%) tendon and 23 (4.2%) nerve injuries.

Associated injuries: Only two other regions; the head and the abdomen sustained 97 (17.1%) and 5 (0.9%) injuries respectively. All the abdominal injuries were splenic and they occurred in vehicle passengers. Injuries to the head consisted of 53 (54.6%) facial and scalp injuries, 27 (27.8%) unspecified head injuries, 12 (12.4%) skull fractures and 5 (5.2%) cephalhematoma.

Treatment and complications: In keeping with pediatric fracture management worldwide¹²,

most of the patients with fractures had conservative management. These were tractions in 324 (56.8%) patients, cast application in 182 (31.9%), and external fixation in 9 (1.6%) patients. Surgical managements were 39 (6.8%) debridement, 28 (4.9%) primary closures, 11 (1.9%) skin grafting and 8 (1.4%) open reduction and internal fixation. The median duration of immobilization was 33 days ranging from 1 to 250 days. The median duration of hospital admission was 31 days, and the range was 2 to 125 days. The most common complications were joint stiffness 56 (9.8%), delayed union, malunion and non-union 18 (3.1%), and deep infections 11 (1.9%). Soft tissue complications included 43 (7.5%) wound sepsis, 23 (4.0%) plaster sores, 9 (1.6%) nerve palsies and 6 (1.1%) compartment syndromes. Two patients had tetanus.

Table 1: Distribution of limb injuries and the mechanism ofinjuries

	Vehicle occupant (%)	Fall (%)	Pedestrian (%)	Falling object (%)	Birth trauma (%)	Total
Lower Limb	26 (5.9)	176 (40.2)	202 (46.1)	22 (5.0)	12 (2.7)	438 (77.4)
Upper limb	8 (8.2)	60 (61.2)	22 (22.4)	2 (2.0)	6 (6.1)	98 (17.3)
Both limbs	4 (13.3)	0	26 (86.7)	0	0	30 (5.3)
Total	38 (6.7)	236 (41.4)	250 (43.9)	24 (4.2)	18 (3.1)	566

P= 0.000005

Table 2: Age groups and the mechanism of injury

Age Group	Vehicle occupants	Fall	Pedestrian	Falling object	Birth Trauma	Total
0-1	0	12 (40.0)	0	0	18 (60.0)	30
1-4	10 (6.5)	100 (64.9)	32 (20.8)	12 (7.8)	0	154
5-12	28 (8.5)	98 (29.9)	192 (58.5)	10 (3.0)	0	328
13-14	0	26 (50.0)	26 (50.0)		0	100

Table 3: Patients' activities at the time of injury and the mechanism ofinjuries

	Vehicle occupants	Falls	Pedestrians	Falling objects	Total
Going to school	20	29	190	-	139
Playing in school	-	83	-	12	95
Playing at home	-	75	-	-	75
Travelling	17	-	-	-	17
Hawking	1	2	18	-	21
Playing in neighborhood	-	29	22	10	61

Outcome: Three hundred and thirty four (58.6%) patients had satisfactory outcomes, 36 (6.3%) patients had unsatisfactory outcomes, 158 (27.7%) patients were lost to follow-up, 22 (3.95%) took discharges against medical advice while 10 (1.8%) died. The ten (1.8%) patients who died all sustained their injuries in vehicle crashes. Three of these patients had associated head injury, two were referred from other hospitals with tetanus and another had associated head injury (Glasgow Coma Score was 6), splenic injury and femoral fracture. He died two days after splenectomy. The causes of death were not specified in the remaining four cases.

Table 4: Characteristics of fractures

Bone	Close	Open	Total
Lower limbs (N=440)			
Femur	306 (96.5)	11 (3.5)	317
Tibia & fibula	49 (51.6)	46 (48.4)	95
Foot bones	13 (60.0)	7 (40.0)	20
Pelvic bones	5	0	5
Patella	3	0	3
Upper limbs (N=112)			
Humerus	50 (91.9)	5 (9.1)	55
Radius and ulna	15 (45.5)	18 (54.5)	33
Clavicle	16	0	16
Hand	5 (62.5)	3 (37.5)	8

Discussions

This study shows that musculoskeletal limb injuries are significant causes of hospital attendance and morbidity among children. While they form a small proportion of A&E attendance, they are significant in terms of length of hospitalization and subsequent morbidity. The long median duration of admission recorded in this study means that scarce bed space resources are tied down by the patients. A large percentage of these patients also had unsatisfactory outcomes due

to residual disability. Thus many of the effects of these injuries continue to haunt the patients long after they have been discharged.

The most common cause of injuries are road crashes, as has been previously shown in studies from Nigeria^{1, 8} in contrast to those from high income countries^{2, 13}. Road crashes were also implicated in all the fatal cases. Therefore in order to have meaningful reductions of pediatric injuries, preventive measures should be taken to reduce the risk of crashes on our road⁴. Pedestrian injuries can be reduced by environmental modifications like the provision of sidewalks, road barriers and pedestrian bridges and the introduction of traffic calming devices such as speed bumps and rumble strips^{14, 15}. Majority of pedestrian injuries involved students on their way to or from school. Road safety education can be introduced into the school curriculum. Such measures have been implemented and found to be useful in reducing pedestrian injuries from such situations as children emerging from behind parked vehicles¹⁶. Other measures include introduction and enforcement of speed limits in built up neighborhoods^{15, 16}. The latter measure should also help in reducing the incidence of accidents from children dashing across the road to retrieve toys and balls that had been thrown on to the road. Street hawkers are particularly vulnerable because they may be knocked down while crossing the road to answer buyers' summons. Thus street trading by children should be discouraged.

Falls are the second most common injury category in this study. They occurred with almost equal incidence at home and at school, but the age distributions were different. Falls occurring at home affected preschool age group and are likely to be preventable by measures² directed at not leaving such children alone. On the other hand fall injury at schools should be preventable by better playground design and adult-supervised contact sports and games. Children are particularly vulnerable to falling objects because of their¹⁷ curiosity and underdeveloped coordination. Parents should be educated on the need to securely tie down

heavy objects that can be toppled or fall on children. Further measures need to be taken to enforce the building construction codes because more than half of this category of injuries was due to collapsing walls.

Many studies from middle income countries have shown that low cost improvements in training, equipment and intervention can reduce morbidity and mortality from traumatic injuries¹⁴. Improving the quality of transport to the hospital can reduce both the pre-hospital as well as admission deaths^{2, 14}. Improving hospital-based care may likely reduce disability from limb injuries¹³. For example, two patients died because they were not given tetanus immunoprophylaxis, a simple preventive measure that is sometimes omitted by caregivers in peripheral hospitals. Thus measures should be taken to improve orthopedic and trauma care in developing countries where many trauma-related disabilities involve the limbs¹⁴.

In conclusion, a hospital based study like this would most likely have missed cases that died on the spot and were probably taken to the morgue or buried at home immediately⁶. Also limb injuries considered minor by parents may not be brought to the hospital; the true impact of trauma on mortality can only be established from population based studies⁶.

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