Epidemiological patterns of pediatric orthopedic trauma in a district hospital in Mizoram, India

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ABSTRACT

Background and Objective: The objective of the study was to document the epidemiological patterns of significant pediatric orthopedic trauma in a district hospital in Mizoram, India. The information so collected may be used as baseline data in health-care planning and resource mobilization in areas where workforce and resources are limited, especially in the orthopedic specialty. **Materials and Methods:** A retrospective analysis of 570 pediatric age group patients, attending accident and emergency services at district level hospital from January 2013 to December 2017 was done. Significant traumatic orthopedic trauma, defined as fractures, dislocations, and ligaments injuries for this study, was taken into account. Record was analyzed for age, sex, type, and mode of injuries and seasonal variations. **Results:** A total of 431 (75.61%) patients attending orthopedics emergency had significant trauma. This accounted for 23.68% of all orthopedics emergency cases in a calendar year. The male-to-female ratio was 2.75:1 and injuries were predominantly high in 5–8 years of age. Injury pattern is similar to other reported series while the mode of injuries is significantly different from those in Western world. **Conclusion:** Pediatric orthopedic traumas do well with early intervention. Proper referral system is the need of the hour. Supportive health-care policy and decision-making based on epidemiological trends of injuries would result in favorable outcome of such management.

Key words: *Childhood fractures, Institutional treatment, Neglected fractures, Pediatric trauma*

Pediatric trauma is one of the leading causes of childhood death in the United States [1] and globally it is the sixth leading cause of childhood morbidity and mortality [2]. In India, it accounts for nearly 8.2% of deaths and 20–25% of all pediatric age groups hospitalizations [3]. Despite various preventive measures and necessary legislations, the incidence of these traumas may be expected to be on the rise due to rapid urbanization and increasing number of vehicles and outdoor activities for children. Initial attention to such traumas is often neglected; care given by the untrained persons often results in an outcome which is functionally and structurally unacceptable as the child grows. In India, there is a certain inclination to consult traditional healers by parents, either out of ignorance or due to ease of access, leading to further delay in institutional care. This results in the child's physical pain and social and functional handicap.

A significant number of pediatric trauma happens outside home and children often conceal such injuries due to fear or ignorance. Furthermore, the first point of medical contact is often not with a trauma facility. This results in a significant delay toward a definitive treatment. The present study aims at finding out the common orthopedic pediatric trauma attending an orthopedic emergency at a district level hospital so that parents, educational authorities, policy-makers, and health-care institutions may be aware of these common injuries, and also highlight the importance of institutional management with regards to outcome when such injuries are neglected or treatment delayed. The study also attempts at emphasizing the impact of timely treatment, the role of early referral, and possibly a guide in future planning of trauma management set up.

MATERIALS AND METHODS

A retrospective analysis of all pediatric age group patients (age <18 years), attending an emergency orthopedics service between January 2013 and December 2017 at a district level hospital in Mizoram, India, was done. Since the population catered to was small, the time period of 5 years was chosen to have a fair representation of various parameters and their impact on the problem under study. For this particular study, significant orthopedic trauma was defined as fractures, dislocations, and ligaments injuries and only these were taken into account. Record was analyzed for age, sex, types, and modes of injuries. Statistical analysis was done using the Chi-square test and p value was determined wherever appropriate.

RESULTS

A total of 570 pediatric patients attended the emergency medical service for orthopedic trauma during the study period. Of these,

431 (75.61%) had significant trauma, thus were included in the present study. The age and sex distributions of the study population are depicted in Fig. 1. In our study, males have reported with significant orthopedic trauma compared to females across all age groups in the study population (p=0.039). We noted a significant association of both sexes with modes of injuries (p=0.0006). The modes of injuries are shown in Table 1. There was no statistical significance in the type of limbs (upper limb/lower limbs) involved (p=0.228) nor in the type of injuries (open/closed) sustained (p=0.43). The limb wise injury distribution and nature of injuries are shown in Table 2. The incidence of various types of injuries across various age groups for both sexes is shown in Fig. 2. All patients were managed with the present standard recommended line of management for the particular injury and all patients had favorable outcome.

DISCUSSION

Our institution is a district level multispecialty government hospital with round the clock emergency service facility, located in the state of Mizoram in Northeastern India. With the catchment population of about 2 lakhs and having patients of all social classes, religion, and ethnicity hailing both from the rural and urban settlement, we assume that it has a significant demographic and geographical representation. We believe that the scenario will be similar in most urban and rural India and other districts and provinces in most developing countries. Due consideration of this representation may be a significant factor in planning of pediatric health-care policy and infrastructural development to address areas of felt need for maximal returns with the limited resources often available at one's disposal. During the period of our study, 570 pediatric patients availed emergency orthopedics services at our instituteand this accounted for 23.68% of all trauma service attendance for the study period. Verma *et al*. in their study on childhood trauma profile at tertiary hospitals stated that 39% of all patients required orthopedics consultation for relevant injuries [4].

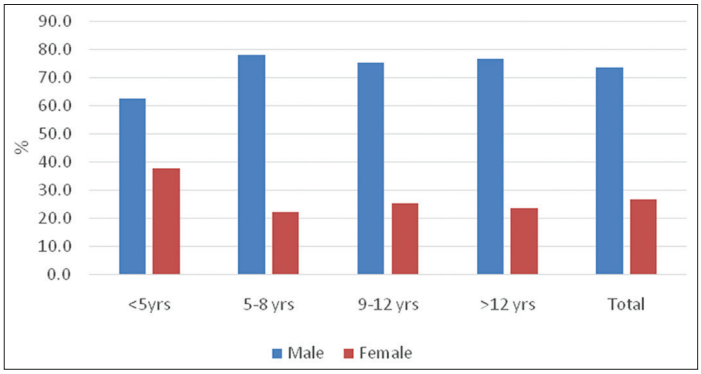

Figure 1: Age and sex distribution of the study population

Table 1: Various modes of injuries in the study population

Mode of injury	Males	Females	Total n=431 (%)
Falls at play	141	45	186 (43.15)
Fall from height	100	19	119 (27.61
Road traffic accident	47	28	75 (17.40)
Crush injury	14	12	26 (6.03)
Traction	14	11	25 (5.81)

Table 2: Comparison of the types of injuries

Sex	Limb involved		Type of injuries	
	Upper limb	Lower limb	Closed injuries	Open injuries
Male	244	72	277	39
Female	95	20	104	11

Three-fourth of the study population (75.61%) had significant orthopedic trauma requiring orthopedic management. It may be noted that injuries sustained in civilian settings are much different from those sustained in conflict zones [5] both in terms of nature and seriousness necessitating an alternative approach toward management. However, it is worthwhile to note that injuries often not obvious may be a cause for serious complications and impairment later. Hence, a proper referral policy should be established by all primary health caregivers for rational care of patients beyond the scope of one's specialty as in other countries [6]. The incidence of injury was predominantly high among the age group of 5–8 years in both sexes. Children of such age group are physically active yet not completely able to fend for themselves in an accident situation which older children are better capable of. The age-sex demographics for various injuries in our study were statistically significant (p=0.039). Various other factors for childhood accidents have been stated [4,7]. The male-to-female ratio in our study is 2.75:1. Similar male preponderance is reported by other authors [8-12]. Boys are by nature more active, thus the susceptibility to injury is much greater. The lesser number of girls with significant injuries may be explained on the assumption that girl child stays indoors and is less active physically. However, for younger children who are often under constant supervision, the ratio is not reported as significant.

The mode of injuries in most cases was accidental fall (70.76%). Falls were sustained during play while at school, on the way to and fro from school, at home, and from height (trees and furnitures). More than 75% of all injuries were sustained outside home environment. Another mode of injury was road traffic accidents and crushing injuries of the digits by a door or window which was shut accidentally and forcefully. Statistically, the various modes of injuries in both sexes were found to be significant in our study (p=0.0006). Societies where children have more amenities for recreation have more modes of injuries. In our society, such means are limited, which make it much easier and possible to take preventive measures at appropriate level. In the prevention of activity-related injuries, schools can ensure and maintain proper playgrounds with strict adherence to hours of play, proper supervision, guidance, and use of standard facilities wherever affordable. Educating students on fewer accidents prone activities at school and out of school behaviors should be considered. The central government policy on disaster management education and drills at school could be one preparatory ground [13]. As a part of injury prevention measures parents can take preventive measures and strictly adhere to traffic

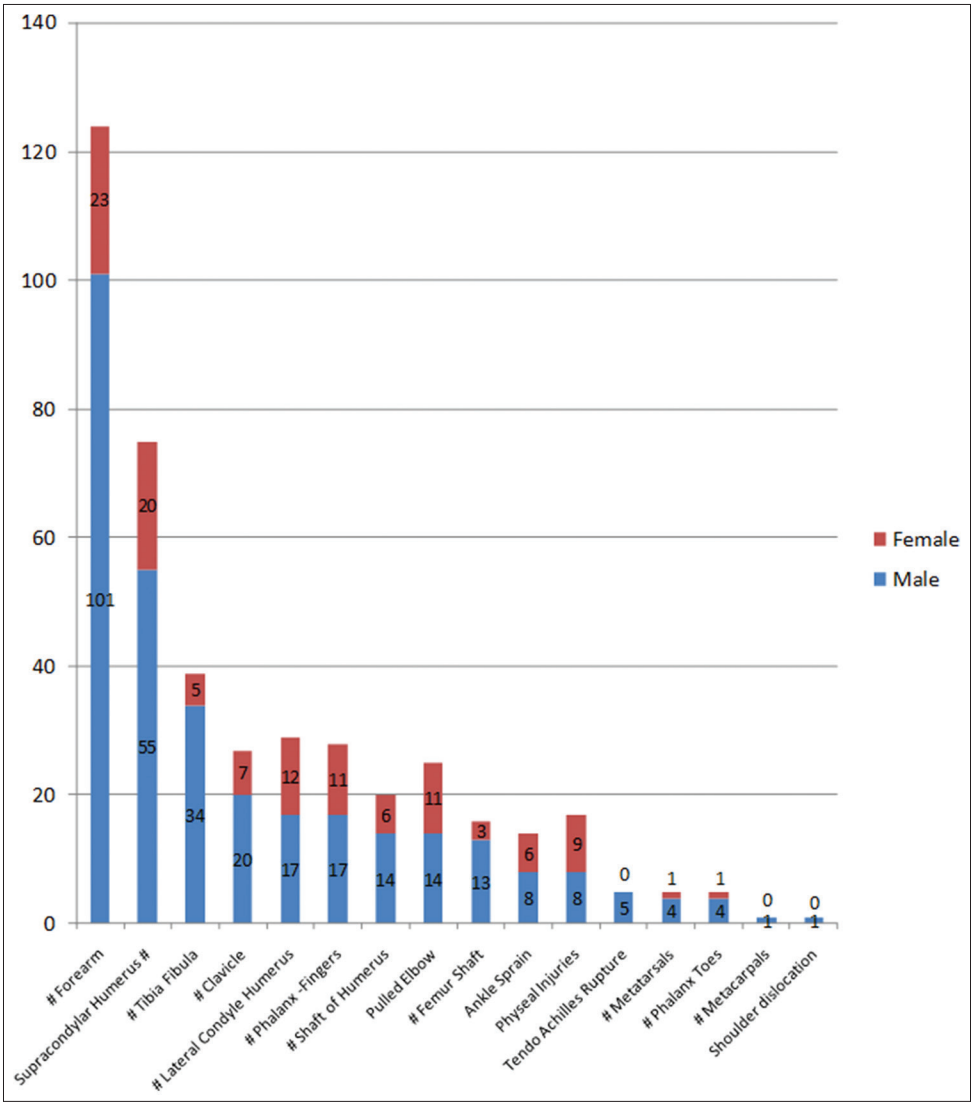

Figure 2: Comparison of common injuries between males and females

rules while driving and thereby set examples and educate children on traffic safety when driving with them.

Left-sided limb involvement was significantly high in the upper limb, accounting for 72% of all upper limb long bone injuries. Similar reports on handedness are seen across the globe [14,15]. This may be explained on the basis that more children are right handed and in an accident situation, the left upper limb plays a protective role to break the force of fall resulting in trauma. Diaphyseal forearm fractures were significantly high in our study group and were managed either by conservative or operative approach. Conservative management is still considered the first line of treatment for pediatric forearm fractures, especially in children <10 years old. At present, if operative intervention is required, both plate fixation and flexible nailing are acceptable treatment options. However, Vopat *et al*. [16] concluded that it is unclear whether flexible nails or open reduction and internal fixation with plates should be recommended as a superior technique. Adequate understanding of the subtleties of either technique is necessary to ensure optimal outcomes, including the limitations of each technique and possible complications. In general, severe comminution and bone loss should be considered as indications for plate fixation, while intramedullary nailing offers better cosmesis and decreased soft-tissue disruption.

Supracondylar humeral fractures were seen in 75 (17.40%) patients. Two-third of all children admitted for elbow injuries are reported to have supracondylar fractures [1]. A high incidence of these fractures was seen at age 5–8 years (50.67%), this is in consonant with a report by Omid *et al*. [17]. Anatomically, the bone is thinned out and weak, children of these age groups are highly active and susceptible to trauma. They can be managed both conservatively and surgically. Conservative management results in bony union but with a possibility of functionally normal and cosmetically deformed cubitus varus from 9% to 33%. However, children are often brought late to the casualty with such fractures, after repeated manipulations by a traditional healer with multiple complications. Surgical intervention results in near anatomical alignment with early joint physiotherapy for early functional return of the limb [18]. Early referral and intervention avoids operative intervention with favorable outcome and this should be stressed on by initial caregivers.

Lateral condyle fractures (29 patients, 6.73%) were seen predominantly between 5 and 8 years. We categorize this injury

as a separate entity from other physeal injuries because of its frequency and associated morbidities. This fracture requires early surgical intervention failing which it results in cubitus valgus, a cosmetic deformity not corrected by bone remodeling often necessitating a corrective surgery later in life. This is to be considered, especially in girls who are more cosmetically conscious as they grow older. Improperly managed lateral condyle fractures result in substantial loss of elbow functions [1]. Such fractures often present late due to various reasons with no particular consensus management guidelines and their treatment continues to be a challenge [19]. Physeal injuries excluding lateral humeral condyles (17 patients, 4.12%) were mostly seen below 12 years of age. We are of the opinion that this is much lower than its actual representation in the light of it being frequently overlooked. Mostly presenting as a localized swelling, pain, and often minimal deformation, it is often missed and managed as a simple injury. X-ray findings are often not obvious to the untrained eyes. Considering its affection of limb length growth and deformity, this injury commands immediate attention and should not be neglected. When in doubt about the possibility of a physeal injury, a second opinion would do no harm than to be alarmed later by its complications. Management algorithms for such injuries are well outlined [20].

Femoral fractures (16 patients, 3.87%), though often unsightly and distressing for patients and parents, can be favorably managed conservatively with excellent outcome. The force causing the fracture may be severe enough to cause other injuries and these should be looked for. With titanium elastic nails now in the market, operative management will be the trend in the near future. However, technique, affordability, and resource availability may hamper this choice in developing countries. Tibial fractures with or without associated fibular fractures were seen in 39 (9.44%) patients. Being subcutaneous, it is highly predisposed to direct trauma mostly while playing contact sports (hockey and football) and falls with direct impact injuries. School authorities and parents should insist on proper sports kits for the protection of their wards. Conservative management results in favorable outcome. Sprains were common at all age groups of both sexes. A good pain killer and rest to the affected part is the necessary treatment. Natural instinct to massage, local ointment applications, and hot fomentations must be avoided to prevent undue prolongation of symptoms and complications.

Open injuries were mostly seen in the fingers, toes, and around the elbow accounting for 12.34% and 9.56% of all injuries in male and female children, respectively. Soft tissues in children are suppler and yield to deforming actions of injuring forces, rarely resulting in extensive wounds. Phalange fractures were seen in 28 (6.78%) patients. The right hand was involved in 23 (82.14%) patients. This could be because the right-handed individuals hold onto objects/structures for support and are thereby predisposed to injuries. What appears as a simple lacerated wound often involves the underlying bone and growth plate and what appears a bruise may conceal underlying phalanx fractures. Such fractures do well with conservative management. However, the possibility of infection of the underlying bone must be considered and proper debridement, wound care and antibiotic covers should always be considered. Badly mutilated injuries often require plastic surgical intervention. Regular follow-up visits are mandatory for phalange fractures for early detection of malalignment and other complications [21]. Pulled elbow was seen in 25 (6.05%) patients. It is a common and painful injury of the young child, occurs due to sudden forceful pulling or lifting of the young child holding the wrist or forearm resulting in dislocation of the proximal radioulnar joint. Excruciatingly painful, closed reduction results in immediate relief with no functional impairment. However, parents should be alerted about the mode of injury during routine immunization visits to the well-baby clinic.

Seasonally, injuries have higher incidence during the hot summer months when children are outdoor, more active and about. About 75% of falls from trees resulting in fractures were seen during the summer months. An Irish study has found a strong positive correlation between monthly sunshine hours and monthly fracture admissions. This may be explained on the basis that on longer days, longer outdoor time increasing the chances of sustaining traumas [22]. Temporary migration from urban to rural settings associated with season is also found to have an effect on the incidence of traumas [23,24]. In relation to physeal injuries, Masterson *et al*. [23] speculated that the rate of growth increases during the summer, the number of physeal fractures should also increase during summer for the physes would be weaker during this time. Patients with associated complications attending the casualty accounted for 11.39% of all cases under study and this was predominantly seen in supracondylar and forearm fractures. The main complications being excessive blistering, local skin breakdown, superficial infections and impending compartment syndromes, and failure of reduction, which are sequelae of intervention by traditional bone setters whose service is still sought after by many parents even in the bigger Indian metros [14].

Soft-tissue injuries in child abuse are reported to be as high as 92% while fractures are reported to be around 9% [25]. This is a sensitive issue and requires a tactful approach which at the time of initial presentation is often overlooked and not accounted for in many trauma centers. Hence, this is also not accounted for in our studies. However, it is important to bear this in mind when pediatric traumas are dealt with for until the cause is addressed the effect will continue to occur. Most pediatric fractures can be managed by conservative methods successfully with a few exceptions. Conservative management aims at attaining a normal anatomical outcome with pre-injury functional status with scientifically established minimal interventional regimens under constant supervision. This involves a graduated immobilization and progressive mobilization according to the physiological recovery of the injured parts to attain an acceptable outcome and to avoid complications resulting from the injury or its treatment thereof. However, many parents neglect institutional treatment and avail the services of traditional healers out of ignorance, financial problems, ease of accessibility, personal preference, and traditional beliefs to name a few. It is with the timely referral by the initial health caregiver at the first contact point that appropriate intervention can be undertaken at an optimum time for maximal benefit.

Educating the parents by the first-aid givers, stressing on the benefits of early scientifically based management will possibly do away with these problems and popularize institutional management. At the administrative level, due consideration to the significantly high injury patterns should be given during resource allocation and workforce distribution so that appropriate training of orthopedic surgeons and primary caregivers for the management of such injuries. At the core of all these lies the need for preventive measures at all level of the society; a drastic reduction of these injuries will be achieved by a comprehensive yet simple and socially acceptable injury prevention measures. Such measures may begin at home and some may require strict legislations which are beyond the scope of this present discussion.

CONCLUSION

Common childhood orthopedic trauma is usually behavior and physical activity-related though actual unforeseen major accidents do occur. Most injuries have favorable outcome when appropriately intervened at, with few exceptions. While strict adherence to disciplines and legislations, recreational guidelines, and behavioral modeling of children could avoid many such injuries, the unfortunate few can still be favorably managed with early referral to an appropriate center, strict adherence to post-interventional advice, and avoidance of unscientific interventions. Orthopedic management of such injuries is progressively in favor of early surgical intervention. Although unavoidable, preventive measures are still the stepping stones and dissemination of knowledge and opinion sharing among medical specialties would definitely reduce the pains of acute trauma and their sequels for the innocent child.

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