

Adolescents with Upper Limb Fractures attending Selected Government Hospitals in a district in Sri Lanka and associated Prehospital Care

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Abstract- Injuries are the number one cause for morbidity and mortality among adolescents. Adolescent fractures are a hidden public health problem in Sri Lanka. Injury to the upper limb will affect all the activities of the adolescent in this new era as risk factors of upper limb fractures are common with highly commercialized society. Prevention of adolescent injuries is an investment for the country as they belong to the economically productive age group. To ease the burden on the state, attention should be given for prehospital care. The objective of the study was to describe the sociodemographic factors of adolescents with upper limb fractures in a district in Sri Lanka and associated prehospital care.

Methods: A hospital based descriptive cross-sectional study was conducted on a sample of 1090 newly diagnosed adolescents with upper limb fractures aged 10 to 19 years treated from higher-level hospitals in the district of Colombo. Descriptive statistics were used to describe socio demographic details and the prehospital care methods.

Results of the sample: The mean age of the sample was 12.45 years (SD=2.59). The majority were males (n = 892; 81.8%). Adolescent's residence (n=518, 47.5%) was the commonest place of injury. Most of the adolescents (n=855, 78.5%) sustained upper limb fractures following a fall. The majority used three-wheeler taxis as transportation methods to reach the hospital (n= 687; 63%). Out of the participants, only 29.5% (n= 322, CI: 26.8-32.3) received any kind of prehospital care.

Conclusion: Most of the adolescents had not received any kind of prehospital care and their transportation method to a health care setting was three-wheeler taxis.

Index Terms: adolescents, injury, prehospital care, upper limb fractures,

1 INTRODUCTION

Musculoskeletal injuries were the commonest cause of hospital admissions among adolescents in all the countries (1).

Unintentional injuries have a significant impact on childhood disabilities and deaths in the world (2). An epidemiologic review stated that the rate of disability among children and adolescents following unintentional injuries was three times higher in low- and middle-income countries compared to that of high-income countries (3). A hospital-based study conducted in China revealed that the incidence of fractures among children and adolescents was 266.6 per 10000 hospital admissions from 2005 to 2008 (4).

Studies have shown that the incidence of distal forearm fractures were the highest, among early adolescents during their pubertal growth spurt (5). The most common fracture in the upper extremity was the distal radius fracture (6). Wang et al., revealed that the commonest cause for fracture among the adolescent population was due to falls (42.5%) and followed by road traffic injuries (29.7%). The study further revealed that the commonest fracture site was upper limb (43.6%) (4).

Indoor Morbidity Mortality Reports (IMMR) from hospitals are available to assess the number of admissions diagnosed and treated for fractures in Sri Lanka. According to IMMR data in 2015, 17,160 children aged five to 16 years were admitted with fractures into six major state hospitals in the district of Colombo (7) and in 2018 the number was increased up to 19,195 (8). Fractures in the upper limbs were more common among adolescent age in Sri Lanka (9). Prehospital care for trauma victims plays an important role before they are brought to hospitals to prevent complications following fractures such as deformities (10). WHO defined prehospital care as the provision of initial medical care to an injured patient by a paramedic or other person before reaching a health care setting. The prehospital care provider may handle the patient when providing one or more forms of first aid, should inform the hospital before directing the patient there, and should then transport and hand over the patient to a health care setting (10). The American Heart Association and the American Red Cross guidelines revealed that one should not move or straighten an injured extremity if there is a fracture (11). They further advised that the stabilization of the extremity with a splint in whatever position to prevent movements of the affected part is the ideal prehospital care method for limb fractures.

Fractures in the upper limbs were more common in adolescents, and prehospital care for adolescent fracture victims was an important part to prevent further complications such as deformity of the limb and damage to vessels or nerves (12). Immobilization of the upper extremity following a fracture will protect further displacement of bony fragments and also prevent further damage to soft tissues. Immobilization is also vital when transporting a patient with a fracture to a health care setting (12). The study described the sociodemographic factors and associated prehospital care for adolescents with upper limb fractures attending selected government hospitals in the Colombo district.

11 METHODS

A hospital based descriptive cross-sectional study was carried out in the district of Colombo in the Western province of Sri Lanka. The study was carried out in all secondary and tertiary care government hospitals in the Colombo district where surgical orthopedic facilities and radiological investigations were available. Data collection was carried out from July 2019 to December 2019. The study population was adolescents aged 10 to 19 years, who were diagnosed as having upper limb fractures due to injuries by a clinical specialist in Surgery or Orthopedic Surgery with confirmation by radiological investigations. The study participants were recruited after receiving initial treatment at the Accident Service Units (ASU) or the Primary Care Units (PCU) in the above hospitals.

The risk was two to three-fold among adolescents who had a previous history of fractures at less than five years of age and predisposed children to sustain repeated fractures during their growth period (13). The exclusion criteria were adolescents who had an existing functional disability before sustaining a fracture, adolescents who were unconscious or critically ill at the time of interviewing or adolescents who had documentary evidence of pathological fractures with the opinion of clinical experts (14). The sample size was determined based on the minimum sample requirement to describe the prehospital care received by adolescent fracture victims. The expected proportion of adolescents with upper limb fractures who received prehospital care was taken as 50%, predetermined level of precision of 0.03 and 95% confidence interval. The calculated sample size was 1067. A further adjustment to the sample size was made and considering a non-response rate, the required sample size was 1185.

Locally and internationally published research findings and other materials related to prehospital care were studied and a qualitative research study was carried out to clarify issues related to prehospital care with the opinion of experts in the field. An interviewer administered questionnaire was developed consisting of three main sections, namely calling for assistance at the time of injury, assessing and providing prehospital care and transportation of the victim to a health care setting. Four pre-intern medical officers were recruited as research assistants and trained for the data collection. Informed written consent was obtained from eligible study participants and their parents or caregivers. The socio-demographic and injury related characteristics were described by frequency distribution. Descriptive statistics was used to describe characteristics of prehospital care received by

adolescent victims. Ethics clearance was obtained from the Ethics Review committee, Faculty of Medicine, University of Colombo, Sri Lanka.

111 RESULTS

The study sample consisted of 1090 newly diagnosed adolescent fracture victims with a response rate of 92.5%. The reason for non-response was, 60 (5%) patients had not given consent to participate in the study and 30 (2.5%) had left the hospital before completion of data collection.

Socio demographic characteristics of adolescent victims are given in Table 1. The mean age of the sample was 12.45 years, with a standard deviation of 2.59 years. Most of the adolescents belonged to the age category of 10 to 12 years (n=664; 60.9%, CI: 57.9-63.8). However, a study done in Iran revealed that one third of adolescents with upper limb fractures belonged to the age category of 13 to 15 years age group (14). Most of the participants were males (n = 892; 81.8%, CI: 79.4-84.1). Male to female ratio of adolescent victims in the study was 4.5:1. Among apparently healthy adolescents in Sri Lanka, this ratio was 1:1.008 (15). According to Indoor Morbidity and Mortality data in 2018, fractures among male victims was 76.6% and female victims was 23.4% (9). Most of the adolescents were school children (n= 1028; 94.3%, CI: 92.8-95.6) and lived with their parents (n=1071, 98.3%, CI: 4.8-5.2).

Table 1: Socio-demographic characteristics of the adolescents with upper limb fractures

<i>Characteristics</i>	<i>(N=1090)</i>	<i>% (95% CI)</i>
Mean age (SD)	<i>12.45(2.59)</i>	
Age category (in years)	<i>Number (N)</i>	
10-12	664	60.9 (57.9-63.8)
13-14	227	20.8 (18.4-23.2)
15-16	84	7.7 (6.2-9.5)
17-19	115	10.6 (8.8-12.5)
Sex		
Male	892	81.8 (79.4-84.1)
Female	198	18.2 (15.9-20.6)
Current state of schooling		
Schooling	1028	94.3 (92.8-95.6)
Not schooling	62	5.7 (4.4-7.2)
Highest level of education if schooling *	(n=1028)	
Grade 5	336	32.7 (29.8-35.6)
Grade 6 to 8	415	40.4 (37.4-43.4)
Grade 9 to 10	183	17.8 (15.5-20.3)

G.C.E. O/L	34	3.3 (2.3-4.6)
G.C.E. A/L	60	5.8 (4.5-7.4)
Parents lived or not with them		
Parents lived	1071	98.3 (4.8-5.2)
Parents not lived	19	1.7 (4.7-14.7)

Table 2 shows injury related characteristics of study participants. Nearly half of the participants were injured at homes or residential areas (n=518; 47.5%, CI: 44.5-50.5). A school or educational institution was the second highest location for injuries among these participants (n=285; 26.2%, CI: 23.6-28.9). The commonest mechanism of injury was falls (n=855; 78.5%, CI: 75.9-80.8) and most of them engaged with leisure time or recreational activities at the time of injury (n=640; 58.7%, CI: 55.7-61.7). Nearly one fifth of adolescent victims had sustained upper limb fractures while engaged with sports activities.

Table 2: Injury related characteristics of the adolescents with upper limb fractures

Characteristic	Number (N=1090)	% (95% CI)
Place of injury		
Home / Residential place	518	47.5 (44.5-50.5)
School/educational Institutions	285	26.2 (23.6-28.9)
Sports/ athletic area	81	7.4 (5.9-9.2)
Public places	34	3.1 (2.2-4.3)
Street/pathways	141	12.9 (11.0-15.1)
Occupational settings	22	2.1 (1.3-3.0)
Other places	9	0.8 (0.4-1.6)
Mechanism		
Falls	855	78.5 (75.9-80.8)
Struck or hit by person*	71	6.5 (5.1-8.1)
Struck or hit by object	80	7.3 (5.9-9.1)
Transport accidents	45	4.1 (3.0-5.5)
Other	39	3.6 (2.6-4.9)
Activity		
Leisure /recreational activity	640	58.7 (55.7-61.7)
Sports/ athletic related activity	210	19.3 (17.0-21.7)
Educational activity	50	4.6 (3.4-6.0)
Working for income	29	2.7 (1.8-3.8)
Travelling	56	5.1 (3.9-6.6)
Domestic activity	31	2.8 (1.9-4.0)
Other activity	74	6.8 (5.4-8.4)

Table 3 depicts the characteristics of calling for assistance at the time of injury by the study participants. Majority of them were not alone when sustained with a fracture. Most of the adolescent

victims had a person nearby at the time of injury (n= 938; 86%, CI: 83.9-88.1). Majority of the participants were reassured by their parents or an immediate family member at the time of injury (n=464; 42.6%, CI: 39.6-45.6). More than half of the study participants did not call for assistance through a communication channel soon after injury (n=614; 56.3%, CI: 53.3-59.3).

Table 3: Characteristics of prehospital care received by adolescents with upper limb fractures

Characteristics	Number(N=1090)	% (95% CI)
Presence of a person at the time of injury		
Present	938	86.0 (83.9-88.1)
Not present	150	13.8 (11.8-16.0)
Not aware of the situation	2	0.2 (0-0.7)
Type of person for reassurance (n=1090) *		
Parents or immediate family member	464	42.6 (39.6-45.6)
Friend	399	36.6 (33.7-39.5)
Neighbour	94	8.6 (7.0-10.5)
Teacher/ coach	38	3.5 (2.5-4.8)
Unknown person	57	5.3 (4.0-6.7)
Another person	21	1.9 (1.2-2.9)
No person to reassure	10	0.9 (0.4-1.7)
Not aware of the situation	07	0.6 (0.3-1.3)
Type of calling (by communication channel) *		
Not called for assistance	614	56.3 (53.3-59.3)
Called parent or close relative	417	38.3 (35.4-41.2)
Called for hospital staff / ambulance	6	0.6 (0.2-1.2)
Called for police	1	0.1 (0-0.5)
Called any other person	52	4.7 (3.6-6.2)

Table 4 shows the characteristics of transportation used by the victims to seek medical care. The transportation is one of the key components to assess the prehospital care received by an injured victim. Most of the injured victims had used three-wheeler taxis to reach the hospital for treatment (n= 687; 63%, CI: 60.1-65.9). Further, almost half of the participants reached the hospital within one-hour period (n=511; 46.9%, CI: 43.9-49.9). This one-hour period was described as the golden hour in provision of prehospital care. One fifth of the participants reached the hospital within one to three hours (n=228; 20.9%, CI:18.5-23.5). Only 2.7% (n=29) received ambulance services to reach hospitals.

Table 4: Characteristics of transportation under prehospital care received by adolescent victims

Characteristic	Number	% (95% CI)
Type of vehicle used (N=1090)		

By Three-wheeler taxis	687	63.0 (60.1-65.9)
By car.	213	19.5 (17.2-22.0)
By bus.	91	8.4 (6.8-10.2)
By an ambulance	29	2.7 (1.8-3.8)
By motorcycle	20	1.8 (1.1-2.8)
By lorry	4	0.4 (0.1-0.9)
By train	9	0.8 (0.4-1.6)
By foot	17	1.6 (0.9-2.5)
Other method	20	1.8 (1.1-2.8)
Person accompanied (N=1090)		
Parent or close relative	933	85.6 (83.4-87.6)
Friend	58	5.4 (4.1-6.8)
Teacher or coach	48	4.4 (3.3-5.8)
Neighbour	8	0.7 (0.3-1.4)
Another person	43	3.9 (2.9-5.3)
Time spent to reach hospital (N=1090)		
Less than 1 hour or 1 hour	511	46.9 (43.9-49.9)
More than 1 hour to 3 hours	228	20.9 (18.5-23.5)
More than 3 hours to 5 hours	153	14.0 (12.0-16.2)
More than 5 to 10 hours	68	6.2 (4.9-7.8)
More than 10 hours to 24 hours	48	4.4 (3.3-5.8)
More than 1 to 3 days	47	4.3 (3.2-5.7)
More than 3 days	35	3.3 (2.2-4.4)
Ambulance care received for transportation (N=1090)		
Ambulance care received	29	2.7 (1.8-3.8)
Ambulance care not received	1061	97.3 (96.2-98.2)
Type of ambulance services used at any time* (n=48)		
Government hospital ambulance service	20	1.8 (1.1-2.8)
1990 "Suwasariya" ambulance service	26	2.4 (1.6-3.5)
Private hospital ambulance service	2	0.2 (0.0- 0.7)

Table 5: Characteristics of overall prehospital care received by adolescents with upper limb fractures

Characteristics	Number	% (95% CI)
Receiving any kind of prehospital care (N=1090)		
Pre hospital care received	322	29.5 (26.8-32.3)
Pre hospital care not received	768	70.5 (67.7-73.2)
Type of prehospital care received* (n=322)		
Stabilize by a splint	158	49.1 (43.5-54.7)
Sling to elevate the arm	45	14.0 (10.4-18.2)
Bandage to cover affected part	54	16.8 (12.9-21.3)
Received analgesics	14	4.3 (2.4-7.2)
Applied topical treatment	46	14.3 (10.7-1)
Applied ice	5	1.6 (0.5-3.6)
The time of prehospital care received*(n=322)		
Within 10 minutes	196	60.9 (55.3-66.2)
11 to 60 minutes	112	34.8 (29.6-40.3)
61 to 120 minutes	7	2.2 (4.4-0.9)
121 to 240 minutes	4	1.2 (0.3-3.1)
More than 240 minutes	3	0.9 (0.2-2.7)
The person attended to provide prehospital care*(n=322)		
Parent or close relative	130	40.4 (35.0-46.0)
Teacher or coach	112	34.8 (29.6-40.3)
Health care worker in Western medicine	33	10.2 (7.2-14.1)
Health care worker in Indigenous medicine	7	2.2 (0.9-4.4)
Friend	29	9.0 (6.1-12.7)
Some other person	11	3.4 (1.7-6.0)

Table 5 depicts the characteristics of prehospital care received by adolescent fracture victims soon after injury. Out of the injured victims, only 29.5% (n= 322, CI: 26.8-32.3) of them received any kind of prehospital care. Out of them, half of the adolescents received stabilizing the affected part of the upper limb with a splint (n=158; 49.1%, CI: 43.5-54.7). Splinting the affected part to keep the area immobilized is the most suitable prehospital care method for upper limb fractures (12). Majority of the victims (n=196; 60.9%, CI: 55.3-66.2) had received any kind of first aid within the first 10 minutes. The first 10 minutes is considered as "platinum period" and the first one hour is considered as "golden hour" in prehospital care practices as described previously (13). Out of the participants who received any kind of prehospital care, majority of them (n=196; 60.9%) received any type of prehospital care within 10 minutes. However, nearly 40% (n=130) of their parents or a close relative had attended to provide prehospital care at the time of injury and followed by a teacher or a coach of adolescent victims (n=112; 34.8%, CI:29.6-40.3).

IV DISCUSSION

The current study revealed that the mean age of the sample was 12.45 years with a standard deviation of 2.59 years. Inconsistent results were found in a cross-sectional population-based study done in Iran among 478 adolescents. The study revealed that the mean age of sustaining an upper limb fracture was 13.7 years (14). This observed difference could be attributed to the difference in the total sample size. The current study results showed that the highest percentage of adolescents were between the ages of 10 and 12 years (n=664; 60.9%). A Global School Health Survey (GSHS) conducted in Sri Lanka in 2016 found that fractures were a common injury in adolescents between 13 and 15 years of age (15). Further, the age group considered in the GSHS survey was not comparable with the age group used in the current study since the participants of GSHS survey were between the ages of 13 and 17 years of age. This observed difference could be due to the different study settings, as in the present study, adolescent victims were recruited consecutively from hospitals although the GSHS survey and the study conducted in Iran were carried out in the

community (14) (15). The male to female ratio was 4.5:1 in the present study with 81.8% of males and 18.2% of females. The male to female ratio was 2.8:1 in a study conducted in tertiary care hospitals in China (4). These two studies revealed that males were more prone to sustain upper limb fractures during adolescence.

This study further revealed that the most common place of sustained adolescent's upper limb fractures was at their homes (47.5%). Consistent results were given in a study conducted in a hospital in Italy among pediatric upper limb fracture victims (41.6%) (16). Therefore, public health programmes have a major role to play in prevention of home injuries and the promotion of safe activities at adolescent homes (17). A previous study revealed that long bone fractures were mainly due to falls and hand, foot and axial skeletal fractures were due to collisions, blunt trauma or traffic accidents (18). More than two thirds of adolescents with upper limb fractures in the present study had been injured due to falls. These results were compatible with National Injury Surveillance data in Sri Lanka as well as studies carried out in other countries by using hospital data bases (9) (16) (19).

The commonest fracture site was the bones of the forearm in almost all the studies (14) (16) (18). Findings of the present study were compatible with those of the above studies. Hospital data collected in the past 14 years in Sweden stated that the commonest activity engaged in, at the time of injury was sports or sports related activities. However, the present study found that most injuries (58.7%) had occurred when the victims were engaged in leisure time or recreational activities. Future studies are needed to cover more districts with bigger sample sizes to get more accurate data.

A previous study carried out at the National Hospital of Sri Lanka (NHSL) to assess the prehospital care received by trauma victims revealed that 65% of them were transported to hospital by three-wheeler taxis (19). The NHSL is the largest hospital in Sri Lanka and it is situated in the district of Colombo. The present study also revealed that 62.1% of victims were transported by three-wheeler taxis from the site of injury to seek treatment from hospitals. Though well-equipped health care facilities and free ambulance services were available in the Colombo district, most of the victims (97.3%) had not utilized these ambulance services for transportation of victims to a health care setting.

The current study revealed that out of all the study participants only 28.3% (n= 308) had received any kind of prehospital care. Therefore, awareness of prehospital care needs to be strengthened among the general population. The awareness of providing proper first aid care to fracture victims and using proper transportation to bring victims to a health care setting within the period of golden hour has helped the speedy recovery of injured victims (13). A community-based study carried out in India revealed that the majority of children (65%) received prehospital care within the golden hour (20). In this study, most of the victims with burns and road traffic crashes received prehospital care with comparison to other injuries. The present study revealed that only one fourth (25.8%) had received prehospital care within the golden hour. Inclusion of all the pediatric victims and variations in socio

demographic background in India would have caused the above observed differences.

In the First aid manuals on prehospital care for upper limb fractures was specifically described that the immobilization is a major component in providing care to the fracture victim (12). Out of the adolescents received any method of pre hospital care, 49.1% (n=158) of them had received splinting procedure which is described as a good prehospital care method for upper limb fractures. However, out of all (n=1090) only 14.5% of adolescents received splinting procedures. A study carried out in Dakota among five-to-18-year age groups revealed 65% of fracture victims had splinting procedure at schools and 48% received splinting procedure in other than the school (P<0.001) (21). Variations in socio-cultural backgrounds, their educational levels and inclusion of children at different age groups as study participants would have caused the above observed differences.

V CONCLUSION

The ongoing public health programmes in the country can be utilized to prevent home injuries among adolescents where the highest number of injuries have taken place. Transportation of an injured victim to a health care setting needs improvement as the present study found that most of the injured victims were transported to hospitals by three-wheeler taxis. Conducting awareness programmes among school children, their parents and teachers will be beneficial to the country since adolescents belong to the productive age group and it is the transition period from childhood to adulthood.

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Declaration of interest:

I declare that there is no conflict of interest.

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