The Professional Medical Journal
www.theprofesional.com

DOI: 10.29309/TPMJ/2020.27.09.4586

ORIGINAL PROF-0-4586

TO STUDY THE CHARACTERISTICS AND BURDEN OF PEDIATRIC TRAUMA IN LOW RESOURCE SETTINGS.

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Article received on:
20/02/2020
Accepted for publication:
04/04/2020

ABSTRACT… Objectives: Purpose of the study is to identify the characteristics and burden of pediatric trauma in a hospital with limited resources and to compare the results with published literature and to formulate the effective injury prevention strategies. **Study Design:** Prospective, Descriptive, Cross-sectional study. **Setting:** Department of Pediatric Surgery, DHQ Teaching Hospital Sahiwal. **Period:** January 2019 to December 2019. **Material & Methods:** A total of 871 patients aged 12 years and below with a history of trauma were included. The patients were categorized into four age groups, 0-2 years, 3-5 years, 6-8 years, and 9-12 years. Data collected included, age, gender, area (rural/urban), type of injury, mechanism of injury, regional pattern of injury, any intervention required and final outcome. The data were compared in different age groups and both sexes. **Results:** Out of total 2609 admissions, 871(33.38%) patients were of trauma and burn. 699(80.3%) trauma patients and 172(19.7%) burn patients. The males were 595(67.9%) and females comprised 276(32.1%). Age ranged from 05 days to 12 years (mean5.07years). By age groups, distribution of patients was, 0-2years 201(23.1%), 3-5years 340(39.0%), 6-8years 213(24.5%), and 9-12years 117(13.4%). Blunt trauma was most common type of injury 688(95.56%) and penetrating trauma was 31(4.43%). Most common mechanisms of injury were, vehicle related incidents 380(54.4%) and fall 238(34.0%). The majority of injuries 432(61.8%), were seen in head, neck and face region. Scald was most common type of burn and seen in 125(14.4%) patients. **Conclusion:** This study clearly shows that pediatric injuries and burn contribute a substantial proportion of all pediatric surgical admissions. Pediatric trauma including burn is a significant burden on health care system. Vehicle related incidents, fall injuries and scald burns are most common type of injuries.

Key words: Epidemiology, Pediatrics, Polytrauma, Preventive Measures, Traumatology.

Article Citation: Shafiq Ur Rehman, Makki Y, Fazal S, Afzal HS, Ishtiaq F. To study the characteristics and burden of pediatric trauma in low resource settings. Professional Med J 2020; 27(9):1958-1965.
DOI: 10.29309/TPMJ/2020.27.09.4586

INTRODUCTION

Pediatric trauma continues to be a major cause of death and disability, worldwide. It accounts for significant burden on health care system, especially in countries with economic restraints. In recent decades, significant reduction in the burden of communicable diseases in children has occurred due to continuous and sustained efforts. Similar type of initiatives and commitment can reduce the burden of pediatric trauma, which is a preventable surgical disease. Effective and efficient preventive measures, resource-adapted trauma care protocols and training of health care providers can have great impact on pediatric trauma outcomes.

In spite of all preventive and safety measures, the trauma has been a real health concern of modern world. Rapid motorization is further accelerating the problem. Trauma has been a leading cause of death in pediatric population in both the developed and developing countries.[1,2] Injuries are the most common cause of death in children above one year of age.[3] Pediatric trauma is a significant burden on healthcare system globally.[4] Intentional and unintentional injury is a traumatic and stressful event for children and their families. For the injured child, being admitted to the hospital can be a frightening and confusing experience that leads to subsequent psychological distress.[5] Trauma is a major public health problem and a significant cause of death

and disability, worldwide. More than 90% occurs in low and middle income countries.[6] Due to inadequate pre hospital and hospital based medical care in low and middle income countries; the outcome of pediatric trauma is unsatisfactory. Mortality rate for seriously injured patients is six times more in under developed countries than at the level 1 trauma center in USA.[7] Treatment of injured children at a pediatric trauma centre is associated with increased survival rate.[8] Even in the UK, reports have shown suboptimal care and poor outcome for patients with traumatic injury.[9,10] However in the high income countries due to the establishment of well-coordinated systems of triage, emergency medical care, critical care and multidisciplinary surgical care, the outcome of trauma patients has improved. Due to resource limitations, such trauma management systems do not exist in low income countries like Pakistan. The absence of formal triage system in many hospitals in low and middle income countries leads to potentially life threatening delay in the medical care of severely injured or critically ill patients.[11] Inadequate staff and huge patient loads also lead to delay in assessment and treatment in many hospitals in low and middle income countries.[12]

The situation in Pakistan is worse because of absence of appropriate prehospital and hospital based medical care for trauma patients, especially for pediatric population. To the best of my knowledge, pediatric surgery units do not exist in any DHQ/THQ Hospitals in Pakistan. Only a few pediatric surgery units have been established in Teaching Hospitals. It means a vast majority of children with surgical problems including trauma, is considered as scaled-down adults and is being treated by General Surgeons. Differences between children and adults with respect to patterns of injury, physiologic response and management should be recognized. In a study of seven Emergency Departments in Pakistan, noted that only about 17% of patients were appropriately triaged, and fewer than 25% had any vital signs documented.[13] A study conducted at Karachi reported that 58% of the victims of violence died on the way to hospital.[14]

Limited data is available regarding epidemiology and burden of pediatric trauma in Pakistan. Different demographics, mechanisms, presentations, injury patterns and outcomes are present in different age groups and regions. Trauma burden also varies from region to region. This study is an attempt to get insight and understanding of characteristics and burden of pediatric trauma, which is a necessary prerequisite to formulate effective injury preventive measures. This study will also be helpful for public health professionals and policy makers to plan, design and implement the pediatric trauma management network which almost non existing in Punjab.

MATERIAL & METHODS

This is a prospective, descriptive, cross-sectional study conducted in the department of pediatric surgery, at DHQ teaching hospital Sahiwal, over a period of twelve months, from January 2019 to December 2019. Formal approval of the study was obtained from ethical review committee of Sahiwal Medical College and Allied Hospitals, Sahiwal. A total of 871 patients, aged 12 years and below, admitted in pediatric surgery unit through emergency department, with a history of trauma and burn, were included in this study. Patients with sexual assault, drowning, poisoning, animal bites, snake bites and patients of psychiatric disorders with trauma were not included in the study. Patients with isolated head injury, limb trauma with bony fractures, ocular injury and injuries related to ENT were also excluded from the study. Resident doctor on duty recorded the characteristics of all patients. A standard proforma was used to collect the data from all trauma patients. Data collected included age, gender, area (rural/urban), type of injury, and mechanism of injury, regional pattern of injury, any intervention required and final outcome. Every pediatric trauma patient was evaluated with medical history, clinical examination and investigations. ATLS guidelines were followed for evaluation and management.

The data was processed using SPSS 20 and involved descriptive statistics like means, medians, standard deviations and frequency distribution. Frequency and percentage were

presented for all variables and frequency tables were used.

RESULTS

Total admissions in the pediatric surgery unit during the study period from January to December 2019, were 2609. A total of 871(33.38%) children were included in the study, 699(80.3%) trauma patients and 172(19.7%) burn patients. 490(56.3%) patients came from urban area and 381(43.7%) from rural area. Distribution of admissions by month is shown in Table-I. On average, 73 patients were admitted per month. The highest number of patients were admitted in November (n=126) and lowest in February (n=39). When comparing the distribution of admissions by quarters of the year, the fourth quarter (October to December) had the highest proportion of admissions (n=282) second quarter (April to June) had the lowest (n=174). Among all patients, 595(67.9%) were male and 276(32.1%) were female. Among trauma patients, 491(70.24%) were male and 208(29.75%) females. Whereas among burn patients, 104(60.46%) were male and 68(39.53%) female. Among all patients, age ranged from 05 days to 12years, with mean age 5.07 years. For trauma patients, age range was 05days to 12 years and mean age was 5.2 years. Whereas burn patients ranged in age from 04 months to 12 years, with mean age 4.2 years and 125(72.67%) were blew 05 years of age. By age groups, distribution of patients was, 0-2years 201(23.1%), 3-5years 340(39.0%), 6-8years 213(24.5%), and 9-12years 117(13.4%) Table-II. Blunt trauma was most common type of injury and seen in 668(95.56%) patients and only 31(4.43%) patients had penetrating injury. The mechanisms of injury among 699 trauma patients were, fall 238(34.0%), vehicle related incidents 380(54.4%), firearm injury 05(0.7%), stabbing injury 06(0.9%), blows 06(0.9%), crush injury 06(0.9%), blast 03(0.4%) and miscellaneous 55(7.9%). Vehicle related incident was most common mechanism of injury and seen in 380(54.4%) patients. Fall was second most common mechanism of injury and found in 238(34.0%) patients. Agriculture related injuries were included in the miscellaneous group 55(7.9%). Body was divided into seven regions and total 1023 injuries among 699 trauma patients were stratified based on different body regions Table-III. The highest number of injuries 432(61.8%) were seen in Head, neck and face region. Thermal injuries were, scald 125(14.4%), flame 30(3.4%), electric 06(0.7%), chemical 03(0.3%), contact 04(0.5%) and miscellaneous 04(0.5%). Scald was most common type of burn and seen in 125(14.4%) patients. Mechanisms of injuries by age groups are shown in Table-IV. Pattern of regional injuries by age groups is shown in Table-V.

Distribution of Admission By Month			
Month	**Burn**	**Trauma**	**Total**
January	18	48	66(7.6%)
February	13	26	39(4.5%)
March	12	64	76(8.7%)
April	19	54	73(8.4%)
May	13	45	58(6.7%)
June	9	34	43(4.9%)
July	11	60	71(8.2%)
August	13	72	85(9.8%)
September	12	66	78(9.0%)
October	10	62	72(8.3%)
November	18	108	126(14.5%)
December	24	60	84(9.6%)
Total	172	699	871
Distribution of admission by Quarter of the year			
1st Quarter (January-March) 181			
2nd Quarter (April-June) 174			
3rd Quarter (July-September) 234			
4th Quarter (October-November) 282			

Table-I. Sub analysis of admission of pediatric Trauma and burn patients

Trauma Patients	699(80.3%)
Burn Patients	172(19.7%)
Area	
Urban	490(56.3%)
Rural	381(43.7%)
Sex Distribution total Patient (871)	
Male	595(67.9%)
Female	276(32.1%)
Sex distribution of Burn Patients (172)	
Male	104 (64.46%)
Female	68(39.53%)
Age Rang/ Mean	
Total Patients (871)	05days-12years(mean5.0years)
Trauma Patient (699)	05days-12years(mean5.2years)
Burn Patients (172)	04months-12years(4.2years)
Number of Patients by Age Group (871 Patients)	
0-2 Years	201(23.1%)
3-5 Years	340(39.0%)
6-8 Years	213(24.5%)
9-12 Years	117(13.4%)

Table-II. Demographics of the 871 pediatric trauma patients.

Type of Injury	
Blunt	668(95.56%)
Penetrating	31(4.43%)
Mechanism of Injuries (699 Patients)	
Fall	238(34.0%)
Vehicle related incidents	380(54.4%)
Firearm Injury	05(0.7%)
Stabbing	06(0.9%)
Blows	06(0.9%)
Crush	06(%0.9)
Blast	03(0.4%)
Miscellaneous	55(7.9%)
Pattern Of Regional Injury (699 Patients)	
Head, Neck, Face	432(61.8%)
Thorax	151(21.6%)
Abdomen	137(19.6%)
Upper Limb	117(16.7%)
Lower Limb	138(19.7%)
Pelvis and Prenium	45(6.4%)
Spine	03(0.4%)
Treatment(699 Patients)	
Conservative	102(14.6%)
Minor Surgery	564(80.7%)
Major Surgery	33(4.7%)
Mechanism of Burn(172 Patients)	
Scald	125(14.4%)
Flame	30(3.4%)
Electric	06(0.7%)
Chemical	03(0.3%)
Contact	04(0.5%)
Miscellaneous	04(0.5%)

Table-III. Characteristics of trauma:

Age group	Fall	Vehicle Related incident	Fire arm Injury	Stabbing	Blows	Crush	Blast	Miscellan-eous	Total
0-2 Years	52(7.4%)	78(11.2%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	06(0.9%)	136(19.5%)
3-5 Years	103(14.7%)	151(21.6%)	2(0.3%)	01(0.1%)	0(0%)	02(0.3%)	01(0.1%)	25(3.6%)	285(40.8%)
6-8 Years	58(8.3%)	96(3.7%)	0(0%)	03(0.4%)	04(0.6%)	02(0.3%)	01(0.1%)	20(2.9%)	184(26.3%)
9-12 Years	25(3.6%)	55(7.9%)	3(0.4%)	02(0.3%)	02(0.3%)	02(0.3%)	01(0.1%)	04(0.6%)	94(13.4%)
Total	238(34.0%)	380(54.4%)	05(0.7%)	06(0.9%)	06(0.9%)	06(0.9%)	03(0.4%)	55(7.9%)	699(100%)

Table-IV. Mechanism of injury by age group (699 Patient of Trauma)

Age Group	Head, Neck, Face	Thorax	Abdomen	Upper Limb	Lower Limb	Pelvis, Prenium	Spine
0-2	91(13%)	38 (5.4%)	21(3%)	29(4.1%)	23(3.3%)	6(0.9%)	0(0%)
3-5	193(27.6%)	58(8.3%)	47(6.7%)	50(7.2%)	44(6.3%)	12(1.7%)	2(0.3%)
6-84	100(14.3%)	33 (4.7%)	43(6.2%)	25(3.6%)	48(6.9%)	19(2.7%)	1(0.1%)
9-12	48(16.9%)	22 (3.1%)	26(3.7%)	13(1.9%)	23(3.3%)	8(1.1%)	0(0%)
Total	432 (61.8%)	151 (21.6%)	137(19.6%)	117(16.7%)	138(19.7%)	45(6.4%)	3(0.4%)

Table-V. Patterns of regional inquiries by age group; Total No of patients 699, Total No. of injuries 1023

DISCUSSION

We must continue to improve the safety and quality of care of our children. Their right to safety should not be neglected. Pediatric trauma is on the rise and has become an important social problem.[15,16] Trauma accounts for about 12% of the disease burden worldwide and places disproportionate burden on countries with limited resources.[17] Health care needs of pediatric trauma patients are being ignored due to economic considerations. The only way forward is optimal use of locally available resources, cost efficient injury preventive strategies, education and training of health care providers, and development of resource adapted health care network for pediatric trauma patients.

This study provides very important information regarding the pediatric patients of trauma and burn, admitted in small pediatric surgery unit at DHQ Teaching Hospital Sahiwal. Out of total admissions (n=2609), 33.38 %(n=871) patients were of pediatric trauma and burn, which is very high percentage. According to one study conducted in 2015 in South Africa, trauma accounted for 15.9% of all pediatric patients.[18] The present study showed highest frequency of admissions (n=282) in fourth quarter of the year. The study conducted by G Naqvi et al 2017, revealed highest proportion of pediatric trauma admissions in the third quarter of the year.[19]

One previously published study reported increased frequency of pediatric trauma admissions in spring and summer months.[20] Due to the biological, behavioral, social and cultural factors, males are more prone to be involved in injuries. In agreement with many previously published studies, our study also shows male predilection for injuries, males 67.9 %(n=595) and females 32.1 %(n=276).[21,22,23] The present study revealed that 3-5 years age group is the most common victim of trauma,39%(n=340). 6-10.9 years 20.7%(n=2038) has been reported as the most frequently injured age group[10] A study conducted in India reported that 11-15 years comprised the most common age group involved in trauma.[24] However in our study, only the children aged 12 years and below were included. Blunt trauma is the most common type of injury 95.56 %(n=668) and penetrating injury is 4.43% (n=31). Almost same pattern has been reported in the study.[19] We found that vehicle related incidents, 54.4 %(n=380), were the most common injury mechanism. Less stringent traffic rules in Pakistan may be the reason. This finding was supported by many previously published studies.[19,25,26,27] Unlike the previous studies[21,22,28] fall was not the most common injury mechanism, rather it was the second most common injury mechanism, 34.0 %(n=238). Vehicle related incidents are the most common injury mechanism in boys and fall is most common in girls.[24] Based on mechanism of injury, 7.9% (n=55) patients were included in miscellaneous group. Children included in this group suffered from animal hits, fall from animals, toka injury and other injuries related to equipment and machinery used in agriculture. Relatively high number of patients in this group can be explained on the finding of the study that 43.7% (n=381) children came from rural area. While comparing the mechanism of injury in different age groups, it was seen that both vehicle related incidents, 21.6% (n=151) and fall, 14.7 %(n=103), are common in 3-5 years age group. This finding is not in agreement with some studies in which fall is most common mechanism of injury in younger children and vehicle related incidents is most common mechanism of injury in older age groups. In our study, majority of injuries 61.8% (n=432), were found in head neck and face region. The thorax was the 2nd most commonly involved region, 21.6% (n=151). Similar to our study, in another study, head region was reported as most commonly involved region but the second most commonly involved region was limbs.[19] Burns, especially those that lead to permanent disfigurement and disability, are the most catastrophic events to happen to a child.[29] Over eleven million people are estimated to suffer burn injuries, worldwide.[30] Children under 5 years of age are at greatest risk of burn injuries.[31] In our study, out of total 871 children, 19.7% (n=172) had burns. 72.67% (n=125) burn patients were below five years of age. Mean age of burn patients was 4.2 years (4month to 12 years). Scald was the most common type of burn 14.4% (n=125). One study reported that burns accounted for 34.8%.[32] According to one study conducted in

India, thermal injuries are third most common mode of injury,8.44%(n==97) and scalds and flame injuries are more common in >5years age group.[24] Similar to our finding, scald was reported as most common type of burn by Ahmad M 2010.[33] Contrary to our results, in some studies, flame has been reported as the most common mechanism of burn.[24,34] Poor outcomes of burns are more often due to delayed presentation, lack of trained staff, and paucity of burn centers.[35]

Simple measures are recommended such as increased awareness of the public regarding risk factors and adequate supervision of children at homes, schools and playgrounds. Homes, schools and playgrounds should be safe and child friendly. There should be separate playgrounds for different age groups. Implementation of traffic rules through education and legislation is necessary to reduce the vehicle related incidents. In the rural areas, agriculture is the main occupation of the people and children usually help their parents in their work. The use of technology, modern equipment and machines in this field has increased the risk for children to be involved in injuries. Education, awareness and safety measures are necessary.

Considering the burden of pediatric trauma, it is suggested that pediatric surgery as a specialty should be given a due place in health care system and as a subject should be included in undergraduate medical education. Pediatric surgery units consisted of three separate bays, general pediatric surgery, pediatric trauma and burn bay, should be established in every teaching hospital and DHQ hospital. State of the art children institutions with multiple specialties of pediatric medicine and surgery should be established at divisional level.

Due to certain limiting factors, this study may not be truly representative of severity and extent of the problem. It was conducted at very small pediatric surgery unit, small sample size and study period was only one year. The isolated pediatric trauma which is managed in neurosurgery, orthopedic, ENT, ophthalmology and urology departments was not included in the study.

CONCLUSION

This study clearly shows that pediatric injuries and burn contribute a substantial proportion of all pediatric surgical admissions. Pediatric trauma including burn is a significant burden on health care system. Vehicle related incidents, fall injuries and scald burns are most common type of injuries. Effective and efficient preventive measures are required to reduce these injuries. Public health programs aimed to improve the safety of vehicles, roads, homes and play grounds are desperately needed. Effective strategy should be devised to create awareness regarding agriculture related trauma in the rural area. As boys are more commonly involved in injuries, they need greater supervision and safety measures. Keeping in mind the obstacles such as ignorance, illiteracy and economic restraints, the low cost measures can play pivotal role.

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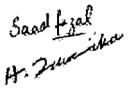
2	Yasir Makki	Literature review, Final approval.	
3	Saad Fazal	Data entry, Proof reading, literature review.	
4	Hafiza Swaiba Afzal	Biostatistics.	
5	Fareena Ishtiaq	Data entry, Proof reading, Literature review.