

PATTERN AND SURGICAL MANAGEMENT OF PEDIATRIC TRAUMA CASES IN A RURAL TERTIARY CARE HOSPITAL

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ABSTRACT

Background

Pediatric trauma remains a significant public health challenge and a leading cause of morbidity and mortality among children, particularly in low-resource settings. Understanding the patterns of injury, clinical presentations, and outcomes is critical for developing effective prevention and management strategies.

Objective

To evaluate the patterns, clinical presentations, management strategies, and outcomes of pediatric trauma cases in a rural tertiary care hospital.

Methods

This cross-sectional study was conducted for about 6 months from June, 2011 to Nov, 2011 in the Department of Paediatric Surgery, Khalifa Gulnawaz Teaching Hospital, Bannu Medical College, Bannu, Pakistan. A total of 300 pediatric trauma cases were analyzed. Data were collected using a structured proforma, including demographic details, injury patterns, clinical presentations, management approaches, and outcomes. Statistical analysis was performed to identify significant associations, with a *P-value* of less than 0.05 considered statistically significant.

Results

The majority of trauma cases occurred in children aged 6–10 years (40%), with a male predominance (68%). Falls (45%) and road traffic accidents (30%) were the leading mechanisms of injury, with 60% of injuries occurring at home. Most cases (75%) presented with mild injuries based on Glasgow Coma Scale scores, and 55% required surgical intervention. Postoperative complications were minimal (10%), and the recovery rate was high (80%). However, delays in presentation and poor follow-up compliance were identified as key challenges.

Conclusion

Pediatric trauma predominantly affects school-aged boys and is mainly attributable to falls and road traffic accidents. Although the study describes immediate management of acute cases with low complications and mortality rates, the study emphasizes the need to redouble preventive measures, increase parental sensitization, and develop postoperative follow-up programs to achieve optimal outcomes.

Keywords: *Pediatric trauma, injury patterns, rural healthcare, falls, road traffic accidents, surgical management, prevention, follow-up compliance*

INTRODUCTION

Pediatric trauma is one of the significant causes of illness and death amongst children and, thus, a primary concern to child health globally (1). Trauma is most acutely seen in low-middle-income countries where there are fewer resources for preventing and managing injuries. The infant and the

child are in a constant search of something new, and this, coupled with physical helplessness, makes them very susceptible to suffering from trauma, especially when they are in places that are inadequately protected (2).

Child injury rates differ depending on geographic location and socioeconomic status. In rural areas, children encounter different hazards related to poor infrastructure, unregulated traffic, and insufficient supervision at home or in recreational areas. It is crucial to consider these patterns while developing strategies to prevent injuries and enhance the outcomes observed in victims (3).

Pediatric trauma requires proper diagnosis and timely intervention in management, as indicated in studies (4-6). However, delayed presentation, restricted access to specialized care, and inadequate follow-up might hinder recovery. This study aims to counter these challenges by exploring the frequency of occurrence of pediatric trauma injuries, their presentation, and the management of cases at the identified rural tertiary care hospital.

Therefore, the study was aimed to fill the gap by identifying the characteristics of care needs of the pediatric population in similar environments. Finding common risk factors and possible barriers to proper care, the study aims to outline prevention measures and enhance the management of clinical practices in the field of childcare to enhance outcomes for injured children.

METHODOLOGY

This cross-sectional study was conducted for about 6 months from June, 2011 to Nov, 2011 in

the Department of Paediatric Surgery, Khalifa Gulnawaz Teaching Hospital, Bannu Medical College, Bannu, Pakistan. As a tertiary care facility, the hospital serves a huge population. Among the many patients it receives, there are many pediatric trauma patients from rural and urban areas. Thus, the study employed a cross-sectional observational design to compare the pediatric trauma cases in the hospital during the study period. The objective was to determine the nature of lesions, treatment approaches, and prognosis of the children involved.

The study included children aged 0 to 15 years who presented to the hospital with traumatic injuries. Inclusion criteria were: Pediatric patients (aged ≤ 15 years), Trauma cases require medical or surgical intervention and consent from the guardian or parent.

The exclusion criteria were Patients with non-trauma-related conditions and those who left against medical advice before definitive treatment.

The total sample consisted of 300 pediatric trauma cases. The sample size was chosen to obtain a representative sample of the trauma patterns and management outcomes within the hospital's capabilities over a period of six months.

Data was collected using a structured proforma that included the following sections:

1. **Demographic Details:** Age, gender, residence (rural/urban), socioeconomic status, and parental education.
2. **Injury Patterns:** Mechanism, type, and site of injury, as well as the location where the injury occurred.
3. **Clinical Presentation:** Time elapsed between the injury and hospital presentation, Glasgow Coma Scale (GCS) scores, and vital signs at admission.
4. **Management Details:** The type and timing of interventions (surgical or non-surgical), the length of hospital stay, and intraoperative or postoperative complications.

5. **Outcomes:** Recovery status (full recovery, partial recovery, or residual disability), mortality, and follow-up compliance.

Patients were identified through the hospital's emergency and outpatient department registers. After initial assessment, detailed information was obtained through patient interviews, clinical examinations, and medical record reviews. For surgical cases, operative notes were reviewed to gather details about the type and timing of procedures and any complications.

All collected data was entered into a database for statistical analysis. Frequencies and percentages were calculated for categorical variables, while continuous variables were summarized using means and standard deviations. Chi-square tests assessed associations between categorical variables, and a

P-value of less than 0.05 was considered statistically significant. Informed consent was secured from the parents or guardians of all participants. Confidentiality was maintained throughout the study, and data was used solely for research.

Results

The demographic characteristics showed that trauma was most prevalent among children aged 6–10 years, comprising 40% of the cases, followed by the 11–15 years group at 30%. Infants under one year accounted for only 5% of the cases, indicating a lower exposure to trauma risks in this age bracket. Male children significantly outnumbered females with a ratio of approximately 2:1 (68% male, 32% female), highlighting a gender-based disparity likely due to differences in activity levels. Rural residents formed the majority (72%), emphasizing a potential lack of safety measures in these areas. Most families belonged to the low-income bracket (58%), indicating an association between socioeconomic status and trauma incidence (*P-value: 0.04*).

Table 1: Demographic Characteristics of Pediatric Trauma Cases

Variable	Categories	Frequency	Percentage (%)	P-value
Age Distribution	<1 year	15	5%	0.03
	1–5 years	75	25%	
	6–10 years	120	40%	
	11–15 years	90	30%	
Gender	Male	204	68%	0.001
	Female	96	32%	
Residence	Rural	216	72%	0.02
	Urban	84	28%	
Socioeconomic Status	Low	174	58%	0.04
	Middle	102	34%	
	High	24	8%	

Falls were the leading cause of trauma, accounting for 45% of the cases, followed by road traffic accidents (30%) and burns (15%). Less frequent mechanisms included animal bites and other causes (5% each). Home was the most common location of injury (60%), followed by playgrounds (25%). Public roads and schools were less common injury sites at 10% and 5%, respectively. Blunt injuries predominated in 50% of cases, followed by penetrating injuries (30%) and burns (20%). Head and neck injuries were the most frequent (35%), with extremity injuries close behind at 30%. Soft tissue injuries (20%), abdominal trauma (10%), and thoracic injuries (5%) were less common. These findings underscore the need for targeted interventions in homes and playgrounds to mitigate common injury risks.

Table 2: Mechanisms and Patterns of Pediatric Injuries

Variable	Categories	Frequency	Percentage (%)	P-value
Mechanism of Injury	Falls	135	45%	0.02
	RTAs	90	30%	
	Burns	45	15%	

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	Animal Bites	15	5%	
	Others	15	5%	
Location of Injury	Home	180	60%	0.01
	Playground	75	25%	
	Public Roads	30	10%	
	School	15	5%	
Type of Injury	Blunt	150	50%	0.001
	Penetrating	90	30%	
	Burns	60	20%	
Site of Injury	Head/Neck	105	35%	0.005
	Extremities	90	30%	
	Soft Tissue	60	20%	
	Abdomen	30	10%	
	Thorax	15	5%	

Most children (45%) were brought to the hospital within an hour of injury, indicating good pre-hospital care for a significant portion of patients. However, 35% presented within 1–6 hours, and 20% delayed for over six hours, potentially contributing to worse outcomes in those cases (*P-value: 0.03*). Vital signs at admission were normal in 75% of cases, while 25% had abnormal parameters, reflecting the severity of certain injuries. According to the Glasgow Coma Scale (GCS), the majority (75%) had mild injuries, while moderate and severe injuries accounted for 15% and 10%, respectively, emphasizing the predominance of non-life-threatening trauma.

Table 3: Clinical Presentation of Trauma Cases

Variable	Categories	Frequency	Percentage (%)	P-value
Time to Presentation	<1 hour	135	45%	0.03
	1–6 hours	105	35%	
	>6 hours	60	20%	
Vital Signs at Admission	Normal	225	75%	0.04
	Abnormal	75	25%	
Glasgow Coma Scale (GCS)	Mild (13–15)	225	75%	0.001
	Moderate (9–12)	45	15%	
	Severe (<8)	30	10%	

Surgical interventions were required in 55% of cases, with emergency procedures constituting 60% of the total surgeries performed. Elective surgeries accounted for the remaining 40%, demonstrating a mix of urgent and planned interventions (*P-value: 0.001*). Hospital stays varied, with half of the patients discharged within three days, 30% staying 3–7 days, and 20% requiring prolonged stays over a week (*P-value: 0.03*). Postoperative complications were minimal, occurring in only 10% of cases, including infections (5%), wound dehiscence (3%), and bleeding (2%).

Table 4: Management Approaches and Surgical Outcomes

Variable	Categories	Frequency	Percentage (%)	P-value
Type of Intervention	Surgical	165	55%	0.001
	Non-surgical	135	45%	
Surgical Timing	Emergency	180	60%	0.02
	Elective	120	40%	
Length of Stay (LOS)	<3 days	150	50%	0.03
	3–7 days	90	30%	

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	>7 days	60	20%	
Complications During Surgery	None	270	90%	0.01
	Infections	15	5%	
	Wound	9	3%	
	Dehiscence			
	Bleeding	6	2%	

Outcomes were largely favourable, with 80% of patients achieving full recovery. Partial recovery was observed in 15%, while 5% experienced residual disabilities. The mortality rate was low at 2%, reflecting effective management strategies for most trauma cases. Follow-up compliance was highest in the short term, with 50% attending follow-ups within three months, but dropped to 35% at 3–6 months and 15% beyond six months. These findings highlight the importance of structured follow-up protocols to ensure long-term recovery.

Table 5: Outcomes and Follow-Up of Pediatric Trauma Cases

Variable	Categories	Frequency	Percent (%)	P-value
Recovery	Full	240	80%	0.001
	Partial	45	15%	
	Residual Disability	15	5%	
Mortality	Yes	6	2%	0.05
	No	294	98%	
Follow-Up Compliance	<3 months	150	50%	0.04
	3–6 months	105	35%	
	>6 months	45	15%	

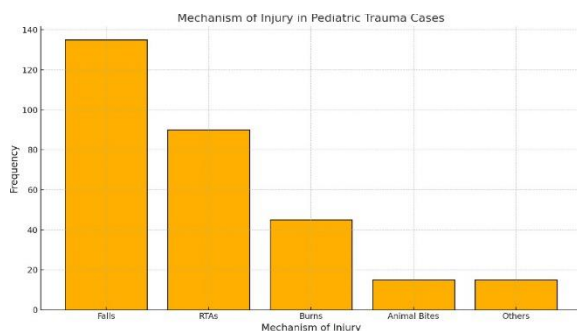


Figure 1: The bar chart illustrating the mechanism of injury highlights the prominence of falls as the leading cause, accounting for 45% of all trauma cases. Road traffic accidents (RTAs) followed at 30%, while burns comprised 15%. Less frequent causes, including animal bites and other mechanisms, accounted for 5%. These results indicate that falls and RTAs are the primary contributors to pediatric trauma in this setting, emphasizing the need for preventive measures at home and in traffic-heavy areas. The visual representation also aligns with the findings from Table 2, reinforcing the dominance of falls as a significant concern.

DISCUSSION

This study has highlighted comprehensive details of pediatric trauma, frequency, prevention, and prognosis in a rural tertiary care centre. In accordance with worldwide statistics, children between the ages of six and ten years were most often affected by trauma; a significant number of the patients were boys (7-9). Other studies similar to this one that have been done in developing countries have also found that there are higher levels of trauma among school-aged boys, and this could be due to more participation in physical activities and taking of reckless actions by the boys (10-12).

The leading mechanism of injury identified in this study was falls, accounting for 45% of cases, followed by road traffic accidents (30%). This was consistent with findings from regional studies highlighting falls as the most common cause of pediatric injuries (13-15). The predominance of falls underscores the need for preventive measures at home and playgrounds, particularly in rural areas where safety standards may be lacking.

In terms of injury location, the majority occurred at home (60%), with a smaller proportion attributed to playgrounds (25%) and public roads (10%). These findings align with studies that noted a high prevalence of home injuries among children in resource-limited settings (3, 16). This

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highlights the importance of parental supervision and safety education to reduce preventable injuries.

Clinical presentation data revealed that most children (45%) presented within an hour of injury, while a significant proportion (20%) experienced delays exceeding six hours. Studies have demonstrated that delayed presentation can negatively impact outcomes, particularly in cases of head injuries and severe trauma (17, 18). Early intervention remains a critical factor in improving prognosis.

Management strategies showed a balanced approach, with 55% of cases requiring surgical intervention. Emergency surgeries were more common than elective procedures, reflecting the acute nature of most injuries. The low rate of postoperative complications (10%) suggests that the surgical care provided was adequate and in line with established protocols. Studies have reported similar outcomes, where timely and appropriate surgical interventions significantly reduced morbidity and mortality (19).

The 80% overall recovery rate is encouraging and comparable to international benchmarks. However, the 5% residual disability rate indicates room for improvement in rehabilitation services. Studies emphasize the role of structured follow-up programs in ensuring optimal functional recovery (20). Additionally, the low mortality rate (2%) reflects the effectiveness of trauma management in this setting.

This study highlighted critical areas for improvement, including enhanced safety measures, better parental awareness, and strengthened follow-up protocols. Future research should focus on evaluating the impact of preventive strategies and addressing barriers to timely presentation and comprehensive care.

CONCLUSION

This study underscores the significant burden of pediatric trauma cases managed in a rural tertiary care hospital. The findings reveal that falls and

road traffic accidents are the leading causes of injuries, with a substantial proportion occurring at home. The male predominance and high prevalence among school-aged children suggest targeted prevention strategies focusing on improving home safety, enhancing traffic regulations, and raising awareness among parents and caregivers. In conclusion, although the recovery rates and low mortality are impressive results of acute care, they underline the necessity for further improvement of preventive measures and rehabilitation services to decrease the burden of pediatric trauma in the long term. Future research assessing particular programs can help policymakers make more informed decisions regarding children's trauma care in facilities.

REFERENCES

1. Peden M. World report on child injury prevention. 2008.
2. Roudsari BS, Shadman M, Ghodsi M. Childhood trauma fatality and resource allocation in injury control programs in a developing country. *BMC Public Health*. 2006;6:1-5.
3. Grossman DC. The history of injury control and the epidemiology of child and adolescent injuries. *The future of children*. 2000;23-52.
4. Bartlett SN. The problem of children's injuries in low-income countries: a review. *Health policy and planning*. 2002;17(1):1-13.
5. Sethi D. European report on child injury prevention: WHO Regional Office Europe; 2008.
6. Noordin S, Wright JG, Howard AW. Global relevance of literature on trauma. *Clinical Orthopaedics and Related Research®*. 2008;466(10):2422-7.
7. Haider AH, Efron DT, Haut ER, DiRusso SM, Sullivan T, Cornwell III EE. Black children experience worse clinical and functional outcomes after traumatic brain

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- injury: an analysis of the National Pediatric Trauma Registry. *Journal of Trauma and Acute Care Surgery*. 2007;62(5):1259-63.
8. Nemeroff CB. Neurobiological consequences of childhood trauma. *Journal of Clinical Psychiatry*. 2004;65:18-28.
 9. Heim C, Newport DJ, Mletzko T, Miller AH, Nemeroff CB. The link between childhood trauma and depression: insights from HPA axis studies in humans. *Psychoneuroendocrinology*. 2008;33(6):693-710.
 10. Keenan HT, Bratton SL. Epidemiology and outcomes of pediatric traumatic brain injury. *Developmental neuroscience*. 2006;28(4-5):256-63.
 11. Brehaut JC, Miller A, Raina P, McGrail KM. Childhood behavior disorders and injuries among children and youth: a population-based study. *Pediatrics*. 2003;111(2):262-9.
 12. Reinberg O, Reinberg A, Mechkouri M. 24-hour, weekly, and annual patterns in traumatic and non-traumatic surgical pediatric emergencies. *Chronobiology international*. 2005;22(2):353-81.
 13. Pitone ML, Attia MW. Patterns of injury associated with routine childhood falls. *Pediatric emergency care*. 2006;22(7):470-4.
 14. Sawyer JR, Flynn JM, Dormans JP, Catalano J, Drummond DS. Fracture patterns in children and young adults who fall from significant heights. *Journal of Pediatric Orthopaedics*. 2000;20(2):197-202.
 15. Imahara SD, Hopper RA, Wang J, Rivara FP, Klein MB. Patterns and outcomes of pediatric facial fractures in the United States: a survey of the National Trauma Data Bank. *Journal of the American College of Surgeons*. 2008;207(5):710-6.
 16. Flavin MP, Dostaler SM, Simpson K, Brison RJ, Pickett W. Stages of development and injury patterns in the early years: a population-based analysis. *BMC public health*. 2006;6:1-10.
 17. Cimpello LB, Khine H, Avner JR. Practice patterns of pediatric versus general emergency physicians for pain management of fractures in pediatric patients. *Pediatric emergency care*. 2004;20(4):228-32.
 18. Agran PF, Anderson C, Winn D, Trent R, Walton-Haynes L, Thayer S. Rates of pediatric injuries by 3-month intervals for children 0 to 3 years of age. *Pediatrics*. 2003;111(6):e683-e92.
 19. Rothrock SG, Green SM, Morgan R. Abdominal trauma in infants and children: prompt identification and early management of serious and life-threatening injuries. Part I: injury patterns and initial assessment. *Pediatric emergency care*. 2000;16(2):106-15.
 20. Damore DT, Metzl JD, Ramundo M, Pan S, Van Amerongen R. Patterns in childhood sports injury. *Pediatric emergency care*. 2003;19(2):65-7.