

Outcome Of Conservative Management Of Blunt Abdominal Trauma In Children

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Abstract: Blunt abdominal trauma (BAT) is a leading cause of pediatric morbidity and mortality, particularly in low-resource settings like Pakistan, where road traffic accidents (RTAs) and falls are major contributors. The standard of care has shifted from mandatory surgical intervention to non-operative management (NOM) for hemodynamically stable patients with solid organ injuries. This study evaluates the outcomes of conservative management of pediatric BAT in a tertiary care hospital in Pakistan, assessing its success rate, complications, and factors contributing to treatment failure. **Methods:** This prospective observational study was conducted at Pakistan Institute of Medical Sciences (PIMS), Islamabad, over six months (October 2024 to March 2025). A total of 90 pediatric patients (≤ 16 years) with confirmed BAT were enrolled. Patients were stratified based on injury severity using the American Association for the Surgery of Trauma (AAST) grading system and managed conservatively if hemodynamically stable. Primary outcomes included NOM success rate, need for surgical intervention, and mortality. Secondary outcomes included hospital length of stay, blood transfusion requirements, and complications such as secondary hemorrhage and delayed splenic rupture. Data were analyzed using SPSS version 26, with a p -value of < 0.05 considered statistically significant. **Results:** NOM was successful in 78 patients (86.7%), with failure observed in 12 patients (13.3%), primarily those with severe injuries requiring surgical intervention. The most commonly injured organs were the spleen (40.0%) and liver (38.9%). RTAs were the leading cause of BAT (53.3%), followed by falls (30.0%). Complications included secondary hemorrhage (11.1%), delayed splenic rupture (6.7%), and infection (10.0%). ICU admission was required in 24.4% of cases, while 27.8% required blood transfusions. The mean hospital stay was 5.7 ± 2.3 days, with prolonged stays observed in severe cases. **Conclusion:** This study demonstrates that NOM is a safe and effective approach for managing pediatric BAT in Pakistan, with a high success rate and favorable patient outcomes. The findings highlight the importance of strict hemodynamic monitoring, timely transfusion support, and selective surgical intervention in high-risk cases. Given the increasing burden of pediatric trauma due to RTAs and falls, efforts should be directed toward improving trauma care infrastructure, enhancing training for NOM protocols, and implementing preventive strategies to reduce pediatric injury rates in Pakistan.

Keywords: Blunt abdominal trauma, Pediatric trauma, Non-operative management, Solid organ injury, Pakistan, Conservative treatment, Road traffic accidents

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Introduction

Blunt abdominal trauma (BAT) is a significant cause of morbidity and mortality in pediatric populations worldwide, including Pakistan, where road traffic accidents (RTAs), falls, and sports-related injuries are common mechanisms of injury (1,2). Pediatric trauma patients present unique challenges due to their anatomical and physiological differences, including a more compliant rib cage, larger solid organ size relative to body mass, and lower fat content, making them more vulnerable to abdominal organ injuries (3). In Pakistan, limited access to specialized pediatric trauma care, delayed hospital presentations, and resource constraints often impact the management and outcomes of these patients (4).

Traditionally, surgical intervention was considered the primary treatment for pediatric BAT; however, with advances in imaging and critical care, non-operative management (NOM) has become the standard of care for hemodynamically stable patients with solid organ injuries (5). Studies have shown that NOM is successful in over 80% of pediatric BAT cases, leading to shorter hospital stays, lower rates of post-surgical complications, and improved long-term outcomes (6). The introduction of Focused Assessment with Sonography for Trauma (FAST) and contrast-enhanced computed tomography (CT) has further facilitated timely and accurate diagnosis, allowing clinicians to stratify injury severity and tailor management accordingly (7).

In Pakistan, pediatric trauma management remains an under-researched area, with most hospitals lacking dedicated pediatric trauma teams and standardized NOM protocols (8). Delayed diagnosis, inadequate monitoring, and limited access to advanced imaging are major concerns in resource-limited settings (9). Additionally, the prevalence of road traffic accidents, particularly involving motorcycles, is high due to poor enforcement of traffic laws, lack of child safety measures, and risky riding behaviors (10). As a result, many children with BAT present late or in deteriorated conditions, complicating their management and increasing the likelihood of adverse outcomes.

International literature supports NOM as the preferred approach for pediatric BAT, with splenic and hepatic injuries being the most commonly managed injuries without surgery (11). However, the success of conservative treatment depends on rigorous hemodynamic monitoring, timely blood transfusions, and adherence to standardized trauma care protocols (12). Despite these established guidelines, there is limited data on the outcomes of NOM in Pakistani pediatric populations, warranting further research to optimize treatment strategies (13).

This study aims to evaluate the effectiveness and safety of conservative management in pediatric patients with blunt abdominal trauma in a tertiary care hospital in Pakistan. By assessing NOM success rates, factors contributing to treatment failure, and patient outcomes, this research seeks to contribute valuable data to improve trauma management guidelines for pediatric patients in Pakistan. The findings may help refine clinical



decision-making, enhance patient monitoring protocols, and reduce unnecessary surgical interventions, ultimately improving pediatric trauma care in the country.

Methodology

This prospective observational study was conducted at Pakistan Institute of Medical Sciences (PIMS) Hospital, Islamabad, over six months, from October 2024 to March 2025, to evaluate the outcomes of conservative management in pediatric patients with blunt abdominal trauma (BAT). The study enrolled pediatric patients aged 0 to 16 years who presented with BAT and were hemodynamically stable at the time of admission. Patients with penetrating abdominal trauma, hemodynamic instability requiring immediate surgical intervention, pre-existing coagulopathies, or incomplete medical records were excluded. A total of 90 pediatric patients meeting the inclusion criteria were selected using a non-probability consecutive sampling technique.

Upon admission, all patients underwent a comprehensive clinical evaluation, including a detailed history of the trauma mechanism and a focused abdominal examination. Imaging studies, including Focused Assessment with Sonography for Trauma (FAST) and contrast-enhanced computed tomography (CT) where necessary, were performed to assess the extent of intra-abdominal injury. Injury severity was classified based on the American Association for the Surgery of Trauma (AAST) grading system for solid organ injuries. Hemodynamic stability was defined as normal age-adjusted vital signs without the need for continuous vasopressor support or emergent blood transfusion at presentation.

Patients were categorized into three groups based on injury severity: mild, moderate, and severe. Those with mild to moderate injuries were managed conservatively through close hemodynamic monitoring, serial abdominal examinations, and repeat imaging as needed. Conservative management strategies included fluid resuscitation, pain control with age-appropriate analgesia, and transfusion support where indicated. Hemoglobin levels and vital signs were monitored every four to six hours in the first 48 hours and every 12 hours thereafter. The failure of conservative management was defined as worsening hemodynamic instability, persistent or worsening abdominal pain, or evidence of ongoing hemorrhage requiring surgical intervention.

The primary outcomes assessed were the success rate of non-operative management (NOM), the need for surgical intervention, and overall survival. Secondary outcomes included hospital length of stay, blood transfusion requirements, complications such as secondary hemorrhage, delayed splenic rupture, or infection, and intensive care unit (ICU) admissions.

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of PIMS Hospital. Written informed consent was obtained from the parents or legal guardians of all enrolled patients before participation in the study. Patient confidentiality was maintained by de-identifying personal data, and the study was conducted by the principles outlined in the Declaration of Helsinki.

Data were collected on structured forms and entered into SPSS version 26 for statistical analysis. Continuous variables such as age and hospital stay were expressed as mean ± standard deviation, while categorical variables such as mechanism of injury and treatment outcomes were reported as frequencies and percentages. The chi-square test was used to compare categorical variables, and a p-value of <0.05 was considered statistically significant.

Results

Demographic and Baseline Characteristics of Study Participants

A total of 90 pediatric patients (≤16 years) with confirmed BAT were included in the study. The mean age of the patients was 9.4 ± 3.2 years,

with a male predominance (61.1%). The most common mechanism of injury was road traffic accidents (RTA), accounting for 53.3% of cases, followed by falls (30.0%). The presence of associated injuries, such as extremity fractures and head trauma, was recorded. The demographic characteristics of the study participants are summarized in Table 1.

Table 1 presents the demographic and baseline characteristics of the study population. The majority of cases were due to RTA, followed by falls, which aligns with the common injury patterns observed in pediatric trauma cases in Pakistan. More than half of the patients (54.4%) had isolated BAT, while the remaining had associated injuries.

The severity and type of intra-abdominal organ injuries were assessed through imaging (FAST ultrasound and contrast-enhanced CT scan when necessary). The liver and spleen were the most commonly injured organs, followed by the kidney and mesenteric structures. The injury severity score (ISS) was used to stratify patients into mild, moderate, and severe categories. The distribution of abdominal injuries is presented in Table 2. Table 2 demonstrates that splenic and hepatic injuries were the most frequent findings. The majority of patients had mild to moderate injuries, with only 15 cases categorized as severe. The decision for conservative management was based on hemodynamic stability and serial clinical evaluations.

The overall success rate of non-operative management (NOM) was 86.7%. Patients were monitored for hemodynamic stability, need for blood transfusions, and signs of deterioration requiring surgical intervention. Those with mild and moderate injuries showed favorable outcomes with conservative management, whereas a small proportion of severe cases required operative intervention. The outcomes are summarized in Table 3.

Table 3 highlights that conservative management was highly successful, particularly in mild and moderate injuries. Severe cases had a higher failure rate (60%) requiring surgery, ICU admission, and transfusion support.

The incidence of complications and length of hospital stay were analyzed. The most common complications included secondary hemorrhage, delayed rupture of the spleen, and infection. The mean hospital stay was 5.7 ± 2.3 days, with significant variations based on injury severity. These findings are presented in Table 4.

Table 4 indicates that complications were more common in severe cases, particularly secondary hemorrhage and delayed splenic rupture. The length of hospital stay increased with injury severity, emphasizing the need for careful monitoring in high-risk patients.

These findings support the safety and efficacy of non-operative management in appropriately selected pediatric BAT patients in Pakistan. They highlight the importance of early imaging, careful monitoring, and selective surgical intervention.

Table 1: Demographic and Baseline Characteristics of Pediatric Patients with BAT

Variable	Value (n=90)	Percentage (%)
Mean Age (years ± SD)	9.4 ± 3.2	-
Gender (Male/Female)	55/35	61.1/38.9
Mechanism of Injury		
- Road Traffic Accidents (RTA)	48	53.3
- Falls	27	30.0
- Sports-Related Trauma	9	10.0
- Other	6	6.7
Associated Injuries		
- Extremity Fractures	20	22.2
- Head Trauma	13	14.4
- Thoracic Injuries	8	8.9
- No Associated Injuries	49	54.4

Table 2: Pattern of Intra-Abdominal Injuries in Pediatric BAT Patients

Organ Injured	Mild (n=40)	Moderate (n=35)	Severe (n=15)	Total (n=90)
Liver Injury	18	12	5	35 (38.9%)
Spleen Injury	14	15	7	36 (40.0%)
Kidney Injury	4	5	2	11 (12.2%)
Mesenteric Injury	3	2	1	6 (6.7%)
Multiple Organ Injury	1	1	0	2 (2.2%)

Table 3: Outcomes of Conservative Management in Pediatric BAT Patients

Outcome Measure	Mild (n=40)	Moderate (n=35)	Severe (n=15)	Total (n=90)
Successful NOM	40 (100%)	32 (91.4%)	6 (40.0%)	78 (86.7%)
Failure of NOM (Surgery Required)	0	3 (8.6%)	9 (60.0%)	12 (13.3%)
ICU Admission	4 (10.0%)	6 (17.1%)	12 (80.0%)	22 (24.4%)
Blood Transfusion Required	5 (12.5%)	9 (25.7%)	11 (73.3%)	25 (27.8%)

Table 4: Complications and Length of Hospital Stay

Parameter	Mild (n=40)	Moderate (n=35)	Severe (n=15)	Total (n=90)
Secondary Hemorrhage	1 (2.5%)	3 (8.6%)	6 (40.0%)	10 (11.1%)
Delayed Spleen Rupture	0	2 (5.7%)	4 (26.7%)	6 (6.7%)
Infection	2 (5.0%)	3 (8.6%)	4 (26.7%)	9 (10.0%)
Mean Hospital Stay (days ± SD)	3.4 ± 1.2	6.2 ± 1.8	9.5 ± 2.7	5.7 ± 2.3

Discussion

The findings of this study demonstrate that non-operative management (NOM) of blunt abdominal trauma (BAT) in pediatric patients is both effective and safe in a significant majority of cases, with an overall success rate of 86.7%. These results are consistent with global trends advocating for NOM as the standard of care for hemodynamically stable pediatric trauma patients with solid organ injuries. The higher success rate observed in mild and moderate injuries (100% and 91.4%, respectively) supports the growing body of evidence that conservative management is a viable alternative to surgical intervention when strict monitoring protocols are followed.

Our results align with those reported by Stylianos (14), who found that NOM of solid organ injuries in pediatric BAT cases had an overall success rate exceeding 85%, provided that hemodynamic stability was maintained. Similarly, a multicenter study by Al-Jundi et al. (15) highlighted that conservative management reduced the need for unnecessary laparotomies, leading to lower morbidity and improved long-term outcomes. The relatively low failure rate of NOM in our study (13.3%) is also comparable to that reported by Mutabdzic et al. (16), where only 10-15% of pediatric BAT cases required surgical intervention due to hemodynamic instability or worsening clinical conditions.

The most frequently injured organs in our cohort were the liver (38.9%) and spleen (40.0%), which is in line with previous studies indicating that hepatic and splenic injuries are the most common solid organ injuries in pediatric BAT (17). Saeed et al. (18) observed similar patterns in Pakistani children with abdominal trauma, emphasizing the importance of careful monitoring to prevent delayed hemorrhage or rupture. The increased risk of failure of NOM in severe cases (60.0% requiring surgery) suggests that while conservative treatment remains the preferred approach, a subset of high-risk patients may still require operative intervention, as also noted by Gruszecki et al. (19).

One key observation in this study was that road traffic accidents (RTAs) accounted for the majority of injuries (53.3%), followed by falls (30.0%). These findings are consistent with the work of Khan et al. (20), who reported that RTAs are the leading cause of pediatric trauma in Pakistan due to inadequate child safety measures, poor traffic regulation, and high rates of motorcycle-related injuries. Preventive measures such as improved road safety policies, helmet use for child passengers, and better

enforcement of traffic laws could play a crucial role in reducing the incidence of pediatric BAT in Pakistan.

The requirement for ICU admission (24.4%) and blood transfusion (27.8%) in our cohort was primarily observed in moderate to severe injury cases. Shah et al. (21) found that aggressive fluid resuscitation and transfusion strategies improved outcomes in pediatric trauma patients, particularly those managed conservatively. However, delayed complications such as secondary hemorrhage (11.1%) and delayed splenic rupture (6.7%) were notable concerns in our study. These complications, also documented by Ullah et al. (22), highlight the importance of prolonged observation and follow-up imaging in patients with high-grade solid organ injuries.

Despite the promising outcomes of NOM, the study had some limitations, including its single-center design and relatively small sample size. Additionally, variations in clinician decision-making and imaging protocols may have influenced patient management. Future research should focus on multi-institutional studies with standardized NOM protocols to validate these findings across diverse healthcare settings in Pakistan.

Conclusion

Our study reinforces the safety and effectiveness of conservative management in pediatric BAT patients in Pakistan, with a high success rate in appropriately selected cases. The findings suggest that early and accurate injury assessment, strict hemodynamic monitoring, and timely intervention in cases of NOM failure are key to optimizing outcomes. Given the increasing burden of pediatric trauma due to RTAs and falls, efforts should be directed toward public health initiatives, enhanced pre-hospital care, and trauma system development to improve pediatric trauma outcomes in Pakistan.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-PIMSISB-033w-24)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution**TA** (Resident),*Manuscript drafting, Study Design,***MAM** (HO)*Review of Literature, Data entry, Data analysis, and drafting article.***MMK** (HO),*Conception of Study, Development of Research Methodology Design,***SB** (Consultant Peads)*Study Design, manuscript review, critical input.***HHM** (MO)*Manuscript drafting, Study Design,***AC** (Professor)*Review of Literature, Data entry, Data analysis, and drafting article.**All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.***References**

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