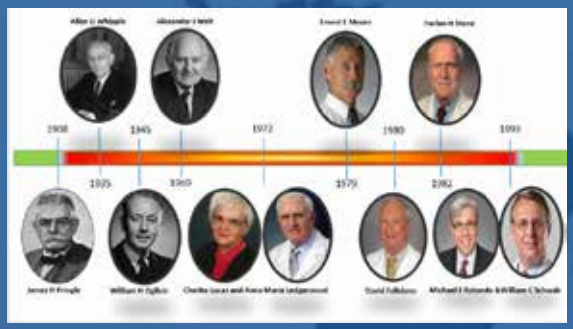
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Blunt Polytrauma in Two Pediatric Patients: Surgical vs. Conservative Management – A Two-Case Study

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Abstract

Background: Pediatric blunt abdominal trauma presents complex diagnostic and therapeutic challenges. This case series highlights two pediatric patients with polytrauma from road traffic accidents, each with distinct intra-abdominal injuries and differing management strategies.

Case Presentation: Case 1 involved a 7-year-old female with pulmonary contusion, facial lacerations, splenic rupture, and bowel perforation. Case 2 involved a 13-year-old female presenting with macrohematuria and left flank pain after ejection from a vehicle; imaging revealed a Grade III/IV renal laceration with retroperitoneal hematoma and minor pleural effusion.

Intervention: Case 1 underwent emergency laparotomy with splenectomy and segmental bowel resection, followed by intensive monitoring and antimicrobial therapy. Case 2 was managed conservatively with intravenous fluids, antibiotics, and blood transfusion.

Outcome: Both patients recovered without major complications. Case 1 had a shorter hospital stay following definitive surgical control. Case 2 required prolonged observation due to the risk of delayed renal complications but achieved complete recovery.

Conclusions: Hemodynamically unstable patients with splenic rupture and bowel perforation require urgent surgery, while stable patients with high-grade renal injuries can be managed non-operatively, emphasizing individualized, stability-based care.

Keywords: pediatric trauma, blunt abdominal injury, polytrauma, splenic rupture, non-operative management, emergency surgery

Introduction

Blunt abdominal trauma (BAT) remains one of the most frequent and challenging scenarios in pediatric trauma care. Due to anatomical differences such as proportionally larger solid organs and thinner abdominal walls children are more prone to solid organ injuries (SOIs) than adults[1]. The spleen, liver, and kidneys are the most commonly affected organs, with management strategies varying according to injury severity and institutional protocols[2].

Operative interventions such as splenectomy were once common, but advances in imaging and clinical practice have shifted care toward non-operative management (NOM) in hemodynamically stable children, as endorsed by APSA[3–4]. Renal trauma care has evolved similarly, with growing reliance on conservative treatment and selective angioembolization in stable patients[6].

Previous reports from our center have described successful management of other pediatric abdominal emergencies, including urgent echinococcosis surgery[7] and splenic torsion due to wandering spleen[8], underscoring the importance of timely diagnosis and individualized treatment. Similar observations have also been reported in regional pediatric surgical literature[9].

This case series compares two pediatric patients with similar mechanisms of injury but different intra-abdominal injuries and management approaches, highlighting individualized decision-making.

Case Presentations

These two cases illustrate two different management approaches in pediatric abdominal trauma, aligning with current evidence and guidelines.

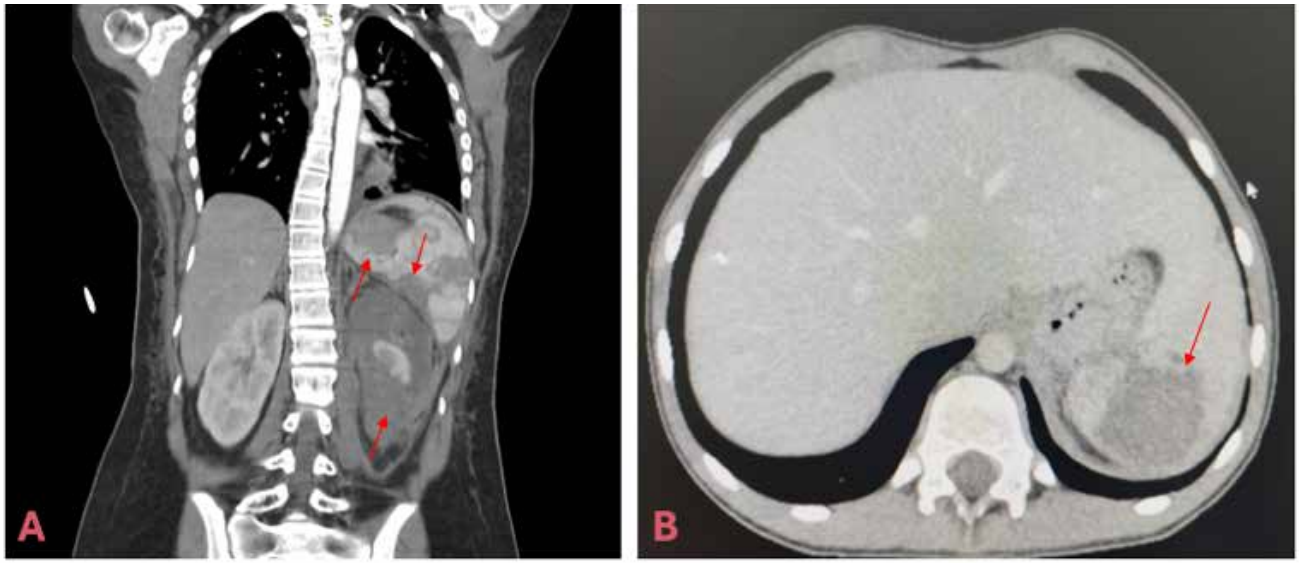
Case 1

A previously healthy 7-year-old female was brought to the emergency department after being struck by a car while crossing the street, sustaining facial lacerations, extremity excoriations, and abdominal trauma. She was hypotensive (85/50 mmHg) and tachycardic (125 bpm), consistent with hypovolemic shock.

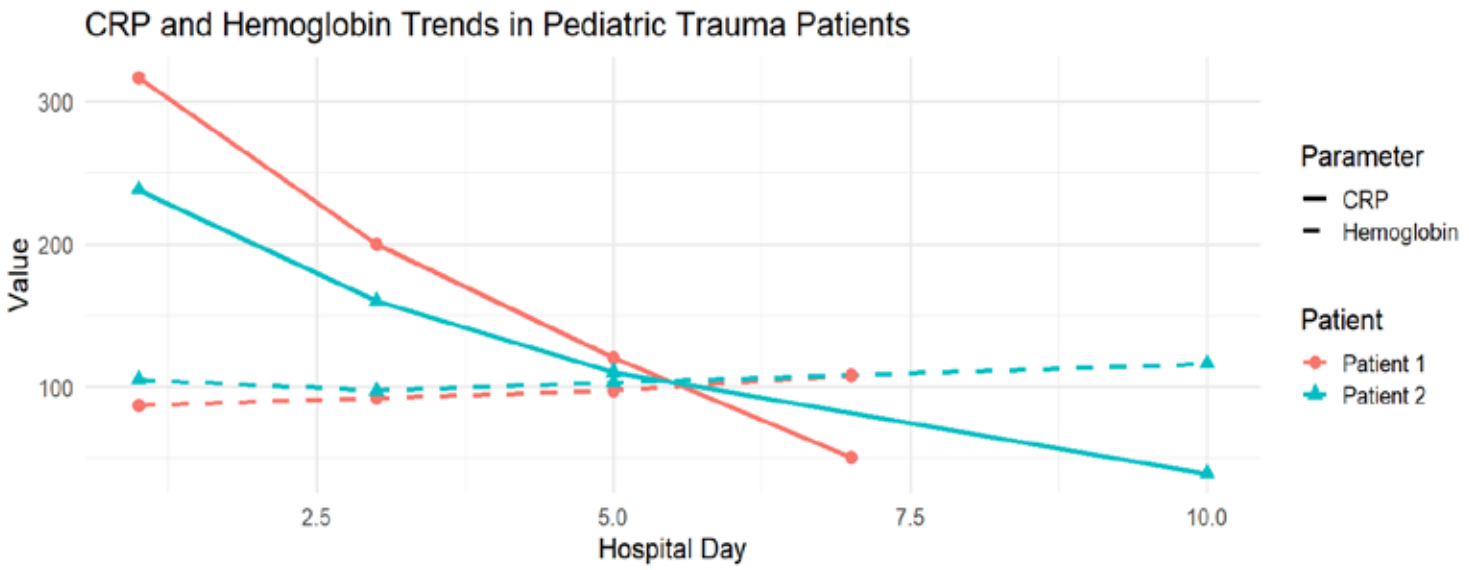
Chest CT demonstrated pulmonary contusion with a minimal left hemothorax. Abdominal CT revealed splenic rupture with perisplenic hematoma (Figure 1). Laboratory testing showed significant anemia (87 g/L), leukocytosis (17.2 × 10^9/L), elevated CRP (260 mg/L), and hypoalbuminemia (28 g/L).

Emergency laparotomy confirmed splenic rupture and descending colon perforation, and she underwent splenectomy and segmental bowel resection with primary anastomosis. Following surgery and source control, CRP levels (Graph 1) declined rapidly, hemoglobin improved after resuscitation, and all laboratory parameters progressively normalized. She was discharged in good condition after 5 days.

Figure 1: Contrast-enhanced CT findings in a pediatric patient with blunt abdominal trauma.
(A) Coronal CT demonstrating a large left renal laceration with surrounding perirenal hematoma (arrows).
(B) Axial CT image showing splenic rupture with heterogeneous splenic parenchyma (arrow).



Graph 1: Serial trends of C-reactive protein and hemoglobin in two pediatric trauma patients managed surgically and conservatively.



Case 2

A 13-year-old female passenger was ejected through a lateral window during a high-speed collision. She presented alert and hemodynamically stable (BP 100/50 mmHg, HR 87 bpm) with left flank pain, facial excoriations, and macrohematuria.

Abdominal CT demonstrated a Grade III/IV left renal laceration with perinephric hematoma and retroperitoneal fluid. Thoracic CT revealed mild pulmonary contusion and a small left pleural effusion (200 mL). Laboratory results showed anemia (105 → 91 g/L), elevated CRP (238 mg/L), and hypoalbuminemia (28 g/L).

She was managed non-operatively with intravenous fluids, analgesia, meropenem, ciprofloxacin, transfusion of one unit of packed red blood cells and plasma, tetanus prophylaxis, and gastroprotection. CRP (Graph 1) declined gradually, reflecting slower resolution of renal parenchymal inflammation, and hemoglobin stabilized after transfusion. She was discharged in good condition after 18 days.

Although both children sustained blunt abdominal trauma in motor vehicle accidents, their courses diverged due to differences in injury severity and physiological response. Patient 1 was unstable with splenic rupture and bowel perforation, requiring urgent laparotomy, resulting in rapid postoperative clinical and laboratory improvement. Patient 2, despite having a high-grade renal laceration, remained stable and successfully underwent conservative management with prolonged observation and serial laboratory monitoring. Both recovered well, illustrating the effectiveness of stability-based, individualized treatment strategies in pediatric polytrauma (Table 1).

Discussion

The trend toward non-operative management (NOM) in pediatric abdominal trauma has significantly reduced the need for surgery while maintaining excellent outcomes in appropriately selected patients. Data from Bagwell et al. show that up to 78% of children with splenic trauma were successfully treated without surgery, with splenectomy rates markedly lower at pediatric trauma centers compared to adult centers (7.8% vs. 15.7%).[1] This underscores the importance of specialized pediatric care and the influence of institutional experience on surgical decision-making.

Similarly, liver injury grading based solely on imaging does not reliably predict clinical outcomes, reinforcing that hemodynamic stability should guide management rather than radiologic severity alone.[1] Current APSA-endorsed guidelines recommend tailored approaches based on vital signs, transfusion needs, and signs of ongoing bleeding.[4]

Renal trauma, while less frequent, follows a similar trajectory. Fernández-Ibieta emphasizes the value of four-phase contrast-enhanced CT in diagnosis and highlights the success of NOM, even in high-grade injuries, when patients remain stable.[6] The growing role of interventional radiology, particularly selective angioembolization, has further reduced the need for operative

Table 1: Comparative summary of clinical characteristics and management in two pediatric patients with blunt abdominal trauma

Category	Patient 1	Patient 2
Age	**7 years**	**13 years**
Mechanism of Injury	Road traffic accident (RTA)	Blunt trauma (RTA, ejection)
Renal Injury	None	Grade III/IV renal laceration
Major Injuries	Splenic rupture, bowel perforation, pulmonary contusion	Renal laceration, pulmonary contusion, pleural effusion
Hemodynamic Stability	Unstable	Stable
Surgical Intervention	Yes	No
Management Approach	Emergency laparotomy (splenectomy, bowel resection)	Conservative (fluids, antibiotics, transfusion)
Hospital Course	ICU → Surgery → Step-down	Ward observation → Discharge
Length of Stay	5 days	18 days
Discharge Outcome	Good condition, transferred	Good condition, discharged

management in pediatric solid organ injuries by offering targeted hemostasis while preserving organ function.

Organ injury grading, such as the American Association for the Surgery of Trauma (AAST) classification, remains an important reference for assessing injury severity but should always be interpreted in clinical context. In this study, Case 1 represented a Grade V splenic injury with associated hollow viscus perforation, while Case 2 sustained a Grade III–IV renal injury. These grades correlate with the observed management strategies, where hemodynamic stability rather than grade alone determined treatment choice.

Access disparities remain a significant challenge. As Nance et al. found, more than 17 million U.S. children lack access to a verified pediatric trauma center within a 60-minute transport window, particularly in rural areas.[5] This gap contributes to variability in care, including higher operative rates in centers unfamiliar with pediatric-specific trauma protocols.

Current reviews stress the importance of minimizing unnecessary interventions. Gates et al., through a systematic review, concluded that routine follow-up imaging, prophylactic embolization, and prolonged hospital stays offer little benefit in stable patients,[4] while Lyttle et al. advocate reduced activity restrictions and shorter hospital stays in line with updated protocols prioritizing physiologic recovery over injury grade.[5]

While NOM is preferred for most solid organ injuries, hollow viscus injury remains a major indication for urgent laparotomy in pediatric blunt abdominal trauma.[1] Early recognition is essential, as delays in surgical intervention increase morbidity.

In summary, the shift toward non-operative management (NOM) has improved outcomes and optimized resource utilization in pediatric trauma care. Wider implementation of these strategies and equitable access to specialized pediatric centers are essential for consistent, evidence-based treatment. Surgery remains indispensable in hemodynamically unstable patients, in cases of ongoing hemorrhage, or when hollow viscus injury is suspected.

In our opinion, if Case 1 had sustained an isolated splenic rupture without associated bowel perforation or hemodynamic instability, non-operative management could have been considered, consistent with current APSA guidelines.

This study is limited by its descriptive nature and small sample size, which limits generalizability but provides valuable insight into individualized decision-making in pediatric trauma management.

Conclusion

This case series demonstrates that hemodynamically unstable patients with splenic rupture and bowel perforation require urgent surgical intervention, while stable patients with high-grade renal injuries can be safely managed non-operatively. A multidisciplinary approach, involving pediatric surgeons, radiologists, and critical care teams, remains essential for optimizing outcomes in pediatric blunt abdominal trauma.

Author Contributions

Shaban Memeti – Study conception and design, surgical management of patients, critical revision of the manuscript.
Haris Sulejmani – Literature review, drafting of the manuscript, preparation of tables and figures.
Marjan Kamiloski – Surgical management of patients, acquisition of clinical data, manuscript editing.
Rexhep Selmani – Surgical consultation, contribution to case analysis, manuscript review.
Qemal Rushiti – Data collection, coordination between institutions, case documentation.
Natalija Cokleska – Data analysis, manuscript proofreading, and editing for clarity.
Gani Ceku – Case identification, literature review support, preparation of figure legends.
Defrim Kocinaj – Clinical data acquisition, assistance in drafting the discussion, manuscript review.

Abbreviations

BAT – Blunt abdominal trauma
SOI – Solid organ injury
NOM – Non-operative management
APSA – American Pediatric Surgical Association
CRP – C-reactive protein
ICU – Intensive care unit
RTA – Road traffic accident
CT – Computed tomography

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Conflict of Interest

The authors declare that they have no conflict of interest.

Ethical Approval

Ethical approval for this study was obtained from the Institutional Review Board of the Pediatric Surgery Clinic in Skopje, North Macedonia. All data were anonymized in accordance with institutional guidelines.

Consent for Publication

Written informed consent was obtained from the legal guardians of the patients whose imaging is included in this study. All identifying information has been removed to protect patient privacy.

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