MANAGEMENT OF PEDIATRIC SPLENIC TRAUMA IN A RESOURCE-LIMITED TERTIARY CENTER: A FIVE-CASE SERIES

Memeti S.[1, 2], Sulejmani H.[2], Kamiloski M.[1, 2], Selmani R.[2,3], Isenov O.[4], Gavrilovska Brzanov A.[4]

[1] University Clinic of Pediatric Surgery, Skopje, North Macedonia
[2] Faculty of Medicine, Ss. Cyril and Methodius University, Skopje, North Macedonia
[3] University Clinic for Digestive Surgery, Faculty of Medicine, Ss. Cyril and Methodius University in Skopje, North Macedonia
[4] University Clinic for Traumatology, Orthopedic Disease, Anesthesiology, Reanimation and Intensive Care Medicine and Emergency Department, Medical Faculty, Ss Cyril and Methodius University, Skopje, Republic of North Macedonia

Abstract

Objective: The aim of this report is to present a five-patient case series of pediatric splenic trauma managed in a resource-limited tertiary center, emphasizing diagnostic pathways, management strategies, and the role of hemoglobin and C-reactive protein (CRP) as practical monitoring biomarkers.

Case Report: Five children aged 3–12 years sustained splenic injury following blunt abdominal trauma caused by traffic accidents, falls, or bicycle-handlebar impact. Injury severity ranged from Grade II to Grade IV. Two patients presented with hemodynamic instability and underwent emergency splenectomy, both of whom developed massive hemoperitoneum and additional intra-abdominal injuries. The remaining three children were hemodynamically stable and were successfully managed non-operatively. All five patients required blood transfusion, with hemoglobin decline serving as the main clinical trigger. Serial CRP measurements demonstrated rapid elevation and faster decline in surgically managed patients, whereas conservatively treated patients showed slower normalization. Imaging relied on targeted abdominal ultrasonography and contrast-enhanced computed tomography, depending on stability. Hospital stays ranged from 5 to 18 days. There were no mortalities or major postoperative complications, and all patients recovered fully.

Conclusion: Non-operative management was safe and feasible in hemodynamically stable pediatric patients, while splenectomy remained necessary for unstable presentations and high-grade trauma. Hemoglobin and CRP trends proved practical, low-cost decision-support tools valuable in settings lacking interventional radiology or advanced trauma infrastructure.

Keywords: *non-operative management; pediatric trauma; resource-limited settings; splenic laceration; hemorrhage control.*

Introduction

Pediatric abdominal trauma represents a significant contributor to morbidity and mortality, with injury patterns shaped by the distinct anatomical and physiological characteristics of children. Blunt trauma predominates, most often caused by road traffic accidents, falls, and sports-related impacts, with the spleen and liver being the most frequently affected organs (1–4). Recent national data indicate that over 95% of pediatric splenic injuries are now managed non-operatively, while splenectomy rates remain stable at 6–7% (1). Optimal evaluation relies on rapid clinical assessment, selective imaging, and serial laboratory monitoring, particularly hemoglobin trends. (2,5).

Over recent decades, management strategies have shifted toward non-operative management (NOM) in hemodynamically stable children, reserving splenectomy and laparotomy for unstable cases or those with hollow-viscus injury (6,7). However, imaging utilization varies between pediatric and general trauma centers, influencing diagnostic accuracy and radiation exposure (8). When management aligns with evidence-based guidelines, outcomes are generally favorable, though they may be affected by patient age, institutional protocols, and available resources (9,10).

This case series presents five pediatric abdominal trauma cases, emphasizing splenic injury patterns, management strategies, and clinical outcomes within the context of current evidence.

Case Presentation

Five pediatric patients (ages 3–12 years) with abdominal trauma were retrospectively reviewed. All sustained splenic injury as a primary finding. Mechanisms included road traffic accidents, falls, and bicycle-handlebar trauma. Two patients required emergency splenectomy due to hemodynamic instability and complex intra-abdominal injury, while three were managed non-operatively. Blood transfusion was required in all cases, with hemoglobin decline serving as a key indicator for intervention. Table 1 summarizes the clinical characteristics, management approaches, and outcomes, while brief case narratives highlight key decision points.

Case 1

An 8-year-old girl sustained a Grade IV splenic laceration with polytrauma after a traffic accident. She was unstable and underwent emergency laparotomy with splenectomy, bowel resection, and ileal repair. Post-operative ileus was managed conservatively, and transfusion was required on day 2.

Case 2

A 5-year-old boy presented with Grade II splenic laceration and Grade III liver hematoma following a bicycle-handlebar injury. He remained hemodynamically stable and was treated conservatively. Hemoglobin decline on day 2 prompted a transfusion.

Case 3

A 3-year-old girl fell from a motorized toy vehicle, sustaining a Grade IV splenic laceration and hypovolemic shock. Urgent laparotomy revealed massive hemoperitoneum, requiring

splenectomy and intraoperative transfusion. She developed a low-grade postoperative fever that resolved with antibiotics.

Case 4

A 12-year-old girl sustained a Grade III splenic laceration and a Grade II renal laceration with associated pulmonary contusion following a high-speed traffic accident. She remained hemodynamically stable and was managed non-operatively. Hemoglobin declined on day 3, requiring transfusion, and a transient fever resolved with empirical antibiotics.

Case 5

An 11-year-old boy suffered a Grade II splenic laceration with subcapsular hematoma after a fall. Conservative management was pursued and complicated by transient paralytic ileus, which resolved with decompression. Hemoglobin decline on day 4 required transfusion.

Peak inflammatory and hematologic parameters across the five pediatric trauma cases are presented in Figure 1**.** Peak C-reactive protein (CRP) values varied among patients, while minimum hemoglobin levels ranged from 87 to 97 g/L.

Clinical characteristics, injury patterns, management strategies, and outcomes are summarized in Table 1**.** Two patients with high-grade splenic injuries required operative management, whereas three patients were successfully treated conservatively. All patients recovered without complications.

Representative contrast-enhanced abdominal CT images illustrating the spectrum of splenic injury patterns are shown in Figure 2**.**

Table 1. *Clinical characteristics, management, and outcomes in five pediatric abdominal trauma patients*

Case	Age (years)	Mechanism of injury	Major injury pattern	Management: Operative/non operative	Surgery	Transfusion	Hospital stay	Outcome
1	8	Traffic accident (polytrauma)	Grade IV splenic laceration, GI perforation, lung contusion	Operative	Splenectomy + bowel resection/repair	Yes	17 days	Full recovery
2	5	Bicycle handlebar trauma	Grade II splenic laceration, Grade III liver hematoma, hemoperitoneum	Non-operative	No	Yes	5 days	Full recovery
3	3	Fall from motorized toy/bike	Grade IV splenic laceration, hypovolemic shock	Operative	Splenectomy + lavage	Yes	6 days	Full recovery

4	12	High-speed traffic accident	Grade III splenic laceration, Grade II renal laceration, lung contusion	Non-operative	No	Yes	18 days	Full recovery
5	11	Fall	Grade II splenic laceration, subcapsular hematoma	Non-operative	No	Yes	7 days	Full recovery

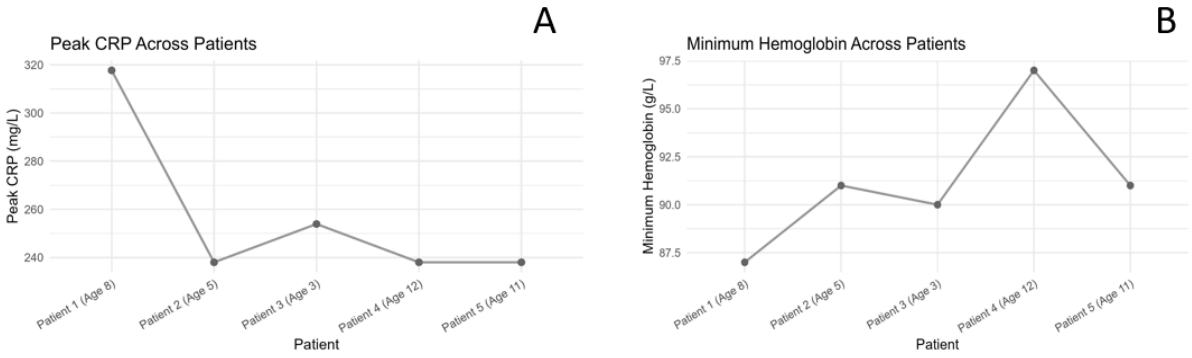

Figure 1. Peak C-reactive protein (CRP) levels (A) and minimum hemoglobin values (B) across five pediatric patients with splenic trauma.

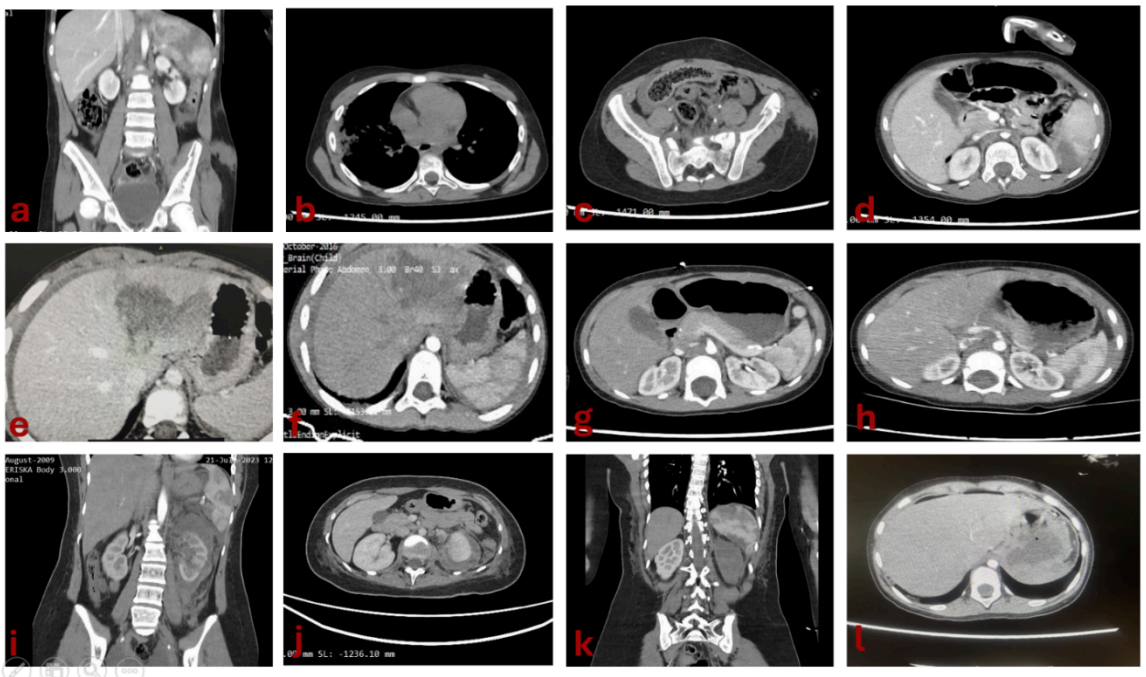

Figure 2. *Contrast-enhanced abdominal CT demonstrating splenic injury patterns across five pediatric trauma cases.*

Case 1 (a–d): *Grade IV splenic laceration* with large hemoperitoneum, associated gastrointestinal perforation and lung contusion. **Case 2 (e–f):** *Grade II splenic injury* presenting as a subcapsular hematoma with preserved perfusion; managed conservatively. **Case 3 (g–h):** *Grade IV splenic laceration* with perisplenic fluid. **Case 4 (i–k):** *Grade III splenic injury* with associated *Grade II renal laceration* and lung contusion; no contrast blush, treated non-operatively. **Case 5 (l):** *Grade II splenic laceration* with contained subcapsular hematoma and no evidence of active bleeding.

Discussion

In this five-patient series of pediatric abdominal trauma, splenic injury was the predominant finding, aligning with reports identifying the spleen as the most frequently affected organ in blunt trauma (1,4,9). Two patients required operative intervention, both splenectomies, due to hemodynamic instability and complex injury patterns, consistent with recommendations indicating surgery primarily for unstable patients or those with hollow-viscus perforation (6,7). Our operative rate (40%) exceeded large national datasets reporting splenectomy rates of 6.7% (1), likely reflecting the small sample size, high-grade injuries, limited interventional radiology, and constrained capacity for prolonged hemodynamic observation.

Our findings are consistent with previous institutional experiences in pediatric surgery, where timely intervention proved critical in cases of wandering spleen torsion (11) and complicated echinococcosis (12). Similar patterns are described in the literature where non-operative success rates remain high in stable splenic and hepatic injuries, with operative rates typically below 15–20% (6,9).

Mechanisms of injury ranged from high-energy trauma (road traffic accidents) to lower-energy, focused impacts such as bicycle-handlebar injuries, reflecting patterns described in comparable cohorts (3,4,9). In this series, younger patients with severe splenic injury required splenectomy, which aligns with evidence indicating that age alone does not determine splenic salvage potential when instability is present (4,9). However, some authors advocate prioritizing splenic preservation in younger children due to their greater immunologic vulnerability (7).

CRP values reflected inflammatory response variations and recovery trajectories; although non-specific, CRP may complement clinical assessment in settings lacking frequent imaging options. Similar findings are reported in pediatric polytrauma studies emphasizing biomarker-supported monitoring (5).

In this cohort, the length of stay ranged 5–18 days, slightly longer than the ranges reported for NOM (3–10 days) and operative cases (7–14 days) (4,6,9). Compared with the U.S. study by Eldredge et al. (1) and the Ethiopian series by Molla et al. (9), our splenectomy rate was intermediate. Universal transfusion in our cohort suggests a conservative transfusion threshold influenced by resource limitations rather than clinical deterioration alone.

Although pancreatic injury was not observed in this cohort, it remains a rare but clinically significant associated injury that may influence operative vs. non-operative decision pathways in pediatric abdominal trauma (13).
Overall, this case series reinforces the feasibility of safe non-operative management in stable patients, the necessity of timely surgery in unstable presentations, and the utility of laboratory trends as decision-support tools in environments with limited subspecialty and imaging capacity.

This study has several limitations. First, the small sample size and the retrospective single-center design limit the generalizability of the findings. Second, the absence of interventional radiology and advanced trauma resources in our institution may have influenced management strategies, including operative decisions and transfusion practices. Finally, the observational nature of this case series does not allow for causal inference or comparison with standardized treatment protocols.

Conclusion

Splenic injury represented the predominant lesion in this series of pediatric abdominal trauma. NOM was safe and effective in stable patients, while splenectomy remained crucial for unstable cases. Serial hemoglobin and CRP monitoring supported clinical and imaging assessments. Favorable outcomes were achieved through timely diagnosis, appropriate intervention, and adherence to evidence-based guidelines. These findings may guide trauma protocols in centers with limited imaging, interventional radiology, and intensive monitoring resources.

Ethical Approval: Non-applicable.

Consent for publication: Written informed consent for publication of anonymized clinical information and imaging was obtained from the legal guardians of all patients.

Conflict of interest: The authors report no financial or personal conflicts of interest.

Funding: This research received no external funding.

Author Contributions: SH: study conception, data collection, manuscript drafting; MS: methodology, supervision; IO: statistical analysis; RS: clinical data interpretation; MK: language editing; AGB: final revision and approval of the manuscript.
All authors approved the final manuscript.

Use of Artificial Intelligence (AI) tools: The authors declare that no artificial intelligence tools were used in the preparation or writing of this manuscript.

Funding information: This research received no external funding.

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