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Original Article

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Management of Pediatric Blunt Trauma Abdomen in a Tertiary Care Center: A Retrospective Record Based Study

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ABSTRACT

Background: Trauma is one of the leading causes of death and disability worldwide. 25% of pediatric patients with major trauma usually because of abdominal injury. Less aggressive treatment and selective operative interventions have become the new standard of care. Most of the cases do not require surgical intervention and can be managed conservatively.

Methods: The retrospective cross-sectional study encompassed patients under 18 years with blunt abdominal trauma, eliminating isolated organ injuries, penetrating trauma, sexual assault, and drowning incidents. Demographic data, injury classifications, management strategies, and outcomes were examined, with conservative or surgical approaches determined by clinical factors and imaging results.

Results: With a median age of 9.75 years, 75% of the 144 pediatric cases of blunt abdominal trauma were male. The predominant injury mechanisms were two-wheeler road traffic accidents (57.2%) and bicycle handle injuries (13.1%). Of these, 81.25% were treated conservatively. The most damaged organs were the spleen (29.6%) and liver (42.7%). 18.75% needed surgery for hollow viscus perforations and solid organ damage.

Conclusion: This study shows that conservative treatment works for stable pediatric blunt abdominal trauma patients of any grade. FAST and CT scans help triage and manage injuries, but physiological reaction, not injury grade, should drive therapy. Pediatric surgeons and interventional radiologists ensure fewer significant interventions.

Key-words: Blunt abdominal trauma, Hemoperitoneum, American Pediatric Surgery Association, Paediatric population

INTRODUCTION

Blunt abdominal trauma (BAT) defines that it leads causes traumatic injury in the pediatric population, despite significant prevention efforts [1]. While BAT is less common than isolated head injuries or penetrating trauma. In addition, it is still a main contributor to morbidity, permanent disability, and mortality in children. Traffic accidents account for 75–80% of BAT cases, with other causes including falls from a height,bicycle handlebar injuries, pedestrian accidents, contact sports, and child abuse [2-4].

Non-operative (conservative) treatment has become the "gold standard" for managing clinically stable children with blunt abdominal injuries. Initially developed for pediatric patients, this approach has since been extended to adults. Conservative management is only suitable for hemodynamically stable patients, requiring continuous monitoring in an intensive care unit (ICU) for at least 48 hours, and necessitating an experienced multidisciplinary team prepared to intervene if needed [5-7].

The American Pediatric Surgery Association (APSA) trauma committee published evidence-based guidelines in 2000 for managing pediatric liver and spleen injuries [8,9]. These guidelines have standardized treatment, reduced hospitalization times, and set benchmarks for non-operative management. Similarly, renal injury

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management has evolved, with recent studies indicating that bed rest is no longer necessary for healing.

Recent research suggests that previous guidelines, which mandated prolonged hospitalization, were overly cautious. It is now considered safe and cost-effective to manage pediatric blunt abdominal trauma based on a patient's hemodynamic stability rather than the severity (grade) of the injury. This shift has led to more efficient care while reducing healthcare costs [10].

MATERIALS AND METHODS

Study design- Retrospective record-based cross-sectional study.

Study setting- Admitted cases of pediatric blunt abdominal trauma in the department of surgery, MIMS, Mandya District

Study population- All pediatric patients with a diagnosis of blunt abdominal trauma were admitted to the MIMS Mandya between 01/08/2018 to 01/08/2022.

Study period- 4 years.

Sample Size- 144 patients

Inclusion criteria- Age <18 years patients with blunt trauma abdomen.

Exclusion criteria

1. Isolated other organ injury
2. Penetrating trauma
3. Cases of sexual assault
4. Drowning.

Method of data collection- All patients with a diagnosis of blunt trauma abdomen admitted in dept of surgery in MIMS Mandya between 01/08/2018 to 01/08/2022 will be reviewed. The epidemiological profile, clinical presentation, treatment modalities, and outcomes of patients with blunt trauma abdomen will be studied retrospectively.

The study population will be selected from hospital data, patients with isolated parenchymatous abdominal organ injuries in children who were consecutively admitted and managed over four years (01/08/2018 to 01/08/2022) in our hospital. Patients with Isolated other organ injury, Penetrating trauma, cases of sexual assault & Drowning were excluded to eliminate chances in the management plan and outcome.

Children were evaluated for conservative management or urgent laparotomy depending on initial physiologic parameters to life support management protocols established for the treatment of pediatric BAT. Focussed assessment with sonography for trauma (FAST) has been used as the first tool to look for the presence or absence of “free fluid and associated solid organ injury. All haemodynamically stable patients who responded to resuscitative efforts were examined with a computed tomography (CT) scan, with intravenous contrast. All parenchymatous organ injuries were graded according to the American Association for the Surgery of Trauma.

On admission, history was collected and a thorough physical examination was done. Data collection on admission included gender, age, grades of injury, mechanism of trauma, management and outcome. All haemodynamically stable patients who were treated non-operatively were on a strict bed rest program, with continuous 24-hour monitoring and serial haemoglobin analyses.

In all patient’s, controlled ultrasounds were performed during the third or fourth day of hospitalization. If the patient’s condition was stable, they were transferred to the regular ward within a few days for further observation. Unstable patients with massive hemoperitoneum were referred to higher centre where pediatric surgery facilities were available.

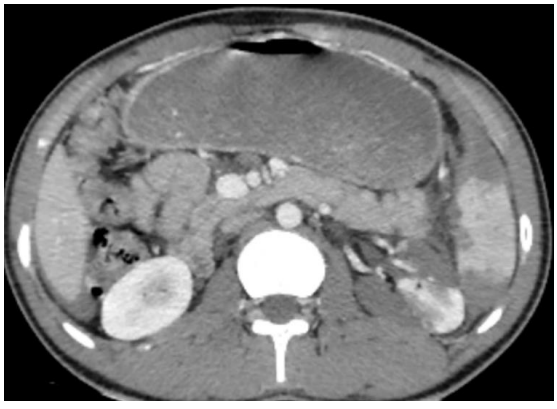

Fig. 1: grade 4 splenic & grade 3 renal injury

Fig. 2: Grade 4 Liver Injury

RESULTS

Table 1 depicts the age breakdown of the study population. The 144 pediatric blunt abdominal trauma cases were 75% male (108 cases) and 25% female (36 cases). The average age of the patients was 9.75 years, with an age vary from 0 to 18 years. This indicates that blunt abdominal trauma affects a diverse range of pediatric demographics, with a median close to the center.

Table 1: Demographic details of patient

Total study population: 144		
Male	108	75%
Female	36	25%
Median age – 9.75yrs (0 – 18yrs)		

Pediatric blunt abdominal trauma patients' damage mechanisms are shown in Fig. 3. Two-wheeler road traffic accidents (RTAs) account for 57.2% of incidents, highlighting the risk of vehicular exposure in youngsters. Cycle handlebar injuries follow at 13.1%, demonstrating that cycling accidents also cause trauma. Self-falls and falls from height account for 11.9% of pediatric trauma cases, demonstrating that non-vehicular accidents are common. Four-wheeler RTAs are the rarest, with 2.3%. Runover injuries account for 3.6%. These findings highlight the need for targeted preventative initiatives, particularly for two-wheeler-related injuries, to reduce childhood blunt abdominal trauma.

Fig. 4 depicts the distribution of solid organ damage in pediatric blunt abdominal trauma patients. As the most common organ in danger, the liver is injured 42.7% of the time. Splenic injuries are the second most common at 29.6%, highlighting the spleen's blunt trauma sensitivity. The 18.1% renal injuries indicate that kidney damage is a major issue. Pancreatic injuries are the rarest at 9.6% but dangerous. Most pediatric abdominal trauma injuries are liver and spleen injuries, underscoring the need for focused diagnostic and therapeutic approaches.

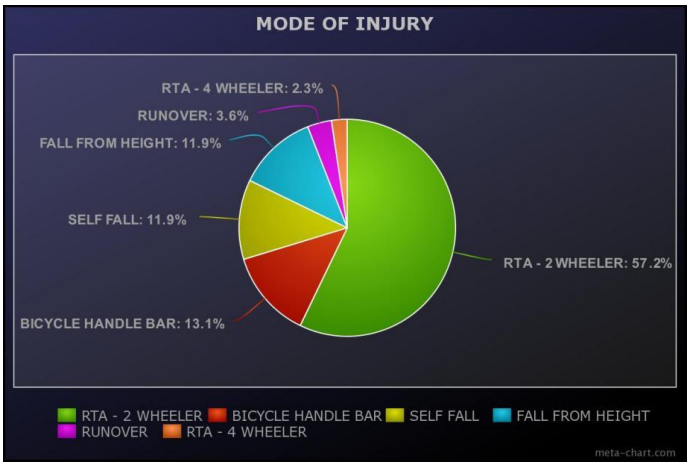

Fig. 3: Mechanisms of Pediatric Blunt Abdominal Trauma and Prevention Insights

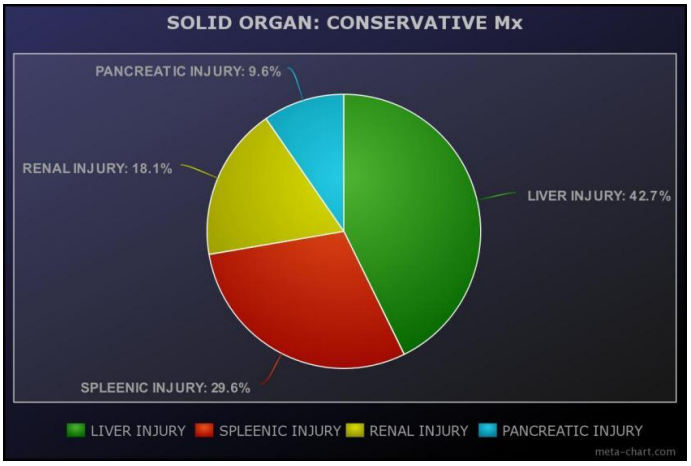

Fig. 4: Distribution of solid organ damage

Fig. 5 shows infant's blunt abdominal trauma liver, renal, and splenic injury severity. Grades 2 and 3 have the most liver damage (34.6% and 38.9%), with grade 4 having 19.2% and grade 5 none. Most renal injuries are in grades 2 (46.2%) and 3 (36.4%), with lesser percentages in categories 1, 4, and 5, suggesting mild renal trauma. Grade 3 (44.5%) and grade 2 (38.9%) have the most splenic injuries, whereas grades 1, 4, and 5 (5.5% each) have a small This distribution shows that moderate-grade organ damage are most common, suggesting that non-operative therapy may work in most situations.

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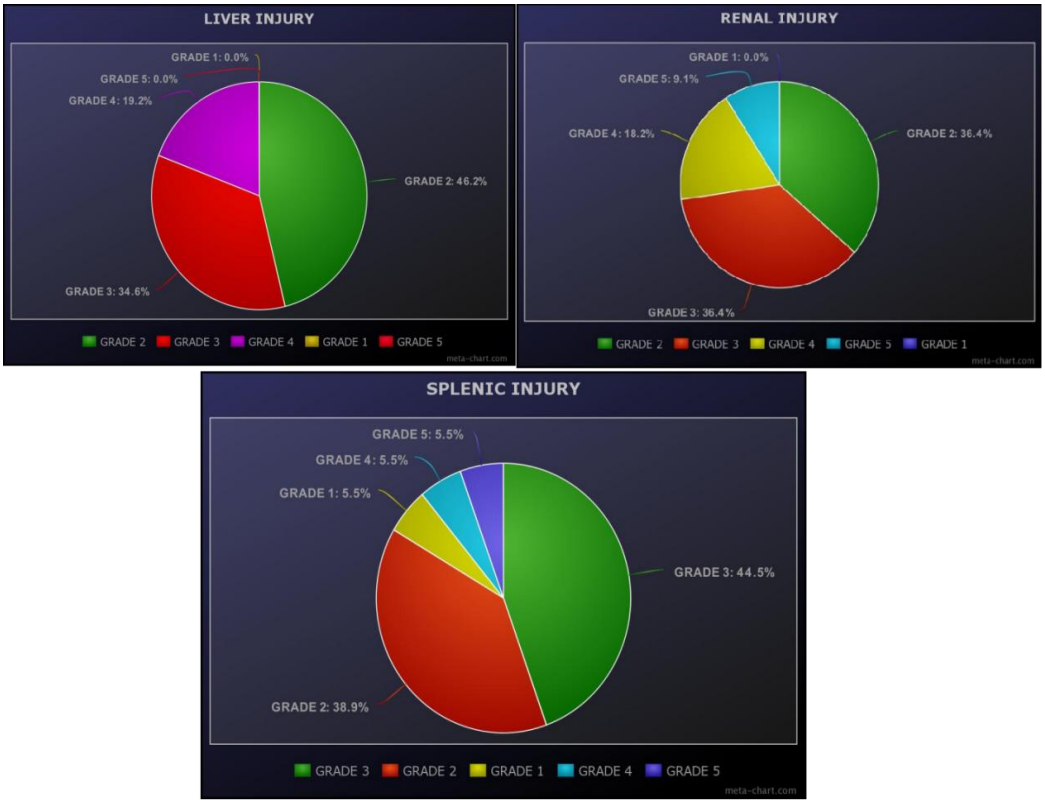

Fig. 5: Severity and Distribution of Organ Injuries in Infant Blunt Abdominal Trauma

Table 2 shows liver injury grades in conservatively treated pediatric blunt abdominal trauma patients. The 26 cases (33.33% of total liver damage) were grade II (46.15%), grade III (34.6%), and grade IV (19.23%). No cases were grade I or V, indicating that conservatively managed patients had more moderate-to-severe injuries (grades II to IV). For stable patients with mild to moderately severe liver injuries, conservative care was preferred over surgical intervention, even for higher-grade damage.

Table 2: Conservative Management of Liver Injuries in Pediatric Blunt Abdominal Trauma

Conservative Mx: Liver injury 26 cases (33.33%)	
Grade	**Case %**
GRADE I	0 (0 %)
GRADE II	18 (46.15%)
GRADE III	12 (34.6%)
GRADE IV	8 (19.23%)
GRADE V	0 (0%)

Table 3 defines the diverse categories of injuries treated conservatively, excluding main solid organ damage, in pediatric patients with acute abdominal trauma.

Soft tissue injuries were the most prevalent, totalling 19 cases, followed by thoracic injuries, which accounted for 13 cases. Fractures and isolated hemoperitoneum occurred less frequently, with 7 and 5 instances, respectively. Injuries to the perineum and adrenal gland were infrequent, with only five perineal injuries and one adrenal gland injury documented. Furthermore, psoas hematoma was observed in three instances. This distribution illustrates the variety of injury types that can be effectively managed conservatively, contingent upon the patient's hemodynamic stability.

Table 3: Conservative Management of Non-Solid Organ Injuries in Pediatric Blunt Abdominal Trauma

Conservative Mx: Other	
Injury	**Cases**
Soft tissue injury	19 cases
fractures	7 cases
Isolated hemoperitoneum	5 cases
Thoracic injury	13 cases
Adrenal gland	1 case
Perineum	5 cases
Psoas hematoma	3 cases

Table 4 includes interventionally handled pediatric blunt abdominal trauma cases. These instances were mostly hollow viscus injuries (72.22%, 13 cases). Six jejunum perforations, five bladder injuries, three ileal perforations, and two duodenal and one colonic perforation were reported. The majority of solid organ damage was treated, with only two instances (11.11%) requiring splenectomy and nephrectomy. In addition, injuries included abdominal wall traumatic hernias (2 instances), perineal injury (1 case), gangrenous intestinal obstruction (1 case), and intestinal obstruction (4 cases). This table shows that hollow viscus injuries, notably perforations, were the most common surgical indications, while solid organ injuries and other damage were less common.

Table 4: Interventional Management of Pediatric Blunt Abdominal Trauma

Interventional Mx (18 cases)		
Hollow viscus **13 CASES (72.22%)**	**Solid organ** **2 cases (11.11%)**	**Other**
Jejunum – 6 (30.76%) Perforation	Splenectomy – 1	Abd wall traumatic hernia – repair – 2
Bladder – 5 (23.07%)	Nephrectomy – 1	Perineal injury -1
Ileal – 3 (15.38%) Perforation		Gangrenous intestinal obstruction – relaparotomy – 1
Duodenum – 3 (7.7%) Perforation		Relaparotomy – intestinal obstruction - 4
Colon -2 (7.7%)		

Fig. 6 shows the types and distribution of hollow viscus injuries in children with blunt abdominal trauma. Most incidents were jejunal perforations (41.7%), followed by bladder ruptures (25.0%). Ileal perforations were 16.7%, duodenal 8.3%, and colonic 8.3%. These findings show that hollow viscus injury most typically affects the jejunum and bladder, requiring surgery. The decreased rates of duodenal and colonic perforations show they are less prevalent but still substantial in abdominal trauma necessitating surgery.

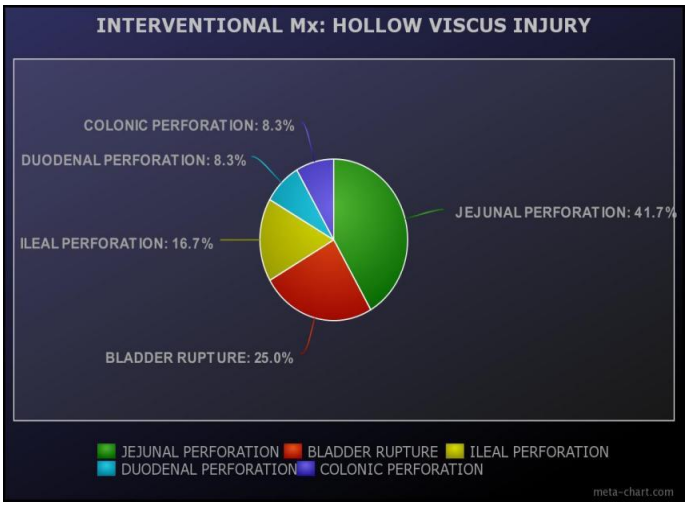

Fig 6: Distribution and Prevalence of Hollow Viscus Injuries in Pediatric Blunt Abdominal Trauma

Fig. 7 shows forms of solid organs and other surgeries performed on blunt abdominal trauma patients. In solid organ injuries, splenectomy was the most prevalent surgery at 2 (11.11%), followed by nephrectomy at 1. Four repairs of abdominal wall traumatic hernias, suggesting trauma vulnerability, and three perineal injury treatments are also performed. Gangrenous intestinal obstruction (1 case) and nonspecific intestinal blockage (2 cases) required relaparotomy. This distribution shows that blunt trauma consequences require different and often complex surgical procedures.

SOLID ORGAN 3 (11.11%)	OTHER
Splenectomy – 2	Abd wall traumatic hernia – repair – 4
Nephrectomy – 1	Perineal injury -3
	Gangrenous intestinal obstruction – relaparotomy – 1
	Relaparotomy – intestinal obstruction -2

Fig. 7: Surgical Interventions in Pediatric Blunt Abdominal Trauma

DISCUSSION

The leading cause of injuries in paediatric patients, especially in young males, is road traffic accidents, causing blunt organ injuries predominantly to the spleen, liver and kidney, followed by pancreatic and liver injuries.

The incidence of pediatric blunt abdominal injury is approximately 9 per 100,000 children [11]. In the United States alone, an estimated 8200 children per year are hospitalized for liver or spleen injury [12]. The leading cause of injuries in paediatric patients, especially in young males, is road traffic accidents, causing blunt organ injuries predominantly to the spleen, liver and kidney, followed by pancreatic and liver injuries.

Out of 144 patients Study population, 108 were males (75%) and 36 Females (25%) with a male-to-female ratio of 3:1. The Median age group of 9.75 (0.5-18) years. A study done by Notricia *et al*. [13] in 2015 also shows a preponderance of 91% in Males and 9% in female children. The median age was around 10 years. The most common mode of injury was 2-wheeler RTA (57.2%), followed by bicycle handle injury (13.1%), self-fall (11.9%), fall from height (11.9%), runover injury (3.6%) and RTA 4-wheeler (2.3%). A study done by Djordjevic *et al*. [14] in 2015 found that 64% of cases were due to RTA, 22.5% were due to falls from height, 6.45% were due to bicycle handle injury, and 3.22% were due to child abuse. Of 144 cases 117 cases (81.25%) were managed conservatively, of which 4 cases initially managed conservatively later required referral to a higher centre i/v/o need for surgical intervention and 27 cases (18.75%) were referred to a higher centre i/v/o need for surgical intervention.

Author	Origin	Number	Conservative	Interventional
Djordjevic *et al*. [14]	Serbia	31	90.32%	9.68%
Roy spijkerman [15]	Europe	121	88%	12%
Dent, Daniel MD [16]	Texas	255	93%	7%
Kwangmin Kim [17]	S.korea	317	93.38%	6.62%
M A Croce [18]	USA	136	82%	18%
Our study	India	144	81.25%	18.75%

The most common organ injured was the liver (42.7%) followed by the spleen (29.6%), renal injury (18.1%) and pancreatic injury (9.6%). Of all cases of liver injury, most cases were of grade 2 (46.2%) followed by grade 3 (34.6%) and grade 4(19.2%). Of all cases of splenic injury, most cases were of grade 3 (44.5%) followed by grade 2 (38.9%) and grades 1, 4 & 5 (5.5% each). Of all cases of renal injury, most cases were of grade 2 (36.4%) followed by grade 3 (36.4%), grade 4(18.2%) and grade 5(9.1%).

CONCLUSIONS

The results of this study emphasize that a conservative line of treatment was a favourable option for all stable patients with blunt abdominal trauma children regardless of the grade of organ injury. The success of non-operative management depends upon the proper selection of the patient. Focussed assessment with sonography for trauma is a screening tool for accurate triage of unstable patients that require laparotomy.

The availability of FAST and CT has improved the management and outcome of blunt abdominal trauma. The choice of non-operative treatment should be based predominantly on the physiological response of the child, rather than injury grade on a CT scan. Assessment of hemodynamic stability is the most important initial concern in the evaluation of a patient with BAT.

Every trauma care center should have a pediatric surgeon and an interventional radiologist so that further need for interventional major procedures can be reduced, and damage control procedures can also be applied whenever it is advantageous.

CONTRIBUTION OF AUTHORS

Research concept- Ramila Ramesh, Sudarshan N
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Data analysis and Interpretation- Ramila Ramesh, Sudarshan N
Literature search- Ramila Ramesh, Sudarshan N
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Critical review- Ramila Ramesh, Sudarshan N
Article editing- Ramila Ramesh, Sudarshan N
Final approval- Ramila Ramesh, Sudarshan N

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