



# **Blunt Abdominal Injuries in Children: Demography at a Pediatric Surgery Department of a Tertiary Level Hospital in Bangladesh**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. Author TKC designed the study, performed the statistical analysis and wrote the first draft of the manuscript. Authors AS, RK, SS, FFR and MSI collected data. Authors SMHK and MAAF edited and approved the final draft. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Aims:** Injuries are becoming major causes of morbidity and mortality throughout the world and one-third of the injured patients have abdominal injuries. The aim of the study was to analyze epidemiological characteristics of blunt abdominal injuries in children at a tertiary government facility in a lower middle-income country.

**Study Design:** Retrospective chart review study.

**Place and Duration of Study:** Department of Pediatric Surgery, Chattogram Medical College Hospital, between January 2017 and June 2020.

**Methods:** This was a tertiary-level hospital-based study on children admitted with blunt abdominal injuries. Epidemiology, mechanism of injury, other associated injury, organ involvement, treatment and outcome were analyzed.

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**Results:** Among 309 patients, male to female ratio was 3.48:1. Age ranged from 32 days to 12 years (mean  $7.29 \pm 3.05$  7 years). Majority were school-age children (183, 59.22%). The commonest mechanisms of injuries were road traffic accidents (RTA), 60.52% and fall from a height, 20.71%. Mechanism of injury did not vary between sexes ( $P=0.39$ ). Solid organ injury was present in 58 patients (18.77%) and gastrointestinal perforation in 20 (6.47%). There was no association between mechanism of injury and presence of visceral injury ( $P=0.38$ ) or solid organ injury ( $P=0.59$ ). Other associated injuries were significantly related with presence of both abdominal visceral and solid organ injuries ( $P=0.19$  and  $0.00$ , respectively). Majority were treated conservatively (229, 74.11%) and laparotomy was performed in 51 (16.50%). Seven (2.27%) patients died.

**Conclusion:** Abdominal organs were susceptible to injuries by all types of trauma throughout the year. Solid organs were more vulnerable than hollow viscus. Presence of other associated injuries were related to presence of visceral injury.

*Keywords: Blunt injury; abdomen; children; epidemiology; traffic accident.*

## 1. INTRODUCTION

Every year, injuries kill more than five million people worldwide which account for 9% of all global deaths [1]. In 2019, road injuries alone were the 7th leading cause of death in low-income countries and 10th leading cause of death in lower-middle-income countries [2]. By the year 2020, injuries are anticipated to become the first or second leading cause of "loss of productive years of life" for both developed and developing countries [3]. Approximately, one third of injured patients have abdominal trauma and blunt traumatic injury is the most common cause of death and disability in childhood [4,5]. Almost 90% of all trauma impacts in children are blunt in nature [6]. In this era of speed, the incidence of blunt injuries to the abdomen are at its peak [3]. As nutrition and infection control has improved, trauma is becoming a serious childhood health problem in the low- and middle-income countries (LMICs) [7].

The abdomen is a diagnostic black box and unlike many overt injuries in other parts of the body, blunt abdominal injuries often make diagnostic and management dilemmas. Early diagnosis and prompt management is essential in these conditions to prevent morbidity and mortality. Although developed countries have made major progresses in trauma management, the epidemiology and demography of blunt abdominal injuries in many LMICS are largely unknown and there are concerns of resource limitation. Among all child injury deaths worldwide, more than 95% occur in the LMICs [8]. Studies have highlighted that majority of injuries in children are preventable by knowing the epidemiology of pediatric trauma [4]. This study aims to provide epidemiological and demographic characteristics of blunt abdominal

injuries in children and their outcome at a tertiary government facility from a country from where it is not well-reported in the literature.

## 2. MATERIALS AND METHODS

### 2.1 Study Design and Set up

This was a hospital-based retrospective chart review study and we reviewed records of all patients of blunt abdominal injuries admitted in the Department of Pediatric Surgery, Chattogram Medical College Hospital between January 2017 and June 2020. This hospital is the largest government referral center for pediatric surgical services for about one fifth of the population of the country. All casualties in children up to 12 years of age are admitted in this department. However, children who have only orthopedic, neurosurgical, ENT related or ocular surgical problems are taken care of in the respective adult surgical departments. But children who have associated abdominal injuries are treated in this department. The general objective of the study was to evaluate demographic characteristics of blunt abdominal injuries in children admitted in this department. The specific objectives were to find out the magnitude of blunt abdominal injuries, their frequency at different ages, assess the common causes (mechanisms) of these injuries and their distribution in different age groups, the most vulnerable abdominal organs or viscera for injuries and their relation with associated injuries of other parts of the body, seasonal variations, mode of treatment and their outcome. Blunt abdominal injury was defined as detectable injuries to abdominal wall or internal abdominal organs by physical examinations, investigations or during surgery or history of application of blunt force to the abdomen causing pain or other symptoms

without the presence of detectable abdominal wall or organ injuries. Abdominal injuries resulting from penetrating wound or sharp cutting injuries were excluded. Patients who received treatment in the emergency or outpatient department and were not admitted in the ward were excluded. However, children with suspected blunt abdominal injuries who attend the OPD or the emergency department are usually admitted in the ward for either observation with conservative treatment or definite surgical procedure as indicated. Patients who were admitted in other departments such as Neurosurgery and Orthopedics with associated abdominal injuries but were not admitted in our ward were also could not be included as the patient files were not available. Patients in whom both the mechanism and site of injury were not recorded were also excluded. During this period, a total of 350 patients were admitted with abdominal injuries for whom records were available; among them, 29 had penetrating injuries and 12 had sharp cutting injuries in the abdomen and they were excluded. Thus, a total of 309 patients were included for final analysis.

## 2.2 Data Analysis

Recorded data were entered into Microsoft Excel V. 2019 to generate a master sheet and coded in unique alphanumeric codes and analyzed using SPSS version 22. Categorical variables (sex, mechanism of injury, organ involved, season when injury occurred, type of treatment and outcome) were described as frequency and percentage and continuous variables (age, hospital stay) were expressed as mean  $\pm$  standard deviation and median. Differences in mechanisms of injury between sexes, among age groups, seasons and pattern of injuries, types of treatment and their outcome were analyzed with Chi-square or Fisher's exact test. Continuous variables were analyzed using Student t test (comparison of mean age between sexes), Mann-Whitney U test (comparison of median age between sexes, hospital stay between conservative and surgical treatment) and Kruskal Wallis (age differences among different mechanisms of injuries). P value  $< 0.05$  was considered to be significant. Age group was classified as infants (up to 1 year), toddlers (1-3 years), preschool (3-6 years) and school-age children (6-12 years) [9]. Seasonal variation was analyzed according to six Bangladeshi seasons: Winter (mid-December to mid-February), Spring (mid-February to mid-April), Summer (mid-April to mid-June), Rainy Season (mid-June to mid-August), Autumn (mid-August to mid-October),

and Late Autumn (mid-October to mid-December) [10]. Since only the first six months of the year 2020 was included in this study and it was also influenced by COVID-19 pandemic, seasonal variations were calculated between 2017 and 2019 only, among a total of 284 patients. The impact of COVID-19 pandemic was analyzed comparing data of April-June, 2020 vs April-June, 2019. This study was approved by the head of the institute.

## 3. RESULTS AND DISCUSSION

Among a total of 309 patients, there were 240 male and 69 female patients (ratio: 3.48:1). Age ranged from 32 days to 12 years (mean  $7.29 \pm 3.05$ , median 7 years). Mean age of male children ( $7.51 \pm 3.12$  years) was significantly higher than female children ( $6.51 \pm 2.70$  years),  $P=0.01$ . Median age was also significantly higher in male in comparison to female (8 vs 6 years,  $P=0.01$ ). There were no neonates, 5 infants and 304 children. School-age children suffered more from blunt abdominal injuries (183 children, 59.22%) than other age groups. Fig. 1. shows that frequency of blunt abdominal injuries increased in every elder age group.

Road traffic accidents (RTA) were the commonest mechanism of injury (187, 60.52%) followed by fall from a height (64, 20.71%), same level fall (18, 5.83%) and assault (15, 4.85%) (Table 1). Mean ages of the patients with RTA, fall from a height, same level fall and assault were 6.81, 8.38, 7 and 8.77 years, respectively. There was no significant difference in ages among different mechanisms of injury ( $P=0.40$ ). There was also no significant difference between sexes regarding mechanism of injury ( $P=0.39$ ).

Table 2 shows that RTA was the most common mechanism of injury in all age groups except infants. In infants, fall from a height was the commonest mechanism. Fall from a height occurred in 50 school-aged children while in all other age groups there were a total of 14 falls from a height. Similarly, assaults occurred in the 14 school-age children while there was only 1 assault in other age groups who was a toddler.

In majority of the patients (161, 52.10%), there were blunt abdominal injuries without any diagnosed visceral or abdominal wall injuries. Among the patients who had detectable injuries, internal visceral injury was the commonest (93 patients, 30.10%) while 44 (14.24%) had abdominal wall injury and 11 (3.56%) had fracture pelvis. Among the patients who had

internal visceral injury, solid organ injury was present in 58 patients (62.37%) and hollow viscus injury was present in 26 (27.96%) patients. In 2 (2.15%) patients, there were both liver and spleen injury and another patient (1.08%) had both renal and pancreatic injury. Injury to the liver was the commonest visceral injury (25/93), followed by injury to kidney (24/93) and spleen (8/93). Fig. 2. shows the pattern of visceral injuries in the patients. Among the patients who had solid organ injuries, the mechanism of injury was RTA in 39 (67.24%), fall from a height in 11 (18.97%), same level fall in 4 (6.90%), and 1 (1.72%) each had assault and animal attack and mechanism was not recorded in 2(3.45%). Gastrointestinal perforation was found in 20 (6.47%) patients. Among them, majority were caused by RTAs (11/20), followed by fall from a height (5/20), object falling on body (2/20), direct blow (1/20), and not recorded (1/20). There was no significant association between mechanism of injury and presence of abdominal visceral injury ( $P=0.38$ ) or solid organ injury ( $P=0.59$ ). There were also no significant differences in the presence of either abdominal visceral injury ( $P=0.47$ ) or solid organ injury ( $P=0.67$ ) among age groups and between sexes ( $P=0.65$  and  $0.55$ , respectively).

In 86 (27.83%) patients, there were associated injuries to other body areas (103 associated injuries in 93 patients) (Fig. 3). Presence of associated injury to other parts of the body was significantly associated with both abdominal visceral injury and solid organ injury ( $P=0.19$  and  $0.00$ , respectively). There was no significant association of mechanism of injury with presence of associated injury ( $P=0.45$ ). Associated injuries were more in females (36.23%, 25 among 69 females) than in males (25.42%, 61 among 240 males),  $P=0.06$ ; however, there were no differences among age groups ( $P=0.45$ ). Fracture was present in 26 (8.41%) patients, among them 11 pelvic, 4 rib, 3 radius bone, 2 each humerus and clavicle and 1 each parietal bone, mandible, ulna, tibia and fibula fracture. Presence of fracture was not associated with mechanism of injury or solid organ injury ( $P=0.77$  and  $0.24$ , respectively).

Fig. 4. shows seasonal distribution of the patients. There was no significant association with seasonal variation with mechanism of injury ( $P=0.70$ ). Analyses of RTA vs other mechanisms and falls vs other mechanisms did not also show any seasonal variations ( $P=0.26$  and  $0.68$ ,

respectively). During the COVID-19 pandemic, only 8 patients were admitted with blunt abdominal injuries between March 2020 and June 2020, in contrast to 43 admissions during the same period of 2019. Among these eight patients, 6 had RTA and one each had blast injury and assault. One patient needed laparotomy and peritoneal toileting.

Majority of the patients were treated conservatively (229, 74.11%). Surgical intervention was needed in 80 (25.89%) patients, among them 51 (16.50%) needed laparotomy. Table 3 lists types of treatment in the patients. Median age of the patients who underwent surgery was higher than those who had conservative treatment (9 vs 7 years,  $P=0.00$ ). Among the patients who had solid organ injuries, 34.48% (20 of 58) underwent surgery. 44% (11 of 25) of the liver injuries, 22.73% (5 of 22) renal injuries, 50% (3 of 6) of splenic injuries and 25% (1 of 4) pancreatic injuries needed surgical intervention. Seven (2.27%) patients died; among them, 4 had RTA and one each had fall from a height, blast injury and assault. All were school-age children, none had any visceral injury and none underwent any surgical procedure. All, except one, died within 24 hours of admission. There was no significant difference in mortality between patients with or without RTA ( $P=0.85$ ) or falls ( $P=0.64$ ) or the presence of associated injury ( $P=0.30$ ). 288 (93.20%) patients were discharged well, 13 (4.21) left against medical advice, one patient was absconded. Hospital stays ranged from 1 to 46 days, mean  $6.94 \pm 6.68$  days, median 5 days, IQR 2.5 to 9 days. There was significant difference in hospital stay between patients who underwent surgery vs conservative treatment (median 11 vs 4 days,  $P=0.00$ ).

#### 4. DISCUSSION

This hospital-based study attempted to evaluate blunt abdominal injury in children, the most affected age group and gender, mechanism of injury, seasonal variation, treatment and final outcome. This study on 309 children from a large tertiary level referral center over a period of 42 months showed that there was a high male to female ratio, majority were school-age children, RTA and falls were the most common causes, about one third had visceral injury, more than a quarter had other associated injuries, and about a quarter of the patients needed surgical interventions.

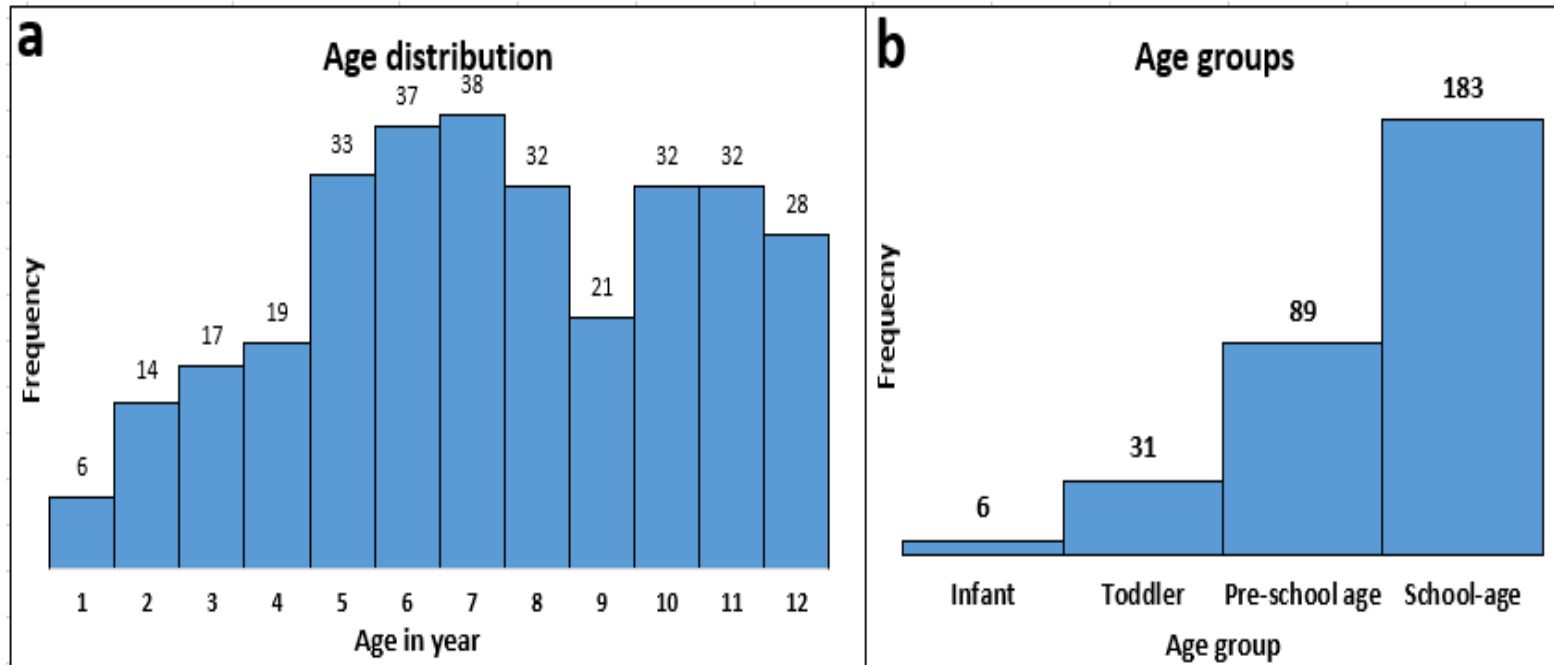


Fig. 1. Frequency of injury at different ages (1a) and age groups (1b). N=309. Infants (up to 1 year), toddlers (1-3 years), preschool (3-6 years) and school-age children (6-12 years)

**Table 1. Mechanism of blunt abdominal injuries (N=309)**

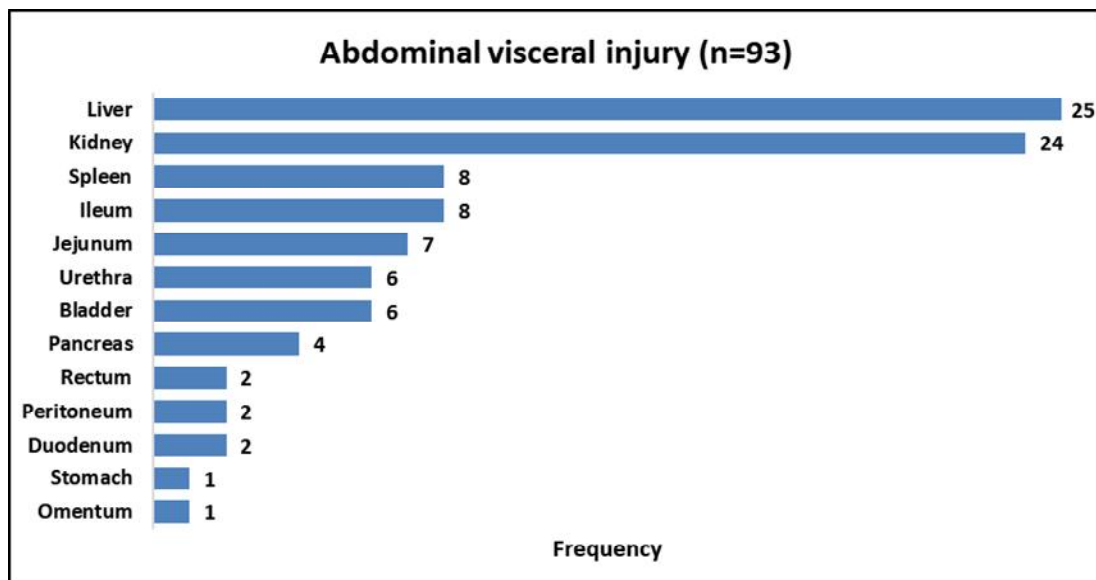
| Mechanism of Injury    | Male |        | Female |       | Total |     | Mean age (years) |
|------------------------|------|--------|--------|-------|-------|-----|------------------|
|                        | No   | %      | No     | %     | No    | %   |                  |
| RTA                    | 141  | 75.40  | 46     | 24.60 | 187   | 100 | 6.81             |
| Fall from a height     | 48   | 75.00  | 16     | 25.00 | 64    | 100 | 8.38             |
| Same level fall        | 13   | 72.22  | 5      | 27.78 | 18    | 100 | 7                |
| Assault                | 14   | 93.33  | 1      | 6.67  | 15    | 100 | 8.77             |
| Not recorded           | 9    | 90.00  | 1      | 10.00 | 10    | 100 | 7.34             |
| Object falling on body | 7    | 100.00 | 0      | 0.00  | 7     | 100 | 6.04             |
| Blow                   | 5    | 100.00 | 0      | 0.00  | 5     | 100 | 9.4              |
| Animal                 | 2    | 100.00 | 0      | 0.00  | 2     | 100 | 0.6              |
| Blast injury           | 1    | 100.00 | 0      | 0.00  | 1     | 100 | 10               |
| Total                  | 240  | 77.67  | 69     | 22.33 | 309   | 100 | 7.29             |

Percent values are relative to number of patients of respective mechanism of injuries.  
RTA: Road traffic accidents

**Table 2. Mechanism of injury at different age groups**

| Mechanism          | Infant |       | Toddler |       | Pre-school age |       | School age |       | Total |       |
|--------------------|--------|-------|---------|-------|----------------|-------|------------|-------|-------|-------|
|                    | No     | %     | No      | %     | No             | %     | No         | %     | No    | %     |
| RTA                | 1      | 16.67 | 25      | 80.65 | 66             | 74.16 | 95         | 51.91 | 187   | 60.52 |
| Fall from a height | 2      | 33.33 | 1       | 3.23  | 11             | 12.36 | 50         | 27.32 | 64    | 20.71 |
| Same level fall    | 0      | 0.00  | 3       | 9.68  | 7              | 7.87  | 8          | 4.37  | 18    | 5.83  |
| Assault            | 0      | 0.00  | 1       | 3.23  | 0              | 0.00  | 14         | 7.65  | 15    | 4.85  |
| Not recorded       | 1      | 16.67 | 0       | 0.00  | 3              | 3.37  | 6          | 3.28  | 10    | 3.24  |
| Object on body     | 1      | 16.67 | 1       | 3.23  | 2              | 2.25  | 3          | 1.64  | 7     | 2.27  |
| Blow               | 0      | 0.00  | 0       | 0.00  | 0              | 0.00  | 5          | 2.73  | 5     | 1.62  |
| Animal             | 1      | 16.67 | 0       | 0.00  | 0              | 0.00  | 1          | 0.55  | 2     | 0.65  |
| Blast injury       | 0      | 0.00  | 0       | 0.00  | 0              | 0.00  | 1          | 0.55  | 1     | 0.32  |
| Total              | 6      | 100   | 31      | 100   | 89             | 100   | 183        | 100   | 309   | 100   |

Infants (up to 1 year), toddlers (1-3 years), preschool (3-6 years) and school-age children (6-12 years).



**Fig. 2. List of abdominal visceral injury in 93 patients. Two patients had both liver and spleen injury, one had renal and pancreatic injury (total injuries =96)**

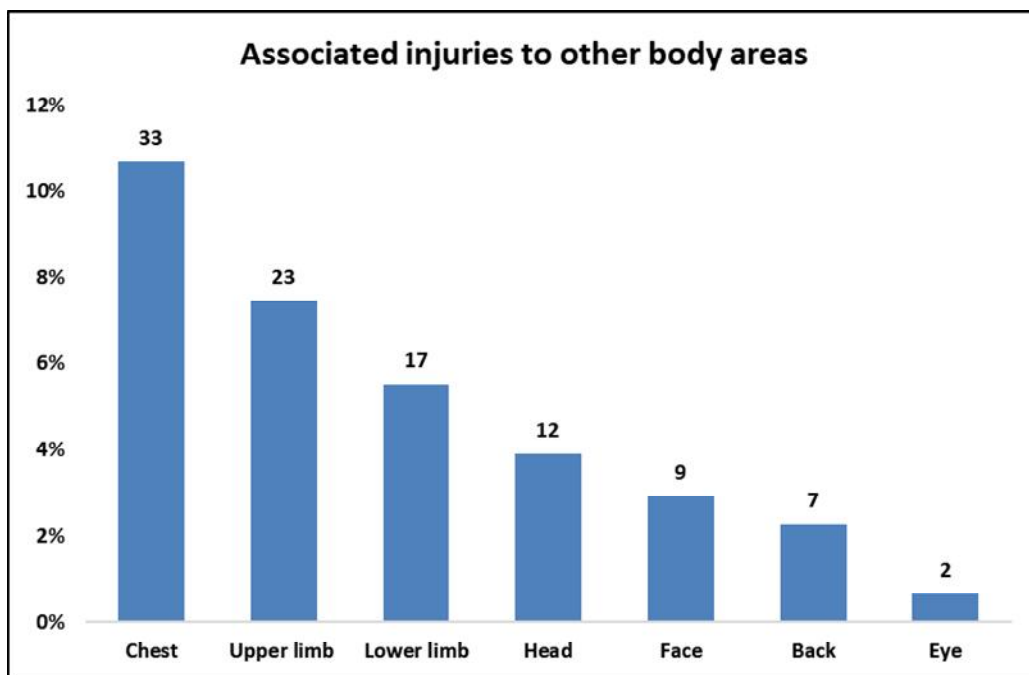


Fig. 3. Associated injuries of other body areas. X-axis denotes body areas and Y-axis represents percent values of associated injuries to other body areas among total patients (N=309). Values at top of bars represent frequency of associated injuries (n=103)

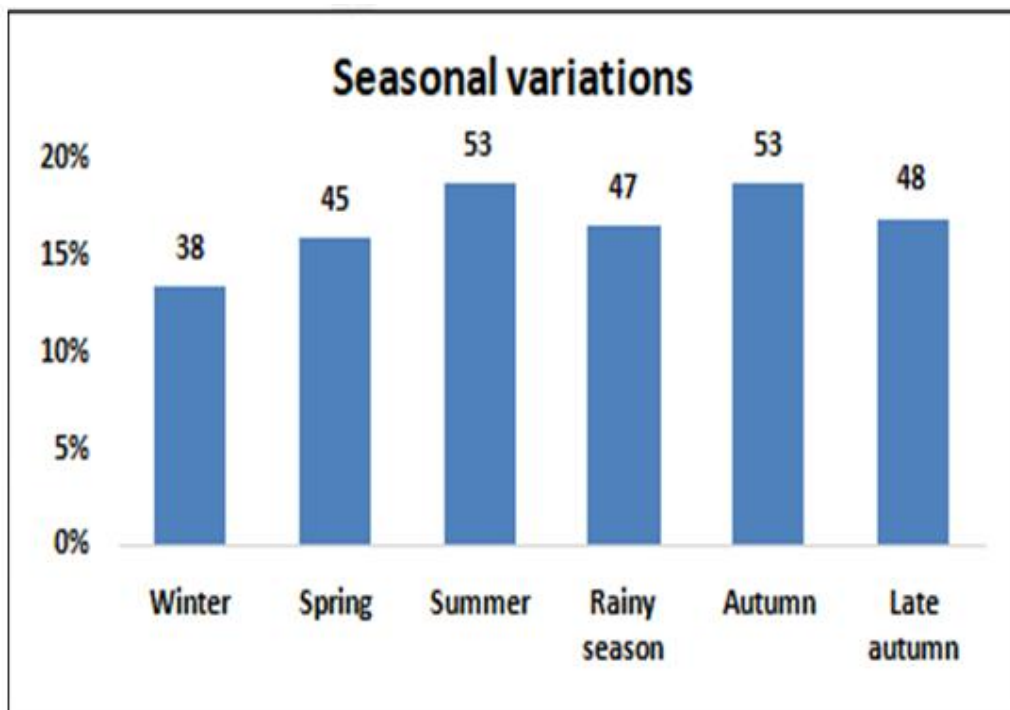


Fig. 4. Seasonal variations of blunt abdominal injury admissions between 2017 and 2019 (n=284). X-axis denotes seasons and Y-axis represents frequency of admissions with blunt abdominal injuries. Values at top of bars represent frequencies

**Table 3. List of treatment performed among the patients (N=309)**

| Type of treatment  | No  | Percentage |
|--|-----|------------|
| Conservative   | 229 | 74.11      |
| Repair of wound  | 18  | 5.83       |
| Laparotomy and peritoneal lavage                         | 16  | 5.18       |
| Repair of intestinal perforation                         | 15  | 4.85       |
| Laparoscopy and peritoneal lavage                        | 8   | 2.59       |
| Surgical toileting of wound only                         | 6   | 1.62       |
| Intercostal tube   | 5   | 1.62       |
| Repair of urinary bladder                                | 3   | 0.97       |
| Creation of stoma  | 3   | 0.97       |
| Gastrojejunostomy and duodenal repair                    | 2   | 0.65       |
| Pyeloplasty  | 2   | 0.65       |
| Intestinal resection anastomosis                         | 1   | 0.32       |
| Repair of splenic injury                                 | 1   | 0.32       |
| Abdominal paracentesis                                   | 1   | 0.32       |
| Supra pubic cystostomy                                   | 1   | 0.32       |
| Removal of bladder clot                                  | 1   | 0.32       |
| Ultrasound guided aspiration of subdiaphragmatic abscess | 1   | 0.32       |
| Nephrostomy  | 1   | 0.32       |

Children are thought to have increased risk of intra-abdominal injuries after blunt trauma because of their different body build than adults [4]. Their musculoskeletal system is under-developed, abdominal wall is thin with less fat contents and abdominal organs are relatively larger and in close proximity to each other. Moreover, there is an increased force per body surface area because of their small size which may cause more damage to internal organs [6]. There is also little fat to cushion the organs and the incompletely ossified rib cage which is also located higher, provides limited protections to solid organs [4].

Age and sex distribution and mechanism of injuries were similar to many other studies. RTA is the commonest cause of injury in both male and female children worldwide and its incidence is increasing. [3,4,6]. In most counties, RTAs cost about 3% of their gross domestic product. Every year, about 1.35 million people die due to RTA and it is the leading cause of death for children and young adults aged 5-29 years. The target for Sustainable Development Goal-2030 was to reduce the global number of deaths and injuries from RTAs into half by 2020 [11]. Unsafe road infrastructure, unsafe vehicles, speeding, non-use of helmets, seat-belts and child restraints, distracted driving, driving under influence of alcohol or substances, inadequate post-crash care, inadequate enforcement of traffic laws are some of the major risk factors

[11]. The Safe System approach advocated by WHO is yet to be applied completely in many LMICs. In 2017, WHO released "Save LIVES"- a road safety technical package that focuses on Speed management, Leadership, Infrastructure design and improvement, Vehicle safety standards, Enforcement of traffic laws and post-crash Survival. Falls are the second major cause of injury deaths worldwide and every year about 646,000 individuals die from falls of which over 80% are in LMICs [12]. Childhood falls occur mostly due to their evolving developmental stages, innate curiosity and increasing levels of independence that relates with more challenging behaviors. Inadequate adult supervision, poverty, sole parenthood, and hazardous environments are some of the risk factors [12].

Blunt injuries result from a combination of crushing, deforming, stretching and shearing forces, the magnitude of which is dependent on the rate of acceleration and deceleration and the direction of impact [3]. It has been estimated that with every 1% increase in mean speed there is a 4% increase in the fatal crash risk and a 3% increase in the serious crash risk [11]. Blunt abdominal injuries are the third most common form of injury in RTAs after limb and head injuries [3]. Injuries of the hollow viscera are less common in blunt abdominal injuries than in penetrating injuries [3]. Blunt abdominal injuries are found in about 5% to 15% of all operative abdominal injuries [3]. The liver is one of the



most frequently injured organs in blunt abdominal injuries [13]. The anterior location, fragile parenchyma and easily disrupted Glisson's capsule make it vulnerable to injury [14]. In contrast to adults and some other studies in children, there were less splenic injuries in our study [4–7,15]. Renal injuries were found in 7% of our patients which is similar to findings from other studies [7].

Gastrointestinal (GI) perforation was found in about 6% of the patients and it was 25% of all patients who needed surgical intervention. Manoranjan et al. [16] reported 13% intestinal injuries in their series of 40 patients of blunt abdominal injuries who underwent laparotomies [16]. We did not include penetrating abdominal injuries in this study. Penetrating injuries comprise 10% of abdominal injuries and complications following penetrating injuries are higher than blunt abdominal injuries, however, mortality is higher in blunt injuries [13,17]. Penetrating injuries are obvious and immediate diagnosis and prompt management is usually done but blunt injuries are sometimes difficult to diagnose early and there is dilemma whether to treat them conservatively or surgically. Fall from height was reported to be a major cause of GI perforation [17]. In our study, majority of GI perforations had RTAs (11 patients, 55% of GI perforations). Ileum was the most common site of perforation similar to other studies [16–19]. The causes of intestinal injuries in blunt trauma are believed to be direct force that can crush the gastrointestinal tract, rapid deceleration that may produce shearing force between fixed and mobile portions of the tract; and a sudden increase in intraluminal pressure that may result in bursting injuries [16].

Our study reports resolution in 74% children after conservative treatment. Other studies also reported that majority of blunt abdominal injuries can be treated conservatively. However, 50% of splenic injuries, 44% of the liver injuries, 25% of pancreatic and 23% of renal injuries needed surgical intervention in this study. This is higher than many other reports; for example, Ghosh et al. [6] and Garg et al. [20] had 10-15% and Barkesiyā et al. [5] had 10% surgical interventions [5,6,20]. However, a study from Nigeria reported that 58% of their patients needed laparotomy [7]. This may be due to the fact that we could not perform CT scan of abdomen in many of these patients, and probably many patients had undiagnosed organ injuries which improved after conservative

treatment. CT scan is expensive, patients have to spend out of pocket money and many cannot afford it. Many institutes practice protocol-based management and use trauma scores to assess patients [21–23]. We did not apply scoring system and this is also not well-practiced in many LMICs. In these countries, many a times, clinical judgments are given emphasis on the decision-making process. However, studies have shown that a surgeon's ability is accurate enough to determine if a child has or has not recently bled and can guide therapy [13]. Prospective studies have also supported management based on hemodynamic status rather than CT grade of injury [13,24,25]. Non-operative management is currently considered the standard of care for hemodynamically stable children with solid organ injuries. Laparotomy is usually needed in cases of peritonitis or failure of conservative treatment [20]. We used laparoscopy in 8 patients (10% of surgical procedures): 1 each had liver, spleen, both liver and spleen, and peritoneal injuries. In 4 patients, there was hemoperitoneum without any identifiable site of injury. Parrado et al. [26] reported use of laparoscopy in 16% of their patients [26].

This study alluded to the need for improved preventive measures in several aspects to avoid blunt abdominal injuries in children. Road safety measures are important preventive factors that are not properly practiced in many of the LMICs. There are tendencies among occupants of vehicles not to use seat belts and seat belts are not also available in many public transports. Many roads run near the houses and children have a tendency to go outside in the roads making them vulnerable to traffic injuries. Parents and teachers need to be more vigilant to teach the children about safe usage of roads. Many unsafe vehicles also run in these countries who are prone to accidents and are susceptible to more trauma if accidents happen. Children in the rural areas have a tendency to climb trees and many injuries occurred from falls from a height. Children should be made more aware of these facts from home and school. In this study, children between 5 and 7 years of age had the highest frequencies of injuries. This is the period when they are in pre-schools or very early year of schools. Which means that in these ages, education about injury prevention should be provided from home and school. This study also showed that there are more chances of having internal organ injuries if there are other associated injuries along with blunt abdominal injuries. In these cases, physicians need to be

more vigilant in searching for the presence of internal injuries.

It was observed that COVID-19 pandemic had a major impact on trauma admissions and reduced our admissions for blunt abdominal injuries to less than one-fifth. It may be due to lockdown, no school and few vehicles in the road. However, RTA was still the major cause of injury during the COVID pandemic period. Injuries were prevalent throughout the year, there was not much seasonal variations, and mechanism of injuries were not different in different seasons.

This study has some limitations. Since this was a retrospective analysis, it was certain that data were not complete. Due to inadequate data entry, many variables such as, period of injury, time lapse between injury occurrence and hospital admission, clinical presentations, examination and detailed investigations findings could not be analyzed. The sample size was obtained from non-probability sampling and there are methodological limitations. CT scan is the gold standard for diagnosing blunt abdominal injuries, and we could perform CT scan in some of these patients. However, the aim of the study was to report the epidemiological characteristics of the blunt abdominal injuries and their outcome in this region. We believe this study provided important insight into children with blunt abdominal injuries in a LMIC perspective. This will add to the growing evidence for the importance of proper injury prevention and trauma management in the children.

## 5. CONCLUSION

Children suffered from blunt abdominal injuries by a variety of mechanisms and almost all abdominal viscera were susceptible to injury. Male suffered more than females. School-aged children were more susceptible to trauma throughout every season of the year. RTAs were the commonest cause and solid organ injuries were more common than hollow viscus injuries. Liver was the commonest solid organ and ileum was the commonest hollow viscus injured. Age, sex, mechanism of injury did not have significant relation with type of injury but abdominal injuries were more if there were other associated injuries. Majority were treated conservatively. Laparotomy needed in about 17% patients and laparoscopy constituted 10% of all surgical interventions.

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## CONSENT

It is not applicable.

## ETHICAL APPROVAL

The current study has guaranteed the confidentiality of patient data by expressly omitting names from the case record forms. The current study has collected and processed the data in absolute anonymity. This was a retrospective study and no experiment was performed in any patients and no subjects were contacted for the purpose of the study. All authors declare that this study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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