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Original Research Article

Epidemiology and injury pattern in blunt trauma abdomen in pediatric population: a two-year experience in a tertiary care institute of Kashmir, India

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ABSTRACT

Background: Blunt abdominal trauma is a frequent cause for presentation of children to the Emergency Department. Children are prone to sustain injuries to intra-abdominal organs after blunt abdominal trauma because of their peculiar body habitus and relatively immature musculoskeletal system. Objectives of this study is to assess the various epidemiological parameters that influences the causation of trauma as well as injury pattern in blunt trauma abdomen in pediatric population.
Methods: The present observational hospital based prospective study was carried out in 96 blunt abdominal trauma patients of both sexes aged up to 12 years, over a period of 2 years. The parameters such as age group, sex, mode of trauma, type of injury, and the overall mortality as well as mortality were assessed.
Results: The most common mode of injury was road traffic accidents (54.2%) followed by fall from height (41.70%). Splenic injury was the most common in 58.30%, followed by hepatic injuries 34.40% and renal injuries 12.50 %. The accuracy of ultrasonography (USG) was 83.33% while accuracy of computed tomography (CECT) as a diagnostic test was 93.33%. When comparing USG findings with operative findings sensitivity of USG was 88% with positive predictive value (PPV) of 91.66% while as specificity was 60% with negative predictive value (NPV) of 50%. Sensitivity of CT scan was 96.00% with PPV of 96.00% and specificity of CECT scan was 80.00% with NPV of 80.00%.
Conclusions: The majority of pediatric injuries are preventable by knowing the epidemiology and pattern of pediatric trauma.

Keywords: Blunt abdominal trauma, Computed tomography, Epidemiology ultrasonography, Pediatric

INTRODUCTION

Pediatric trauma is a very significant cause of mortality and disability, being responsible for more deaths than all diseases combined.[1] The burden of child injuries in India is not clearly known because our knowledge is inadequate about their epidemiology. As per National Crime Records Bureau (NCRB) report of 2006, there were 22,766 deaths (<14 years) due to injuries among children.[2] Globally, approximately one third of trauma patients have abdominal trauma and it accounts for a large fraction of tragic loss of life and unrecognized

abdominal injury remains a distressing frequent cause of preventable death.[3] Abdominal trauma is traditionally classified as either blunt or penetrating.[4] Blunt traumatic injury is the most common cause of death and disability in childhood.[5] Abdominal injuries occur in isolation or as a part of polytrauma. Although trauma has accompanied mankind since millennia: the massive pandemic of childhood trauma is a recent phenomenon, ever increasing in magnitude over the last three decades.

Children are at increased risk of sustaining injuries to intra-abdominal organs after blunt abdominal trauma because of their body habitus and relatively immature musculoskeletal system. Compared with the adult patient, the child's intra-abdominal organs are proportionally larger and are in relatively close proximity to each other. The small size of a child results in a greater degree of force per body surface area, which can lead to significant injury to multiple organs.[6] Furthermore, there is little fat or connective tissue to cushion the organs and the abdominal wall is less muscular, providing little protection to the intra-abdominal contents. The incompletely ossified rib cage is also higher and thus provides limited protection to the liver, spleen, and kidneys. Finally, the increased ratio of body surface area to volume results in an increased propensity toward hypothermia.[6]

There are very few studies from developing countries discussing the epidemiology and injury pattern of blunt abdominal trauma in pediatric population. The present study was carried out to assess the various epidemiological parameters that influence the causation of trauma as well as injury pattern in blunt trauma abdomen in pediatric population.

METHODS

After obtaining Institutional Review Board approval, this observational hospital based prospective study was conducted in total 96 pediatric patients of both sexes having aged between 1-12 years and who were presented with blunt abdominal trauma. The study was carried out in the Department of Pediatric Surgery in collaboration with the Department of Radiodiagnosis at Sher-i-Kashmir Institute of Medical Sciences over a period of three years. A detailed history was taken from parents/relatives/ children and examination was done. All patients were assessed with regards to their age, sex, mode of trauma/injury, type of injury, site of trauma, place of trauma, and mortality.

The management entirely depends upon the clinical examination, hemodynamic stability and assessment of relevant investigations. Management was broadly divided into two groups i.e. conservative / non-operative and operative. Conservative / Non-operative management was offered to patients with solid viscus injury who fulfilled the criteria of hemodynamic stability, CECT documented Grade I to Grade IV solid organ injuries, absence of other clear indications for exploratory laparotomy or associated injuries requiring surgical intervention and absence of associated health condition that carries any associated risk of bleeding (coagulopathy, hepatic failure, use of anticoagulants, specific factor deficiency). This group after discharging from hospital was regularly followed up and repeated abdominal USG were done. Operative intervention was done in patients who had irreversible shock on admission after excluding other causes of shock, signs of generalized peritonitis, continuing intra-abdominal hemorrhage, clinical deterioration during observation, extra luminal air on abdominal X-ray, failure of non-operative management. After discharge from hospital, patients were followed for 3 months.

RESULTS

Total 96 blunt abdominal trauma patients were enrolled in the study. The demographic characteristics of the patients were shown in Table 1. The majority of the patients were aged between 6-12 years [51 (54.16%)] with male predominant [59(61.45%)]. The mean age of presentation was 6.8 years. School-going children were the most commonly injured (53.12%) followed by pre-school children as depicted in Figure 1.

Table 1: Demographic data of the patients.

Sex distribution	Age in Years			Total
	1-3	3-6	6-12	
Male	06	21	32	59
Females	04	14	19	37
Total	10	35	51	96

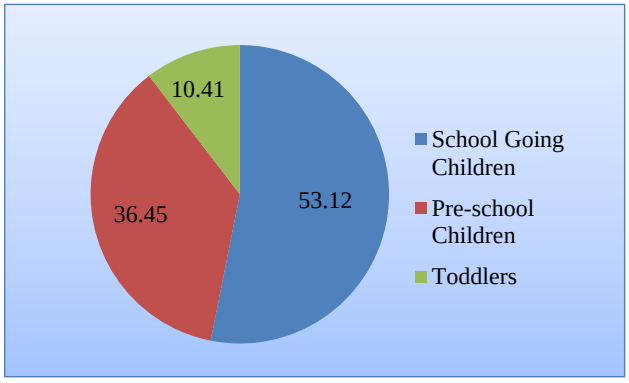

Figure 1: Age distribution of trauma.

Road traffic accidents [52 (54.16%)] and fall from height [40(41.66%)] were the most common mode of injury observed in both male and female children that's leading to pediatric trauma (Figure 2).

As depicted in Figure 3, patients who had sustained injury about 15% had combined injuries (n=14). Splenic injury was the most common in 58.30% (n=56), followed by hepatic injuries 34.40% (n=33) and renal injuries 12.50% (n=12).

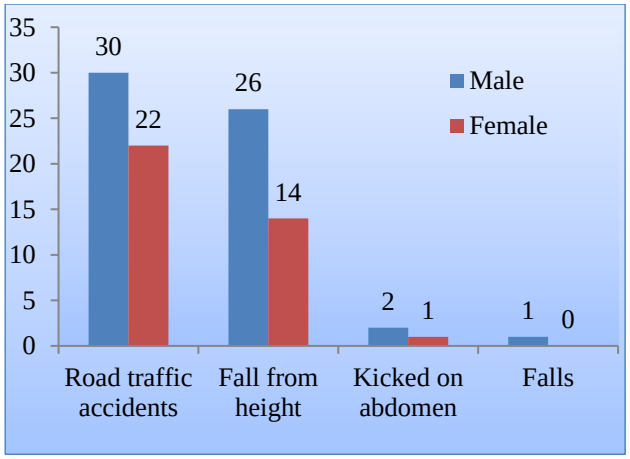

Figure 2: Mode of injury in pediatric blunt abdominal trauma

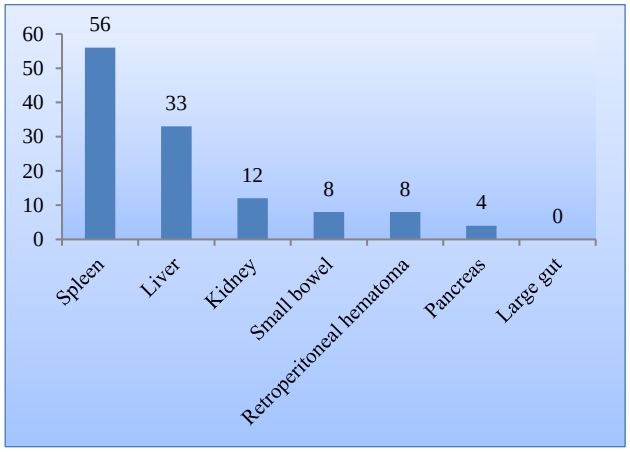

Figure 3: Organ injuries in pediatric patients with blunt abdominal trauma.

Taking operative findings as a standard criterion and on comparing USG findings with them sensitivity of USG was 88% with positive predictive value of 91.66% while as specificity was 60% with negative predictive value of 50%. The low specificity of USG noted was due to the low sample size in the operative group. Accuracy of USG was 83.33% (Table 2).

Table 2: Operative findings confirming visceral injury (VI) in comparison to USG finding of visceral injury (n=30).

Parameter	Opt. findings +ve for VI	Opt. findings -ve for VI	Total
USG positive	22	02	24
USG negative	03	03	06
Total	25	05	30

CECT findings were confirmed on laparotomy in 25 cases. Sensitivity of CT scan was 96.00% with positive predictive value of 96.00% and specificity of CECT scan was 80.00% with negative predictive value of 80.00%.

Table 3: Operative findings confirming visceral injury in comparison to CECT finding of visceral injury (n=30).

Parameter	Opt. finding positive	Opt. finding negative	Total
CT scan positive	24	1	25
CT scan negative	1	4	5
Total	25	5	30

Accuracy of CECT as a diagnostic test was 93.33%, (Table 3).

DISCUSSION

Pediatric abdomino-pelvic trauma both penetrating as well as blunt poses a formidable diagnostic and therapeutic dilemma for the attending surgeon, owing to frequent occurrence as part of poly trauma, the wide range of visceral injuries that may result, the diversity of their presentations and the severity of intra-abdominal injury. The primary focus of present study was to know clinical manifestation, role of investigation protocol, outcome of requisite treatment at the earliest and the feasibility of non-operative management of solid viscous injury in a setup lacking angiography and sophisticated pediatric intensive care unit.

The incidence of pediatric blunt abdominal trauma in current study was 15% which was in agreement with recent international studies conducted by Ma et al.[7] However, earlier study conducted by Cooper et al reported lower incidence (8%).[8] This recent increase in the incidence may be attributed to increased automobile density on the roads, crowded streets, child labor and more mechanized life. History taking, and proper clinical examination usually lead to accurate diagnosis at the earliest. In this prospective study we observed that majority of cases, 83.30% (n=80) presented with pain abdomen after sustaining trauma followed by vomiting in 20 cases (20.40%), loss of consciousness in 18 patients (18.75%), haematuria in 9 cases (9.40%), and bleeding per rectum in 1case (1.33%). Other symptoms like acute urinary retention, pain in limbs, headache etc. were seen in 8 cases (8.3%). However, symptoms did overlap in patients. Tenderness of abdomen was the most common sign observed in pediatric abdominal trauma (66.7%) (n = 64). Studies conducted by Craig et al and Jerby et al had also observed the pain abdomen and clinical signs of peritonitis such as diffuse abdominal ‘tenderness and rebound tenderness as most frequently occurring signs and symptoms in pediatric abdominopelvic trauma patients.[9,10]

They suggested that serial physical examinations are gold standard for the diagnosis of pediatric gastrointestinal perforation from blunt trauma. In case clinical features

are equivocal, investigation protocol helps to reach to a proper diagnosis.

Ultrasonography (FAST) was done in all 96 pediatric blunt abdominal trauma patients in the emergency department after proper resuscitation. Organ injury was detected by ultrasound in 60.40% (n=58) of cases and only free fluid in peritoneal cavity was present in 29.20% (n=28) cases. Ultrasound was normal in 10 patients. Using CT as reference standard, sensitivity, and specificity, positive predictive value and negative predictive value of USG observed were 90.91%, 77.14%, 86.21% and 84.38% respectively.

This high sensitivity and moderate specificity was correlated with the previous studies and all these studies suggested that USG is a promising modality in the evaluation of abdominal trauma in children that is quick, noninvasive, repeatable and cost effective.[11-14] Emergency department ultrasonography performed for abdominopelvic trauma is useful triage tool for deciding the modality of management and also reduces the need for CT scan.

Computed tomography scan was done in 90 patients after performing USG. CT scan was positive for visceral injuries in 61.11% (n= 55) of cases and positive for only free fluid in 14.44% (n = 13) of cases. There were 10% (n=9) of cases with normal CT scan. C

T scan detected visceral injuries in five patients which were missed by USG. In current study, CT scan had missed visceral injury in one case and one false positive visceral injury was confirmed on laparotomy out of 30 cases. CT scan had sensitivity and specificity of 80.00% and 87.5% respectively, PPV of 96% and NPV of 80.00%. This high sensitivity, specificity, NPV and PPV corroborate well with other studies.[9,10,13,15-18]

Regarding visceral injuries, seventy-four patients (77.10%) had isolated injuries and only twenty-two patients (22.90%) had combined visceral injuries. Spleen was the most common (56.30%) solid viscus injured followed by the liver (34.40%) in cases of isolated visceral injuries. Among the solid viscus injuries grade III injuries were most followed by the grade II injuries. The reason may be slightly more severe impact of an injury in our population resulting in grade III solid viscus injuries. Facts related to intra-abdominal injuries observed in present study were supported by many other studies.[8,17,19-21]

Out of 96 cases, 66 (68.75%) were managed non-operatively and 30 (31.25%) were managed with operative modality. 82.10 % (n = 46) of splenic injuries were managed by none operatively, 70% (n = 23) of hepatic injuries were managed conservatively and conservative management was also done in 92% (n = 11) of renal injuries.

There was no failure rate of non-operative management. All hollow viscous injuries were managed operatively. The most common operative procedure performed was splenectomy in 8 splenic trauma cases followed by augmented repair of liver injuries in 6 cases. Gastrointestinal perforations were mostly repaired (n=5) than resection anastomosis (n=3).

Out of 4 pancreatic injuries one was managed operatively with distal panceatectomy and three were managed conservatively. One operated patient of hepatic injury developed bilioma and was managed by percutaneous drainage. The similar findings were observed in previous studies.[21-25]

These studies have managed more proportion of patients with non-operative management in their trauma centers while as in current study, the reason for the more operative modality was that we have performed study in a non-trauma centre hospital, this reason was supported by the studies conducted by Stephen M Bowman et al and Stylianos et al.[26,27]

Those patients who were observed only had average hospital stay of 1- 3 days, returned to their routine activity in average of 1-2 weeks and none of them required ICU care. Those with intra-abdominal injury and were managed non-operatively, had average hospital stay of 7 - 14 days, and none among them require ICU care and returned to their routine activity on an average of 2 - 3 weeks.

Those operated had longer average hospital stay of 14 - 28 days, one among them required ICU stay and returned to their routine activity in average of 3 - 6 weeks. The hospital stays and return to routine activity was longer in those operated than those managed non-operatively. Similar results were observed by Jim et al and Navascues et al.[25,28]

The overall mortality observed in the study was 1.04%, out of which wholly contributed by the operative group only and there was no death in the patients managed conservatively. Contribution to overall mortality was entirely due to liver injury (n=1). This finding was correlated with study done by Jim et al.[25]

The reason for low mortality in current study was because of the exclusion of patients with penetrating abdominal trauma and also patients with head and thoracic injuries which were managed by the concerned super specialty departments at our center.

CONCLUSION

The present study gives an idea about the epidemiology of pediatric trauma, with 6-12 years age group found to be the most affected and 1-3 years age group found to be the most vulnerable with regards to overall mortality.

Road traffic accidents and fall from height were the most common mechanisms of injuries.

Splenic and hepatic injury was the most common pattern of injury. By knowing the epidemiology of pediatric trauma, we conclude that majority of pediatric injuries are preventable and pediatric epidemiological trends differ from those in adults.

Therefore, preventive strategies should be made in pediatric patients on the basis of these epidemiological trends.

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