

## Original Research Article

# Abdominal blunt trauma in children: experience from a single center

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### ABSTRACT

**Background:** Abdominal blunt trauma (ABT) remains an important cause of childhood morbidity and sometimes, mortality. Recently the approach for management of ABT has tilted towards conservative one with excellent results. In this study, we present our experience of ABT from a teaching hospital.

**Methods:** All patients below 17 years with ABT between December 2012 and May 2016 were studied retrospectively and methods and results analyzed.

**Results:** A total of 33 patients presented with ABT, mainly due to fall from height or road-traffic accidents. Age ranged from 3 to 17 years. Of the 33 patients, 30 patients had solid organ injuries and only 3 patients had isolated hollow viscus injuries. Operative intervention was needed in 6 (18.2%) patients, of whom three needed upfront surgery. They had had hollow viscus injury. Others who developed signs and symptoms of other injuries included duodenal injury, ureteric transection and delayed adhesive intestinal obstruction following bile leak, one each. Average hospital stay of patients with solid organ injury was  $5.4 \pm 1.6$  days while for those with hollow viscus injury requiring operative intervention, this was  $12.3 \pm 2.4$  days. There was no mortality.

**Conclusions:** ABT is a frequent emergency in children in the developing world. Prompt initial management significantly affects the eventual outcome. Imaging studies are the cornerstone of diagnosing the type and extent of injury. Most patients can be managed conservatively. However, constant masterly vigilance is needed to pick up the evolving signs, thereby avoiding possible complications and morbidity.

**Keywords:** Blunt trauma, Injury, Liver, Pediatric, Spleen

### INTRODUCTION

Trauma is the leading surgical cause of morbidity and mortality in pediatric population, and the abdomen is the third most commonly injured anatomic region in children, after the head and the extremities.<sup>1</sup> Abdominal trauma can be associated with significant morbidity and may have mortality as high as 8.5%.<sup>2</sup> The abdomen is the most common site of initially unrecognized fatal injury in traumatized children.<sup>1,2</sup>

The incidence of pediatric trauma has recently increased, probably with the increased exposure of the kids to

outdoor activities. During last few decades, the treatment policy for abdominal blunt trauma (ABT) has shifted more towards conservative approach without an increase in morbidity or mortality.

In early 1950s, at the hospital for sick children in Toronto, conservative treatment for splenic trauma in children was suggested and twelve such children were reported between 1956 and 1965.<sup>4</sup> Later in 1968, Upadhyay and Simpson reported their experience with non-operative treatment of splenic injuries in children.<sup>5</sup> Still later this conservative approach was applied to other solid organ injuries as well in hemodynamically stable patients with good results.

The treatment of children with blunt abdominal solid organ injury lacks uniformity despite excellent outcomes.<sup>4</sup> Conservative treatment of isolated liver and splenic injuries in hemodynamically stable children has now become a standard practice (4) although different pediatric surgeons use different management algorithms.<sup>4</sup> This has been confirmed by APSA (American Pediatric Surgical Association) as well.<sup>6</sup>

In 1997, trauma committee of APSA came out with consensus guidelines for stable children with liver and spleen injuries based on CECT scan grading using a multi-institution database.<sup>7</sup> These were used on 312 appropriate patients across many centers and the results were very promising. There was statistically significant reduction in ICU stay, total hospital stay, follow up imaging and interval of physical activity restriction in each grade of injury.<sup>7</sup> Still more than 25% children with trauma need surgical intervention.<sup>8,9</sup>

Management of abdominal injuries in children has evolved considerably over time. It has been shown that non-operative treatment of children with blunt abdominal trauma is successful in more than 95% of appropriately selected cases.<sup>3</sup> We have done the retrospective analysis to evaluate the outcome in our institute.

## METHODS

We collected the data of patients retrospectively during a period from December 2012 till May 2016 who presented with isolated ABT in our hospital. All these patients were managed in the Pediatric Surgery department of the hospital. Patients who had associated thoracic or head injury, or long bone fractures, were excluded from the study. As per a standard protocol, after initial hemodynamic stabilization, all patients underwent FAST (Focused Abdominal Scan for Trauma) to look for free fluid and any solid organ injury. As the majority of the patients come from lower socio-economic strata of the society, the CECT scan was initially reserved for patients who were FAST positive and/or hemodynamically unstable or where the clinical picture was equivocal. If the FAST was negative, patients were clinically monitored (vital signs and urine output) and a formal USG was repeated after 4-6 hours. CECT scan was performed if there was any evidence of free fluid or solid organ injury on USG. The scan was also carried out if the patient was not responding to fluid resuscitation. All solid organ injuries were graded as per American Association of Surgery for Trauma.

All patients received initial fluid resuscitation. Patients who responded to initial management were kept on conservative management. This included complete bed rest, nil by mouth, intravenous fluids, prophylactic antibiotics, and other supportive treatment. Hemodynamic status was monitored continuously and serial hemoglobin and hematocrit measurements were done. Packed red blood cells were transfused if the hemoglobin levels had dropped more than 20% of those normal for the age, or if the given patient was hemodynamically unstable. Patients with obvious surgical indications like hollow viscus perforation were taken up for upfront surgery.

Data were analyzed for age and gender, mechanism and grade of injury, management, and the outcome.

## RESULTS

During the study period, 33 patients presented with isolated ABT. Majority (32/33; 96.9%) were males. Age range was between 3 and 17 years with median age of 9 years. 23 (70%) patients had road traffic injuries, 7 (21%) had fall from height, 2 (6%) patients had bicycle handle-bar injury and one patient had contact sports injury. Of the 33 patients, 30 (91%) patients had solid organ injuries and 3 (9%) patients had isolated hollow viscus injuries (Table 1).

Among patients with solid organ injuries, 60% were liver injuries, 46.7% splenic, 20% renal and 6.7% were pancreatic injuries (Table 2).

Of 30 patients, grade of injury, as per the American Association of Surgery for Trauma, was: Grade V-4 (13.3%), Grade IV-10 (33.4%), Grade III-5 (16.7%), Grade II-7 (23.3%) and Grade I-4 (13.3%) (Table 3).

Ten patients (33.3%) had more than one solid organ injury. Hollow viscus injuries were present in 5 (15%) and of these, 3 (9%) patients had isolated injuries while 2 (6%) had associated solid organ injuries as well. Of these 5 patients, 3 (60%) were small bowel injuries, one patient had complete gastric transection while another had ureteric transection. The patient with complete gastric transection had associated grade 3 pancreatic injury and paraplegia due to SCIWORA (Spinal Cord Injury without Radiographic Abnormality) as well.

**Table 1: Mechanism of injury in various age groups.**

Mechanism of injury	Age groups (in years)			Total N (%)
	0-5	5-10	10-18	
Road traffic accidents	2	13	8	23 (70)
Fall from height	3	2	2	7 (21)
Bicycle handle-bar	0	2	0	2 (6)
Contact sports injury	0	0	1	1 (3)
<b>Total</b>	5 (15.2%)	17 (51.5%)	11 (33.3%)	33 (100)

**Table 2: Solid organ injury grading in various age groups.**

Grade of injury (Any organ)	Age groups (years)			Total
	0-5	5-10	10-18	N (%)
Grade I	0	3	1	4 (13.3)
Grade II	0	2	5	7 (23.3)
Grade III	1	3	1	5 (16.7)
Grade IV	4	3	3	10 (33.4)
Grade V	0	3	1	4 (13.3)
<b>Total</b>	<b>5</b>	<b>14</b>	<b>11</b>	<b>30 (100)</b>

**Table 3: Organ-specific grading of injury.**

Injury Grade	Liver	Renal	Pancreatic	Splenic
Grade I	1	2	1	2
Grade II	2	3	0	1
Grade III	9	1	1	3
Grade IV	4	0	0	6
Grade V	2	0	0	2
<b>Total</b>	<b>18 (60%)</b>	<b>6 (20%)</b>	<b>2 (6.7%)</b>	<b>14 (46.7%)</b>

Operative intervention was needed in 6 (18.2%) patients; in 3 (9.1%) it was upfront due to immediately diagnosed hollow viscus injury while another three (9.1%) patients underwent surgery at a later date as the symptoms and signs appeared gradually. Latter included a duodenal injury which presented late; ureteric transection which manifested with urinoma formation while the third patient had grade V liver injury in which bile leak could not be tackled with conservative management, including pigtail catheter insertion. None of the patients with isolated solid organ injury required operative intervention.

One patient with large subcapsular hematoma in the liver presented after 3 weeks with abdominal distension and USG-guided pigtail catheter placement was done. One patient with grade V renal injury presented more than 20 hours of trauma and there was no flow in the renal parenchyma. He also had extensive retroperitoneal hematoma. No intervention was done at that time. This patient was advised delayed elective nephrectomy. Patients with pancreatic injury responded to conservative management.

There was no mortality in this small cohort of patients. Three patients had failure of conservative management as described earlier. In one patient, we had to drain the liver subcapsular hematoma due to mass effect it produced. Another patient had large perirenal hematoma which settled after few weeks and one patient with pancreatic injury had pancreatic pseudocyst which was drained later under ultrasound guidance and he did well. One patient who underwent operative management had two large jejunal perforations. He developed anastomotic leak which required re-exploration. Two patients had wound infection and one patient with bile leak due to liver injury

had prolonged hospital stay. Average hospital stay of patients with solid organ injury managed conservatively was  $5.4 \pm 1.6$  days while for those with hollow viscus injury, who required operative intervention, this was  $12.3 \pm 2.4$  days.

## DISCUSSION

Pediatric ABT is a leading cause of morbidity and mortality, especially in the developing world where preventive aspect is rather ignored due to multitude of socio-economic factors. Treatment of solid organ injury has been revolutionized as the treatment practice has changed from previous aggressive surgical management to conservative management in most of the patients.<sup>1,2</sup>

FAST (Focused abdominal sonography for trauma) is a valuable, bedside screening tool in children. The test can be performed by the clinician and has a high specificity with much lower negative predictive value.<sup>10,11</sup>

Current gold standard in the majority of children with blunt parenchymal organ injury who are clinically stable is conservative management.<sup>3</sup> Due to small caliber vasculature in children, vasoconstrictive effect is more pronounced. That could be the reason that conservative treatment is more successful in pediatric population than in adults. Current literature describes that more than 95% of pediatric patients can be managed with conservative management alone.<sup>12,13</sup> Our series also recommends this as 97% of our patients with isolated solid organ injury have been managed conservatively.

We also observed high incidence of liver injury (60%) than described in the literature as well as higher grade of injuries (67% Grade III-V injuries) than described in the

literature. The reason for this could be that our centre is the only tertiary care centre in this hilly region of the country.

Pearl et al, showed in their meta-analysis that 97% of splenic injury in children could be managed with conservative management only.<sup>14</sup> Cywes et al, had reported that most of the liver injuries could be managed in the same way.<sup>15</sup> We also observed that the length of hospital stay did not depend on the grade of injury, rather it depended on the hemodynamic stability of the patient.<sup>16</sup> If the patient is stable hemodynamically for more than 48 hours without any drop in the hemoglobin concentration or haematocrit, patient can safely be discharged with the advice for bed rest at home for a week to ten days depending on the severity of injury.<sup>16,17</sup>

ABT is not an infrequent emergency in children in the developing world. Prompt initial management helps significantly in the eventual outcome. Imaging studies are the cornerstone of diagnosing the details and extent of injury. Most patients can be managed by conservative treatment. However, constant intensive vigilance is needed to pick up the late-presenting symptoms and signs for prompt intervention, thereby avoiding possible complications and morbidity.

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