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ORIGINAL ARTICLE

Analysis of Blunt Abdominal Solid Organ Injury in Children: A Single Centre Study

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ABSTRACT

Aim: To determine the management of solid organ injuries in blunt trauma abdomen (BTA) in children whether to conserve or operate.
Study design: Descriptive case series.
Place and duration of study: Department of Paediatric Surgery Sahiwal Teaching Hospital and Sahiwal Medical College Sahiwal from 1st January 2020 to 31st March 2022.
Methodology: Fifty eight patients with blunt abdominal trauma due to any cause, the medical records of all patients with trauma of any kind age upto 13 years were carefully reviewed. Initial resuscitation was done according to ATLS protocol. Ultimate management decision was based on stability of patients after resuscitation.
Results: The mean age was 5.34 years. Most of the patients suffered from road traffic accident, 50(86.2%). Fifty two (89.65%) patients showed free fluid in the abdomen. Organ injury in 27(46.55%) patients. CT abdomen with intravenous contrast confirmed findings of ultra sonography. Despite resuscitation, 17(43.9%) patients remained unstable and were operated. Forty one patients were kept on conservative treatment. Hospital stay ranged from 1-19 days.
Conclusion: Although non-operative management is the treatment of choice in blunt trauma abdomen with solid organ injury but stability of the injured child is the central pivot around which the whole management revolves. Delay in presentation and failure of timely resuscitation results into high operative intervention.
Keywords: Blunt trauma, solid, Liver, Spleen, children

INTRODUCTION

Children and young people are most often killed and disabled by accidents[1]. Blunt trauma accounts for more than 90% of traumatic mechanisms of injury in children. Blunt abdominal trauma accounts for between 10 and 15% of all blunt mechanisms[2,3]. Due to a combination of anatomical factors, including proportionately greater solid organs, comparatively taller, less ossified ribs, and a lack of sufficient fat to deflect impact of energy, the paediatric abdomen is particularly vulnerable to injury[4]. The vascularity of solid organs when injured can contribute significantly to significant haemorrhage, which can result in serious consequences and even death. The solid organ that sustains forceful damage most frequently is the spleen. It is more important to preserve the spleen in youngsters because of its immunological functions[5].

The treatment of paediatric abdominal trauma has evolved during the past 40 years. The establishment of the present non-operative treatment for the majority of blunt solid organ injuries in the paediatric age group was prompted by observations that most blunt solid organ injuries will heal on their own and that surgical intervention would thwart this mechanism[6,7].

Spleen, liver, kidney, and pancreas are among the solid organs that are frequently injured as a result of forceful abdominal trauma. The patients who were hurt by blunt methods are the subject of this study. The vast majority of patients with acute abdominal injuries react effectively to conservative treatment, but in the event of potentially deadly hemodynamic instability, one must continue to take care of unstable patients with caution. Although the stability of the patient determines whether to save or operate rather than the severity of the injury, some patients require prompt operation. Finding these patients as soon as feasible is the challenging aspect[8,9]. Delayed presentation, delayed resuscitation, lack of relevant investigations and absence of paediatric intensive care monitoring result into high rate of operative intervention and decreases the rate of non operative management.

This is exactly what happened in our study and a high number of patients underwent surgery.

MATERIALS AND METHODS

This descriptive case series was conducted at Department of Paediatric Surgery Sahiwal Teaching Hospital and Sahiwal Medical College Sahiwal from 1st January 2020 to 31st March 2022. A total of 58 children with abdominal blunt trauma up to the age of 13 years were enrolled. Patients who had penetrating abdominal injuries, examination-detected peritonitis, pneumoperitoneum on an abdominal X-ray, and who left against medical advice or referred to other hospitals were excluded from study. Age, gender, injury localization, mechanism, and areas of injury were all noted, as were the vital signs at the time of admission, the results of the abdominal exam, the CBC, blood chemistry, and the abdominal US and CT findings. Initial clinical evaluations following admission are typically conducted using Advanced Trauma Life Support (ATLS) protocols, with clinical endpoints assessed in relation to age-appropriate heart rate and blood pressure ranges, as well as the observation of urine output as a stand-in for end-organ perfusion at the bedside.

Regardless of the injury's mechanism, resuscitation was initiated in accordance with ATLS in all trauma patients. Vital indicators were closely watched and monitored. Blood transfusions and intravenous fluids were given as necessary. After a preliminary examination and any necessary bedside investigations, such as X-rays of the chest, pelvis, and C-spine and Extended FAST, it was only then decided to perform a CT abdomen with IV contrast on stable patients.

Patients who required surgery following fluid resuscitation and 20ml/kg packed RBCs were unable to stabilize despite all conservative measures.. Children with haemodynamic instability do not exhibit typical adult clinical findings due to their different physiological responses to hypovolaemia, and tachycardia may be the only clinical symptom of class III shock in the context of normal blood pressure. Only when the amount of blood in circulation has decreased by up to 25% does hypotension become apparent. As a result, isolated tachycardia should raise an alarm and be treated surgically. Data was entered and analyzed through SPSS-26. Chi-square test and student's t-test were applied and P value <0.05 was considered statistically significant.

RESULTS

The mean age was 5.34 years with range was 1 year to 13 years. 38(63.52%) were males while 20 females. Most of the patients suffered from road traffic accident, 50(86.2%). Fall from height 4(6.9%), handle bar injury 2(3.4%) and fall of heavy object 2(3.4%) were other modes of injury [Fig. 1]. Twenty one (36.2%) patients presented within 6 hours while 24(41.37%) after 24 hours of injury, range 1-120 hours (Table 1). Due to lack of emergency medical

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services and illiteracy, usually patients reach hospital with delay which increases morbidity and mortality. Most of the patients presented with complaint of pain abdomen, distension and vomiting. Nearly (100%) presented with abdominal tenderness. Heart rate ranged from 94-158 beats per minute while mean was 128, so (100%) presented with tachycardia. The mean systolic blood pressure was 85mmHg (range 70-125mmHg). All patients were resuscitated, X-Ray chest, c-spine and pelvis were carried out and bed side FAST scan was done. Fifty two (89.65%) patients showed free fluid in the abdomen. Sonography picked organ injury in 27 (46.55%) patients. Out of 27, eight patients had liver laceration, 14 splenic and 5 renal injury. Four patients were having splenic as well as renal laceration. Only one patient (4.16%) showed isolated renal injury. CT abdomen and pelvis with IV contrast was done in 27 (39.65%) of patients. Computed Tomography proved findings of ultrasonography. Four patients had liver laceration grade 2, three patients grade 3 and one patient grade 4 liver trauma. Likewise five patients had splenic trauma grade 1, three patients grade 2, four patients grade 3 and two patients grade 4. Among patients with splenic trauma, four patients had renal injury simultaneously and only one patient had isolated renal trauma, out of five patients with renal injury grade of injury ranged from grade 1 to 3 (Fig. 2).

Despite resuscitation with IV fluids and blood transfusion, 17(43.9%) patients remained unstable and were operated. Forty one patients were kept on conservative treatment. Eight patients were operated within twenty four hours while nine patients after 24 hours underwent surgery. As a whole on admission haemoglobin was less than eight grams/dl in seven patients, 8-9gm/dl in 10 and more than 9 in 41 patients. Two patients underwent multiple transfusions. Splenectomy was done in 12 patients while two underwent splenorrhaphy. Renal laceration was repaired in three patients. Liver lacerations were repaired in all patients. Hospital stay ranged from 1-19 days, mean 5.89 days. Sixteen patients stayed more than 10 days in the hospital while twenty five patients 5-10 days and seventeen less than 5 days. All patients did very well except four operated patients who developed wound infection and were managed with daily dressings.

Table 1: Demographic and other variables of patients

Variable	Mean±SD	Range
Age (years)	5.34±2.61	1-12
GCS	13.9±1.8	12 -15
Systolic blood pressure (mmHg)	89.1±16.5	45-130
Pulse (beats/min)	94.0±8.05	2-161
Respiratory rate (beats/min)	27.6±4.0	20-40
Hb (g/dL)	10.1±1.3	5-13.9
Hematocrit (%)	35±4.9	20.5-37.3
AST (UI/L)	139.4±251.8	16-2016
ALT (UI/L)	147.9±281.1	31-2269
Duration between admission and injury (hours)	18.0±4.2	1-120
Duration between admission and surgery (hours)	10±4.7	6-36
Hospital stay (days)	5.89±4.2	1-19
Findings of US		
Free fluid	52	89.65
Liver injury	8	29.62
Spleen injury	14	51.85
Renal injury	5	18.51

Fig. 1: Frequency of mode of injury

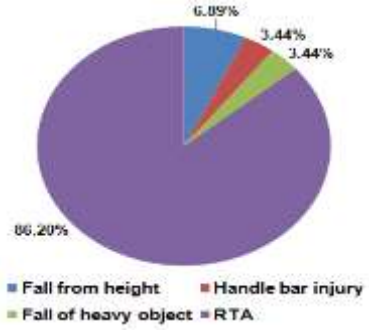
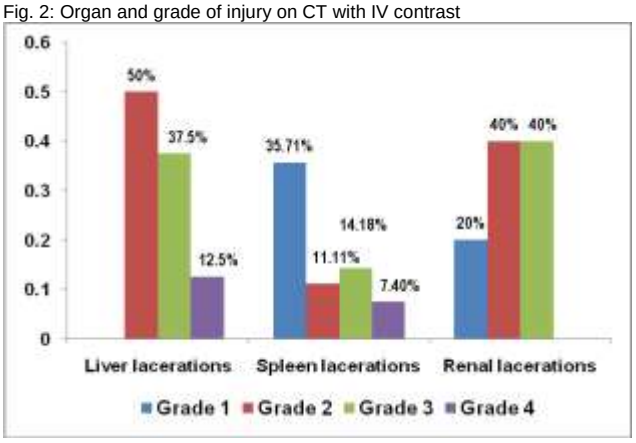


Fig. 2: Organ and grade of injury on CT with IV contrast



DISCUSSION

Particularly in the paediatric age range, blunt trauma abdomen (BTA) is a significant cause of torso trauma.[10] It is one of the main factors contributing to morbidity and mortality in children. The most common causes of blunt abdominal trauma are car accidents, falls from great heights, bicycle handlebar injuries, pedestrian trauma, sports injuries, and child abuse[11,12]. Traffic collisions are the main causes of BTA, which mostly affects the spleen, liver, and kidney. Over the past few decades, non-operative management has evolved into the industry standard for managing children with BTA who are experiencing clinical stability[13]. Due to their anatomically smaller blood vessels, children's blood vessels have a very strong vasoconstrictive reaction[13]. Because of this, the capsule and the damaged blood vessels stop bleeding on their own, regardless of the degree of the injury. Conservative management has an overall success rate of more than 91%, according to recent literature[14,15].

The range of presentation according to ages in our study was 1 year to 13 years, with a mean of 5.34 years. 20 females and 38 males were part of our study. Our research is partially comparable to that of Ameh et al[16], who studied 57 individuals with a mean age of 9 years, 45 males, and 12 females. According to Baiomy et al[17], polytrauma accounted for 22.1% of cases, road traffic accidents (RTAs) for 30.7% of cases, falls from heights for 21.4% of cases, and crush injuries for 10.7% of cases. In our study, the majority of patients were 50(86.2%) injured in automobile accidents. Other injury types included fall from height in 4(6.9%), handle bar injuries 2(3.4%), and falls of heavy objects 2(3.4%). Our study's high rate of traffic accidents is caused by drivers' negligence and poor road conditions, as well as unattended kids riding motorcycles aimlessly.

Wisner et al[18] looked at a total of 605 children who had solid organ injuries and discovered that 49% of them had spleen injuries, 47% had liver injuries, and 24% had kidney injuries. On the other hand, our study discovered that the most often wounded organ demonstrated by CT abdomen with IV contrast was spleen in 51.85% of patients, followed by injury of the liver 29.62% and kidney in 18.51%. According to another study by Coley et al[19], only 32 of the 107 patients with abdominal trauma had CT-documented injuries, and FAST only found free fluid in 12 of the patients.

Ten cases were missed by FAST because they had solid organ damage but no free fluid. In our study, all patients underwent FAST testing, which identified free fluid collection in 52 (89.65%) of the cases. It also identified 8 cases of liver injuries, 14 cases of splenic injuries, and 5 cases of renal injuries. The US is 56-97% sensitive in detecting hemoperitoneum[20]. The US imaging value for determining damage to other organs and the retroperitoneum is lower. Focused assessment using sonography in trauma (FAST) was determined by Er et al. to have a sensitivity of 50% and a specificity of 85% for identifying solid organ injury or free fluid[21].

According to the literature, the prevalence of surgical therapy ranges from 8 to 31% and the prevalence of conservative treatment is from 70 to 92%[22]. Recent investigations have found that the surgery ratio is frequently low. Surgery was found to be 8.7% prevalent in Henderson et al study.[18] In the Rogers et al. trial, only 10% of patients with Grade IV injuries underwent surgery, while the other 80% received conservative care.[23] Seventeen (43.9%) of the patients in our research continued to be unstable and required surgery. Forty one patients were continued on conservative care. Nine patients underwent surgery after 24 hours, while eight patients had operations within 24 hours. The percentage of operated patients was very high in our study, and only 56.1% of patients received non-operative care. This is the result of delayed presentation and a lack of paediatric critical care monitoring and availability. The hospital stay duration in our study ranged from 1 to 19 days, with a mean of 5.89 days. A research by Fodor et al[24] found that the mean hospital stay was 14 days, with a range of 0 to 382.

Although the literature is full of favors in respect of non operative management of blunt trauma abdomen with solid organ injury but timely presentation, prompt resuscitation, CT with intravenous contrast and intensive care monitoring are the mandatory prerequisites of such a management. If such facilities are insufficient, patients should be shifted to other centres with high care environment. The high rate of operative cases in our study is due to delayed presentation, inadequate investigations and lack of intensive care monitoring.

CONCLUSION

Paediatric blunt abdominal injuries are still quite common in our neighborhoods and much work needs to be done to reduce this prevalence. Initial care should focus on oxygenating and perfusing essential organs in accordance with ATLS principles. Since children's physiological needs differ from adults, aggressive fluid resuscitation should commence as early as possible. An inadequate response to fluid resuscitation is a sign that blood transfusion is mandatory and determining the source of the bleeding is necessary. It is necessary to measure serum lactate, base excess, and haemoglobin. A laparotomy will eventually be performed on all unstable patients. CT abdomen with IV contrast and intensive care unit for close monitoring are essential prerequisites for conservative management of solid organ injury in blunt trauma abdomen.

Conflict of interest: Nil

REFERENCES

1. Centers for Disease Control and Prevention. National Center for Health Statistics. Leading causes of death and numbers of deaths, by age: United States, 1980 and 2016.
2. Leeper CM, Nasr I, Koff A, et al. Implementation of clinical effectiveness guidelines for solid organ injury after trauma: 10-year experience at a level 1 pediatric trauma center. J Pediatr Surg 2018; 53:775-9.
3. Gaines BA. Intra-abdominal solid organ injury in children: diagnosis and treatment. J Trauma 2009; 67:S135-9.
4. Streck CJ Jr, Jewett BM, Wahlquist AH, et al. Evaluation for intra-abdominal injury in children after blunt torso trauma: can we reduce unnecessary abdominal computed tomography by utilizing a clinical prediction model? J Trauma Acute Care Surg 2012;73:371-76.
5. Miller M, Perlick C. Pediatric solid organ injury management: the role of initial hematocrit in LEAN times. J Emerg Crit Care Med 2019;3:39.
6. Gaines BA. Intra-abdominal solid organ injury in children: diagnosis and treatment. J Trauma 2009; 67(2): 135-9.
7. Loveland JA, Boffard KD. Damage control in the abdomen and beyond. Br J Surg 2004; 91: 1095-1101.
8. Pitcher RD, Wilde JCM, Douglas TS, Van AsAB. The use of the statscan digital X-ray unit in paediatric polytrauma. Pediatr Radiol 2009;39: 433-7.
9. McVay MR, Kokoska ER, Jackson RJ, Smith SD. Throwing out the 'grade' book: management of isolated spleen and liver injury based on hemodynamic status. J Pediatr Surg 2008; 43:1072-6.
10. Djordjevic I, Slavkovic A, Marjanovic Z, andZivanovic D. Blunt trauma in paediatric patients – experience from a small centre. West Indian Med J 2015; 64(2):126-30.
11. Howard A, McKeag AM, Rothman L, Comeau JL, Monk B, German A. Ejections of young children inmotor vehicle crashes. J Trauma 2003; 55:126-9.
12. Holmes JF, Sokolove PE, Brant WE, Palchak MJ, Vance CW, Owings JT, et al. Identification of children with intra-abdominal injuries after blunt trauma. Ann Emerg Med 2002; 39:500-509.
13. Tiwari C, Shah H, Jayaswal S, Waghmare M, Khedkar K, Dwivedi P. Conservative management of blunt abdominal trauma with solid organ injury in the paediatric age group: our experience. IJTEP 2016;8:215-9.
14. Velmahos GC, Zacharias N, Emhoff TA, Feeney JM, Hurst JM, Crookes BA, et al. Management of themost severely injured spleen. Arch Surg 2010;145:456-60.
15. Harbrecht BG, Ko SH, Watson GA, Forsythe RM, Rosengart MR, Peitzman AB. Angiography for blunt splenic trauma does not improve success rate of non-operative management. J Trauma 2007; 63:44-9.
16. Ameh EA, Chirdan LB, Nmadu PT. Blunt abdominal trauma in children: epidemiology, management, and management problems in a developing country. Pediatr Surg Int 2000; 16(7): 505-9.
17. Baiomy M, El-Ahmady R, Ahmed D, Mohammed M, Shokry S. A comparative study between conservative and early surgical intervention of solid organs injury after blunt abdominal trauma in paediatrics. Ain Shams Medical J 2022; 73(1): 103-14.
18. Wisner DH, Kuppermann N, Cooper A, Menaker J, EhrlichP, Kooistra J, et al. Management of Children with solidorgan injuries after blunt torso trauma. J Trauma Acute Care Surg 2015; 79: 206-14.
19. Coley BD, Mutabagani KH, Martin LC et al. Focused abdominal sonography for trauma (FAST) in children with blunt abdominal trauma. J Trauma 2000;48:902-6.
20. Holmes JF, Gladman A, Chang CH. Performance of abdominal ultrasonography in pediatric blunt trauma patients: a meta-analysis. J Pediatr Surg 2007; 42: 1588-94.
21. Scaife ER, Rollins MD, Barnhart DC, Downey EC, Black RE, Meyers RL, et al. The role of focused abdominal sonographyfor trauma (FAST) in pediatric trauma evaluation. J Ped Surg 2013; 48: 1377-83.
22. Balcioglu ME, Boleken ME, Cevik M, Savas M, Boyacı FN. Blunt renal trauma in children: a retrospective analysisof 41 cases. Ulus Travma Acil Cerrahi Derg 2014; 20(2):132-5.
23. Rogers CG, Knight V, MacUra KJ, Ziegfeld S, Paidas CN, Mathews RI. High-grade renal injuries in children is conservativemanagement possible? Urology 2004; 64: 574-9.
24. Fodor M, Primavesi F, Morell-Hofert D, Haselbacher M, Braunwarth E, Cardini B, Stättner S. Non-operative management of blunt hepatic and splenic injuries–practical aspects and value of radiological scoring systems. Eur Surg 2018; 50(6): 285-98.