Original Article
Received on 20.09.2016, **Accepted on** 12.10.2016

Indian Journal of Trauma and Emergency Pediatrics
Volume 8 Number 3, September - December 2016
DOI: http://dx.doi.org/10.21088/ijtep.2348.9987.8316.6

Conservative Management of Blunt Abdominal Trauma with Solid Organ Injury in the Paediatric Age Group: Our Experience

Charu Tiwari*, Hemanshi Shah, Shalika Jayaswal***, Mukta Waghmare*, Kiran Khedkar*, Pankaj Dwivedi***

Abstract

Background: In paediatric age-group, blunt abdominal trauma is more common and associated with multisystem involvement. Missed or delayed diagnosis can be fatal. Conservative management has been the gold standard for management of solid organ injury in clinically stable paediatric patients. *Materials and Methods:* Twenty-four patients less than 12 year age who were admitted between August 2012 and July 2016 with solid organ injury following Blunt Abdominal Trauma were analyzed on the basis of age, sex, mode of trauma, presenting symptoms and signs, investigation findings, organ involved, grade of injury, management and outcome. *Results:* The average age at presentation was 6.6 years. There were 17 males (70.8%) and 7 females (29.16%). Road traffic accident was the most common mode of injury. Eight patients (40%) had liver trauma of which seven had trauma of grade III-IV. Seven patients (35%) had splenic trauma of which six had trauma of grade II-IV. One patient had splenic artery pseudoaneurysm with multiple collaterals associated with traumatic pancreatitis. She was managed by DSA and splenic artery coiling. Eight patients (40%) had renal trauma – three had grade II trauma, one had grade I and one had grade V trauma. Three patients had urinary extravasation requiring USG guided nephrostomy drain to relieve abdominal distention. All had underlying occult urinary obstruction and underwent interval Anderson-Hynes dismembered pyeloplasty for the obstruction. Three patients had injuries involving 2 organs. Three patients had pancreatic injury. All patients had ileus secondary to haemoperitoneum for 48 to 72 hours. The haemoperitoneum resolved completely in all patients on USG by 3 to 5 days. All patients were conservatively managed. Six patients required image guided intervention. Two patients required ERCP and three patients underwent ultrasound-guided pigtail insertion to relieve the urinoma. One patient required DSA with coiling of splenic artery pseudoaneurysm. All patients responded successfully to conservative management. There was no mortality in this study. *Conclusion:* Conservative management of solid organ injuries is an accepted mode of management of BAT in children with good outcome and fewer complications.

Keywords: Solid Organ Trauma; Blunt Abdominal Trauma; Paediatric Age Group.

Introduction

Trauma is the highest cause of morbidity and mortality in the paediatric age group [1, 2, 3]. Missed or delayed diagnoses may lead to a fatal outcome [5]. Blunt trauma is commoner than penetrating trauma and associated with multisystem involvement in children due to their small size [1, 4]. Spleen (60%) is the most commonly injured organ in Blunt Abdominal Trauma (BAT) followed by liver, kidneys and less frequently small bowel and bladder [5]. Conservative management of solid organ injury has been the gold standard for management of clinically stable paediatric patients.

Materials and Methods

Twenty-four patients less than 12 year age were admitted between August 2012 and July 2016 with

Author Affiliation: *Registrar, **Professor & Head, ***Associate Professor, Dept of Paediatric Surgery, TNMC & BYL Nair Hospital, Mumbai Central, Mumbai, Maharashtra. India- 400008.

Reprint Request: Hemanshi Shah, Professor & Head, Dept of Paediatric Surgery, TNMC & BYL Nair Hospital, Mumbai Central, Mumbai, Maharashtra. India- 400008.
E-mail: hemanshisshah@gmail.com

solid organ injury following Blunt Abdominal Trauma (BAT). After initial stabilization, X-ray abdomen erect, abdominal ultrasound and CECT abdomen was done. Patients with hollow viscus injury underwent emergency exploration and were excluded from the study. Associated injuries like fractures, head injuries and thoracic trauma were managed accordingly. Patients with solid organ trauma were managed conservatively with strict monitoring of pulse rate, blood pressure, urine output and per abdomen examination to look for increasing girth, tenderness and guarding.

Blood transfusion was administered if necessary. Ultrasound abdomen was repeated every 72 hours or as indicated. All patients with solid organ injuries were analyzed on the basis of age, sex, mode of trauma, presenting symptoms and signs, investigation findings, organ involved, grade of injury, management and outcome.

Results

Data of twenty-four patients with solid organ injury secondary to BAT from August 2012 to July 2016 was analyzed. The average age of presentation was 6.6 years; the range being 1 year to 12 years. There were 17 males (70.8%) and 7 females (29.16%). Road traffic accident was the most common mode of injury seen in 14 patients (58.33%), followed by fall from height in 7 patients (29.16%). Three patients sustained BAT due to minor fall while playing.

The most common presenting complaint was blunt trauma accompanied by abdominal pain in all patients (100%) and abdominal distention in 3 patients (15%). Tachycardia was present in all patients (100%) while hypotension was recorded in 4 patients (20%). All were stabilized after administration of crystalloids and colloids. Respiratory distress was present only in two patients.

After initial stabilization, an erect X-Ray chest and abdomen was done to rule out pneumothorax and pneumoperitoneum. This was followed by Ultrasound abdomen and CECT abdomen. The solid organ injury was graded on CECT. Eight patients had liver trauma (40%), seven had splenic trauma (35%), eight had renal trauma (40%), three had pancreatic trauma and one patient had splenic artery pseudoaneurysm following traumatic pancreatitis. Three patients had injuries involving 2 organs.

All patients had ileus secondary to haemoperitoneum for 48 to 72 hours. The haemoperitoneum resolved completely in all patients on USG by 3 to 5 days. Ultrasound before discharge showed no abnormalities in all patients.

Seven patients had liver trauma of grade III-IV and one patient had grade I liver trauma (Figure 1). Two patients with grade IV liver trauma had hypotension at admission which settled by crystalloids and colloids administration. Both had gross haemoperitoneum on abdominal ultrasound. One patient with grade IV injury required abdominal drain insertion for persistent bile leak into the peritoneal cavity. He was managed by ERCP with sphincterotomy and stenting of the injured left hepatic duct.

Six patients had splenic trauma of grade II, III and IV. Two patients with grade IV splenic trauma were hypotensive at admission and were administered crystalloids and colloids. Both had moderate haemoperitoneum. One patient had history of blunt trauma followed by traumatic pancreatitis. CECT revealed features of pancreatitis and splenic artery pseudoaneurysm with multiple collaterals. She was managed by DSA and splenic artery coiling.

Three patients had Grade II renal trauma with perinephric haematoma and one patient had grade I renal trauma. One patient had a Grade V renal injury with complete devascularization of right kidney with retroperitoneal haematoma and normally functioning opposite kidney. The CECT after 48 hours showed organized hematoma. Three patients presented with urinary extravasation on CECT (Figure 2) requiring USG guided nephrostomy drain to relieve abdominal distention. All had underlying occult urinary obstruction and underwent interval Anderson-Hynes dismembered pyeloplasty for the obstruction.

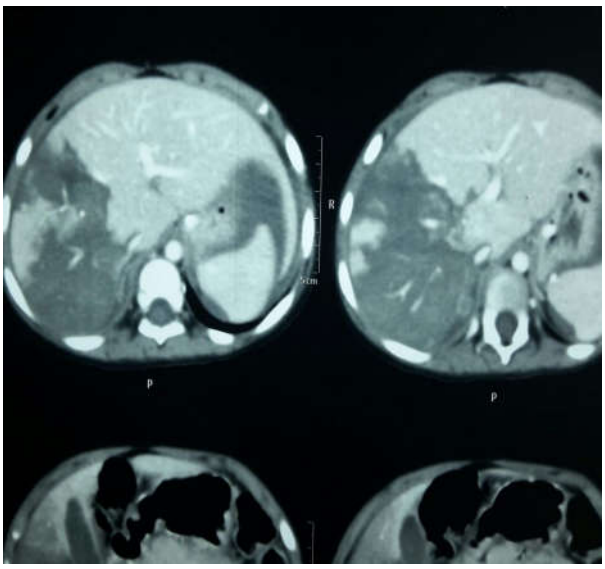

Fig. 1: CECT abdomen of a patient showing grade IV liver trauma

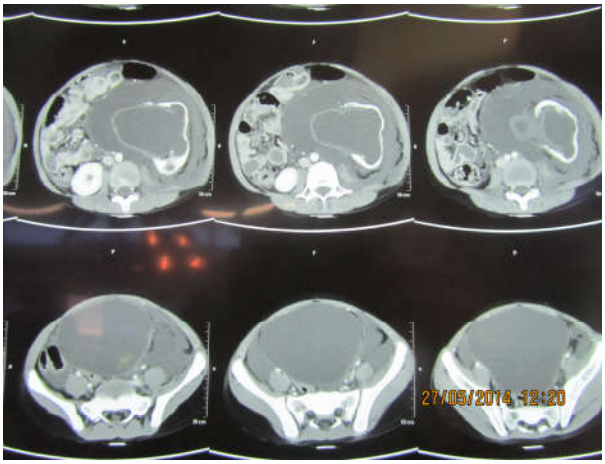

Fig. 2: CECT abdomen of a patient showing urinary extravasation with a tear in capsule of right kidney

Three patients had pancreatic injury. One had pancreatic contusion and one had features of pancreatitis with peripancreatic collection. Both were managed conservatively. One patient had traumatic transection of the pancreatic duct. He was managed successfully by ERCP and stenting of the pancreatic duct.

Five patients required image guided intervention. Two patients required ERCP and three patients underwent ultrasound-guided pigtail insertion to relieve the urinoma. One patient required DSA with coiling of splenic artery pseudoaneurysm. All patients responded successfully to conservative management. There was no mortality in this study.

Discussion

Blunt abdominal trauma (BAT) remains a major cause of torso trauma especially in the paediatric population [5]. It is the leading cause of morbidity and mortality in children [5]. Blunt abdominal trauma is usually associated with a traffic accident; falling from a height, bicycle handlebar injuries, pedestrians' motor vehicle violations, injuries in contact sports or child abuse [5, 6, 7, 8]. Road traffic accidents are the leading causes of blunt abdominal trauma causing injuries predominantly to the spleen, liver and kidney [5].

In the past few decades, non-operative management has emerged as the gold standard for the management of children with blunt abdominal trauma who are clinically stable [5]. Anatomically, children have smaller blood vessels and a very prominent vasoconstrictive response [5]. As a result, the capsule and the injured vessels stop bleeding spontaneously regardless of the grade of the injury [5]. The overall efficacy rate of conservative management has been reported to be more than 91% in modern literature [5, 12, 13].

Literature review suggests that age and gender are one of the factors determining the cause of trauma [1]. Toddlers and pre-school children are more likely to be injured due to fall from height or by a heavy object falling on them [1]. The children between age groups of 6-12 years often play in the streets and sustain BAT due to road traffic accidents [1]. Trauma is commoner in male children [1]. Differences in behaviour between genders, higher activity levels, greater freedom to play alone and increased involvement in risky sports have been cited as the reasons [1].

Focussed assessment with sonography for trauma (FAST), first introduced by Rozycki, is an investigation in the emergency room for prompt identification of haemoperitoneum in patients with BAT and has high sensitivity and specificity of 95–100% [5, 14]. It is a very helpful investigation in the unstable patient for accurate triage to determine who requires urgent lifesaving laparotomy, the signs of which may be masked because of the altered sensorium of these patients [5, 15].

However, FAST is not a replacement for CT scan. CECT scan is the standard investigation for the evaluation and determining the grades of injuries of solid organ injuries in a haemodynamically stable child [5, 16, 17]. The sensitivity of CECT is 97% and specificity is 98%[5, 18].

Blunt splenic injury is the most common injury associated with blunt pediatric abdominal trauma and can be usually managed with non-operative management in haemodynamically stable children [19]. However, there is controversy regarding the optimum management of severe splenic injury with persistent haemorrhage, extravasation, pseudoan eurysm and rebleeding [19]. Transcatheter arterial embolization (TAE) is a very useful tool for managing the above situation with failure rates reported to be as low as 6.5% by Van der Vlies et al [20, 21,22].

Literature suggests that in case of polytrauma patients with open or blunt abdominal trauma, injuries to the liver are found in 16% of patients [23, 24]. Uncontrolled bleeding is the main cause of liver injury-related death, which is associated with a mortality rate of 54% [23, 25].

In the past, surgical management was the standard procedure for all trauma-related liver injuries, because it was felt that surgery was necessary to control the bleeding and prevent biliary complications [23]. However, the recent few decades have witnessed the

shift of paradigm towards a more non-surgical approach with an improved understanding of the natural course of liver injuries and the development of new interventional radiological techniques [23]. Post-traumatic biliary injuries causing bile leaks and biloma are frequent. Major leaks and bilomas are presently managed by percutaneous drainage followed by ERCP and stenting thereby avoiding laparotomy [26]. Minor leaks respond to percutaneous drainage alone [26].

Kidney is the most common genitourinary organ injured in BAT and is seen in up to 10% of abdominal trauma cases [27, 28]. The diagnosis of renal injury requires a high index of clinical awareness and suspicion [27]. Mechanism of injury, complaints of flank or abdominal pain and physical signs such as abdominal tenderness, ecchymosis, and flank abrasion with haematuria suggest renal injury [27]. However, absence of haematuria on initial urinalysis does not always exclude a serious renal injury [27].

The renal injury is graded on CECT.In about 85% of children, the renal injuries are minor with grade I and II contusions and minor parenchymal lacerations predominating [29]. Traumatic renal artery occlusion is rare, but reported to be 0.05-0.1% in various studies [29]. The management of minor grade of renal trauma is always conservative. However, the management of relatively severe renal injury is controversial, especially in a stable patient [29]. The management options of traumatic renal artery occlusion are immediate surgical revascularization, nephrectomy and non-operative therapy [29, 30]. Urinary extravasation following BAT is often encountered in paediatric patients and is generally managed conservatively [31]. A huge urinoma disproportionate to the magnitude of trauma should alarm the surgeon to look for occult obstruction in the renal tract. Some intervention in the form of urgent image-guided drainage followed by interval definitive surgery for the obstruction is required in such cases [31].

Over the past two decades, blunt pancreatic injuries are being managed non-operatively in haemodynamically stable patients [32]. Small lacerations are treated usually by simple external drainage [32]. ERCP is a diagnostic and therapeutic tool and avoids laparotomy and its complications in patients with pancreatic trauma in higher grades of pancreatic trauma.

Conservative management is thus a favourable option for all stable patients with BAT regardless of grade of solid organ injury [5]. The outcome of such patients has greatly been improved by the use of FAST and CECT [5].

Conclusion

Conservative management of solid organ injuries is an accepted mode of management of BAT in children with good outcome and fewer complications. With this type of management, the morbidity and mortality of paediatric trauma patients has decreased considerably.

References

1. Bhatti KM, Taqi KM, Al-Harthy AZS, Hamid RS, Al-Balushi ZN, Sankhla DK. Paediatric Blunt Torso Trauma - Injury mechanisms, patterns and outcomes among children requiring hospitalisation at the Sultan Qaboos University Hospital, Oman. Sultan Qaboos Univ Med J. 2016 May; 16(2): e210–e216. doi: 10.18295/squmj.2016.16.02.012.
2. Seid T, Ramaiah R, Grabinsky A. Pre-hospital care of pediatric patients with trauma. Int J Crit Illn Inj Sci. 2012;2:114–20. doi: 10.4103/2229-5151.100887.
3. Danesco ER, Miller TR, Spicer RS. Incidence and costs of 1987–1994 childhood injuries: Demographic breakdowns. Pediatrics. 2000; 105:E27. doi: 10.1542/peds.105.2.e27.
4. Inaba AS, Seward PN. An approach to pediatric trauma; Unique anatomic and pathophysiologic aspects of the pediatric patient. Emerg Med Clin North Am. 1991; 9:523–48.
5. Djordjevic I, Slavkovic A, Marjanovic Z, and Zivanovic D. Blunt Trauma in Paediatric Patients – Experience from a Small Centre. West Indian Med J. 2015 Mar; 64(2):126–130.
6. Howard A, McKeag AM, Rothman L, Comeau JL, Monk B, German A. Ejections of young children in motor vehicle crashes. J Trauma. 2003; 55:126–129.
7. 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.
8. Machi JM, Gyuro J, Losek JD. Superman play and pediatric blunt abdominal trauma. J Emerg Med. 1996; 14:327–330.
9. Wegner S, Colletti JE, Wie DW. Pediatric blunt abdominal trauma. Pediatr Clin North Am. 2006; 53:243–256.
10. Tataria M, Nance ML, Holmes JH, Miller CC, Mattix KD, Brown RL, et al. Pediatric blunt abdominal injury: age is irrelevant and delayed operation is not detrimental. J Trauma. 2007; 63:608–611.
11. Rance CH, Singh SJ, Kimble R. Blunt abdominal trauma in children. J Paediatr Child Health. 2000; 36:213–215.

12. Velmahos GC, Zacharias N, Emhoff TA, Feeney JM, Hurst JM, Crookes BA, et al. Management of the most severely injured spleen. Arch Surg. 2010; 145:456–460.
13. 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; 63:44–49.
14. Rozycki GS, Ochsner MG, Jaffin JH, Champion HR. Prospective evaluation of surgeons' use of ultrasound in the evaluation of trauma patients. J Trauma. 1993; 34:516–526.
15. Nielsen K, Ewertsen E, Svendsen B, Hillings JG, Nielsen MB. Focused assessment with sonography for trauma in patients with confirmed liver lesions. A comparison between surgeons trained in FAST and radiologists trained in general abdominal ultrasound. Scand J Surg. 2012; 101:287–291.
16. Fang JF, Wong YC, Lin BC, Hsu YP, Chen MF. Usefulness of multidetector computed tomography for the initial assessment of blunt abdominal trauma patients. World J Surg. 2006; 30:176–182.
17. Abu-Zidan FM, Sheikh M, Jaddallah F, Windsor JA. Blunt abdominal trauma: comparison of ultrasonography and computed tomography. Austral Radiol. 1999; 43:440–443.
18. Hoff WS, Holevar M, Nagy KK, Patterson L, Young JS, Arrillaga A, et al. Eastern Association for the Surgery of Trauma Practice management guidelines for the evaluation of blunt abdominal trauma: the East practice management guidelines work group. J Trauma. 2002; 53:602–615.
19. Hashizume N, Asagiri K, Komatsuzaki N, Fukahori S, Shinji Ishii S, Nobuyuki Saikusa. Blunt splenic injury in a child with situs inversus totalis treated with transcatheter arterial embolization. J Ped Surg Case Reports. 2016 Oct; 23:21-24.
20. Mayglothling, J.A., Haan, J.M., and Scalea, T.M. Blunt splenic injuries in the adolescent trauma population: the role of angiography and embolization. J Emerg Med. 2011; 41:21–28.
21. van der Vlies, C.H., Saltzherr, T.P., Wilde, J.C. et al. The failure rate of nonoperative management in children with splenic or liver injury with contrast blush on computed tomography: a systematic review. J Pediatr Surg. 2010; 45:1044–1049.
22. Tiwari C, Sandlas G, Jayaswal S, Shah H. Idiopathic pancreatitis with splenic artery pseudoaneurysm in a child: a rare presentation. Int Surg J. 2015 Aug; 2(#):392-395.
23. Slotta JE, Justinger C, Kollmar O, Kollmar C, Schäfer T, Schilling MK. Liver injury following blunt abdominal trauma: a new mechanism-driven classification. Surg Today. 2014; 44(2):241–246. doi: 10.1007/s00595-013-0515-7.
24. Leenen LP. Abdominal trauma: from operative to nonoperative management. Injury. 2009; 40(Suppl 4):S62–S68. doi: 10.1016/j.injury.2009.10.038.
25. Asensio JA, Demetriades D, Chahwan S, Gomez H, Hanpeter D, Velmahos G, et al. Approach to the management of complex hepatic injuries. J Trauma. 2000; 48:66–69. doi: 10.1097/00005373-200001000-00011.
26. Hommes M, Kazemier G, Schep NW, Kuipers EJ, Schipper IB. Management of biliary complications following damage control surgery for liver trauma. Eur J Trauma Emerg Surg. 2013 Oct; 39(5):511-6. doi: 10.1007/s00068-013-0304-4. Epub 2013 Jun 6.
27. Kumar BN, Akulwar AV. Renal artery injury in paediatric blunt abdominal trauma. Med J Armed Forces India. 2015 Jul; 71(Suppl 1): S261–S263. doi: 10.1016/j.mjafi.2014.04.019.
28. Santucci R.A., Doumanian L.R. Upper urinary tract trauma. In: Wein A.J., Kavoussi L.R., Novick A.C., Partin A.W., Peters C.A., editors. Campbell-Walsh Urology. 10th ed. Elsevier Saunders; Philadelphia: 2012. p.1169–1189.
29. Tiwari C, Shah H, Kumbhar V, Sandlas G. Traumatic Renal Artery Thrombosis in a Child - A Case Report. SEAJCRR Jan-Feb 5(1): 2174-2181.
30. Fraser JD, Aguayo P, Ostlie DJ, St Peter SD. Review of the evidence on the management of blunt renal trauma in paediartic patients. Pediatr Surg Int 2009; 25:125-132.
31. Bothra J, Sandlas G, Jayaswal S, Shah H. Post traumatic urinary extravasation in occult urinary obstruction: Report of three cases. Ped Urol Case Rep 2016; 3(1):12-16.
32. Zala A., Gaszynski R., Punch G. Blunt trauma pancreatic duct injury managed by non-operative technique, a case study and literature review. Trauma Case Reports 2015; 1:13–16.