



ANALYSIS OF INJURY PATTERNS AND OUTCOMES OF PATIENTS WITH BLUNT ABDOMINAL TRAUMA – A TERTIARY CARE CENTRE EXPERIENCE

General Surgery

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ABSTRACT

OBJECTIVE: Blunt abdominal trauma is one of the leading causes of morbidity and mortality in all age groups. Hemodynamic status of the patients and abdominal imaging play a major role in deciding the mode of management. The aim of this study is to analyse the clinical presentations, management and factors predicting outcome in patients with blunt injury abdomen presenting to a tertiary care centre in South India.

METHODS: Combined retrospective and prospective analysis of prospectively maintained institutional database was performed. Data of all patients admitted with blunt abdominal trauma was analysed with regards to baseline characteristics, management and outcomes.

RESULTS: One hundred and ten patients were admitted with blunt abdominal trauma in our institution from July 2014 to June 2015. Ninety-eight patients (89.1%) were male. The most common mode of injury was road traffic accidents (75.5%). Most common organs injured were spleen (28.2%), liver (22.7%) and small bowel (18.2%). Majority of the patients (73.6%) underwent operative management. Success rate of non-operative management was 89.7%. Overall mortality rate was 20.9%.

CONCLUSION: Blunt abdominal trauma is associated with significant morbidity and mortality. Computed tomography is the imaging modality of choice in hemodynamically stable patients to decide management. Non-operative management is successful in carefully selected cases. Old age, delayed presentation, presence of peritonitis, hemodynamic instability, and need for postoperative mechanical ventilation are associated with increased mortality.

KEYWORDS

Blunt abdominal trauma, Computed tomography, Non-operative management, Mortality

INTRODUCTION

Blunt abdominal trauma is one of the leading causes of morbidity and mortality in developing countries.¹ Road traffic accidents are responsible for majority of the cases followed by falls and recreational or industrial accidents.² The clinical findings can be subtle. Identification of serious intra-abdominal pathology is mostly challenging as most of the injuries may not manifest in the initial assessment and resuscitation period.³

Initial assessment in emergency department is in accordance with ATLS (Advanced Trauma Life Support) protocol followed by a detailed secondary survey to look for intra-abdominal pathology. Initial assessment is often difficult and inaccurate due to alteration in the mental status of the patients.⁴ Any patient with hemodynamic instability not responding to aggressive fluid resuscitation must be suspected to have serious intra-abdominal hemorrhage.

The most common organs involved are spleen, liver, kidney, small bowel, and urinary bladder.⁵ Ultrasound (FAST – Focussed assessment with sonography in trauma) is the investigation of choice to identify free intraperitoneal fluid in hemodynamically unstable patients.⁶ It has largely replaced diagnostic peritoneal lavage (DPL) which may be of use in cases when ultrasound is inconclusive.⁷ Contrast enhanced computed tomography (CT) abdomen is the investigation of choice in hemodynamically stable patients. It remains the criterion standard for assessing solid organ injuries. It can determine the source of bleeding and can help in guiding treatment.^{3,4} Diagnostic laparoscopy is useful in selected cases.⁸

Non operative management is currently the standard of care in hemodynamically stable patients with solid organ injuries.⁹ Hemodynamically unstable patients and patients with hollow visceral injuries need exploratory laparotomy and appropriate treatment.

The aim of the present study is to evaluate the clinical presentation, investigational workup, mode of management and outcomes of patients with blunt abdominal trauma presenting to a tertiary care centre in South India.

METHODS

Patient population

This descriptive (retrospective and prospective) study was conducted in the Institute of General Surgery, Madras Medical College, a tertiary referral centre in South India. The study period was between July 2014 and June 2015. All patients admitted with blunt abdominal trauma during the one year period were included in the study. Those with associated head injury, spine and limb injuries were excluded from the study. Data was retrieved from prospectively maintained institutional database.

Patient evaluation and management

All patients presenting with blunt abdominal trauma were admitted in trauma care unit. Demographic data like age, sex, mechanism of trauma and time from the incident to admission were recorded. Patients were evaluated as per ATLS protocol. Vital signs were recorded and hemodynamic status was assessed. Resuscitation was initiated as indicated.

Laboratory investigations including complete blood count, coagulation profile, blood grouping and typing were performed. Specific investigations, namely, ultrasound abdomen, four quadrant aspiration, and CT abdomen were done as necessary. Management protocol (operative vs non-operative) was determined based on the above evaluation. Patients managed non-operatively were managed in high dependency unit. Those who underwent surgery were managed in intensive care unit in the post operative period. Reinterventions were performed as indicated. Outcomes were recorded.

STATISTICAL ANALYSIS

Data collected in the form of epidemiological factors, clinical parameters, imaging findings, mode of management and final outcome of the patients were analysed. Parameters were compared using chi-square test and student t-test. Statistical analysis was done using SPSS software and a p-value of less than 0.05 was considered statistically significant.

RESULTS

One hundred and ten patients with blunt abdominal trauma were

managed in our institution during the one year study period. Road traffic accidents contributed to the majority of cases (75.5%). Fall from height (23.6%) and assault (0.9%) constituted the remaining cases. Ninety-eight patients (89.1%) were male. Mean age of the patients was 33 years. The most common age group affected was 26-30 years, followed by 16-20 years. (see figure 1)

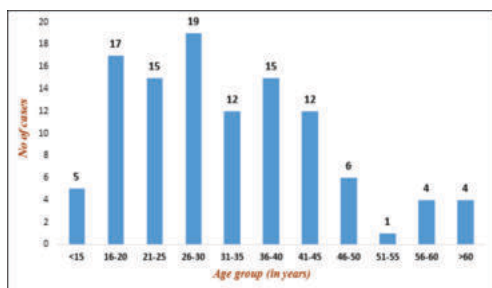


Figure 1: Age distribution

Spleen was the most common organ injured contributing to 28.2% of the cases, followed by liver (22.7%), small bowel (18.2%), urinary bladder (12.7%), and kidney (10%). Retroperitoneal hematoma was present in 10 cases (9.1%). Mesentery, colon, rectum, pancreas, stomach, diaphragm, duodenum, urethra and uterus were injured in minority of cases. In females, bladder was the most common injured organ (41.7%), followed by the liver (33.3%) and spleen (25%). Overall, 9 cases (8.2%) of multiple organ injuries were recorded. (see figure 2)

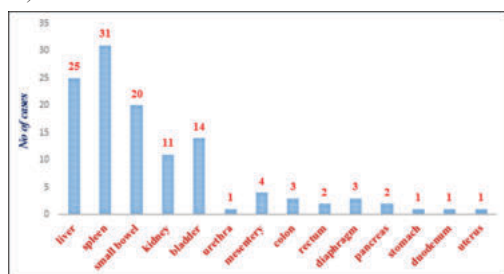


Figure 2: Organs injured

FAST was performed in all cases as the first investigation and was positive in 81 cases (74%). All patients with positive FAST were subjected to four quadrant aspiration which was positive in 85% of cases. Out of 79 patients for whom CT was done, 69 patients (87%) were found to have a positive finding. Small bowel injuries constituted the majority (60%) of cases missed by CT scan.

Non-operative management was adopted in 29 cases (26.4%). These included 13 patients with liver injury, 7 patients with splenic injury, 6 patients with renal injury, and 3 patients with combined liver and splenic injury. Success rate of non-operative management was 89.7%. Rest of the cases (73.6%) underwent operative management according to the grade of injury.

Overall mortality rate was 20.9%. Majority of deaths (60.9%) occurred between the 2nd day and 7th day following trauma (range: 8 hours to 18 days). There were no deaths among patients managed non-operatively. Hollow visceral injuries contributed to the maximum cases of deaths (47.8%). (see figure 3)

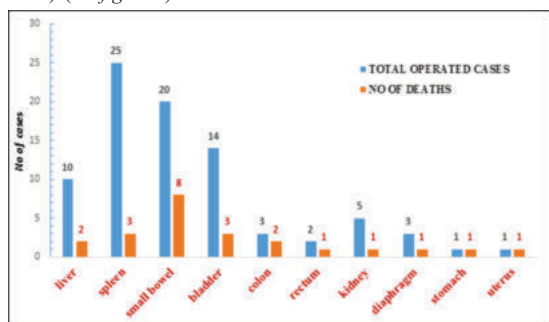


Figure 3: Injured organ-specific mortality

The risk factors associated with mortality were age, delayed presentation, shock at presentation, presence of peritonitis, admission to surgery interval, duration of surgery, transfusion requirement and need for postoperative mechanical ventilation. (see table 1)

Table 1: Risk factors for mortality

Risk Factors	No. of cases who survived	No. of cases who died	p value
Age < 30 years	48	08	0.04
31-50 years	36	09	
> 50 years	03	06	
Sex Male	79	19	0.26
Female	08	04	
Trauma to admission interval < 6 hours	15	03	0.02
6-12 hours	49	07	
>12 hours	23	13	
Shock on admission Yes	38	18	0.003
No	49	05	
Peritonitis Yes	26	16	0.008
No	61	07	
Associated Chest injury Yes	18	02	0.18
No	69	21	
Admission to surgery interval < 6 hours	17	02	0.005
6-12 hours	33	09	
> 12 hours	11	12	
Duration of surgery < 2 hours	44	10	0.01
> 2 hours	17	13	
Blood transfusion < 2 units	60	08	0.005
2-4 units	22	10	
> 4 units	05	05	
Postop mechanical ventilation Yes	11	09	0.04
No	50	14	

DISCUSSION

Blunt injury abdomen is a major cause of emergency hospital admissions and surgeries. This study was conducted to determine the epidemiology of blunt injury abdomen, the role of imaging modalities in the diagnosis, analyse the mode of management and identify various factors determining mortality in patients with blunt trauma abdomen managed in our institution.

A total of 110 patients were included in the study, out of which 98 were male and 12 were female (male to female ratio - 8.2:1). This male predominance is similar to other studies. This is attributable to driving of vehicles, recreational activities, aggressive behavior, and influence of alcohol, which are seen mostly among men.⁵

Most of the affected individuals belonged to adolescence and early adulthood period with majority between 16 – 40 years of age. The peak was in the age group 26 – 30 years, followed by 16 – 20 years. This is attributable to rash driving, driving under liquor influence and failure to use safety mechanisms like helmets, seat belts, etc.¹⁰

The most common mode of injury was road traffic accidents (75.5%) followed by fall from height (23.6%) and assault (0.9%). Increase in vehicular traffic and ignorance of safety precautions are related to majority of the road traffic accidents.¹¹

All the patients were managed according to ATLS protocol and abdomen was carefully evaluated during secondary survey. Hemodynamic status was assessed based on pulse rate, blood pressure, temperature, and urine output. Most of the patients (71.8%) were hemodynamically stable. Peritonitis was noted in 38.2% of cases. Complete blood count, liver function tests, renal function tests, serum amylase, blood grouping and typing were done as necessary.

Abdominal radiography may provide indirect evidence of hollow viscus injury by showing air or gas in the peritoneum, but it lacks sensitivity and specificity.¹ In our study, chest x-ray and abdomen x-ray were done whenever there was clinical suspicion of hollow visceral injury, and there was evidence of pneumoperitoneum in only 40% of bowel injuries.

All patients were subjected to FAST examination to look for free fluid abdomen and was found to be positive in 74% of cases. The most common injuries missed were those of the hollow viscera. All patients with positive FAST were subjected to four quadrant aspiration to look for unclotted blood or intestinal contents. It was positive in 85% of those cases. DPL was not included in this study as it is not done routinely in our hospital.

Those who were hemodynamically stable were subjected to contrast enhanced CT scan of the abdomen and it showed a positive finding in 87% of them. The injuries that were ultimately missed on a CT were predominantly those of hollow viscera. AAST (American Association for the Surgery of Trauma) grading was done based on CT imaging.¹²

The most frequently injured organs in blunt abdominal trauma are liver, spleen, intestine, kidney, pancreas and urinary bladder.¹³ In our study, the most common organ injured was the spleen accounting for 28.2% of the cases, followed by liver (22.7%), small bowel (18.2%), urinary bladder (12.7%), and kidney (10%). Colon, rectum, mesentery, pancreas, diaphragm, stomach, and duodenum were injured in the remaining cases. A case of non-gravid uterine injury was recorded, which is very rare and only few case reports have been reported of such an occurrence.¹⁴ 10 patients (9.1%) had retroperitoneal hematomas combined with other visceral injuries. Nine patients (8.2%) had multiple organ injuries (liver and spleen: 3 cases, liver and kidney: 3 cases, spleen and kidney: 2 cases, uterus and bladder: 1 case).

The golden period of trauma, which denotes the initial hours after injury, is a critical period determining the outcome of patients with blunt abdominal trauma. Timely referral and management can significantly decrease the morbidity and mortality. Based on the hemodynamic status, the organ injured and the severity of injury, patients are treated by either non-operative or operative management.⁹ Hemodynamically stable patients with solid organ injuries are treated with non-operative management. Patients are closely observed in the intensive care or high dependency unit with serial monitoring of vital signs, abdominal examination, laboratory investigations and imaging.^{15,16}

In our study, non-operative management was followed in 26.4% of all cases, and 42% of solid organ injuries. This included 64% of liver injuries, 32.3% of splenic injuries and 54.5% of renal injuries. Angioembolisation was not performed in any of the cases in our study due to lack of availability of emergency intervention radiology facility. The success rate of non-operative management was 89.7%, similar to that seen in many other studies.^{2,17,18} Two cases of splenic injury and one case of liver injury failed non-operative management, and underwent subsequent operative intervention. There was no mortality in this group of patients.

All hemodynamically unstable patients, those exhibiting signs of peritonitis or sepsis, those with visceral injuries as suggested on imaging and aspiration, and those who failed non-operative management underwent exploratory laparotomy. The mean time taken from the accident to initiation of surgery was 9.9 hours; with the shortest being 2 hours and the longest being 72 hours following the incident. The delay was mainly due to delayed referral to our centre from other institutions.

Splenic injuries were managed by emergency open splenectomy. Splenorrhaphy is not routinely performed in our institution. Two patients developed localized subdiaphragmatic collection which was managed with percutaneous catheter drainage. The mortality due to splenic injury was 9.7%.

Liver injuries were managed by perihepatic packing in majority of cases and one patient required hepatorrhaphy in addition. No active bleeding was found in 2 cases which required only topical hemostatic application. Abdominal packs were removed within 36-48 hours in all the cases. The overall mortality due to liver injury was 8%.

Small bowel injuries along with mesenteric injuries were frequently missed by imaging.^{19,20} They were managed by primary repair or

resection and anastomosis or resection and exteriorization based on the severity of injury and the degree of contamination. The mortality rate for small bowel injuries was high (40%). This was due to their late presentation, injuries missed on imaging, and onset of peritonitis and sepsis.

Colorectal injuries were diagnosed relatively late and were managed by diversion stoma (for colonic injury) or Hartmann's procedure (for rectal injury). The mortality rate was high (60%) due to onset of fecal peritonitis.

Urinary tract injuries were common, attributing to 23.6% of the cases. Bladder was most commonly affected followed by the kidneys. Bladder injury was associated with pelvic fracture and pelvic hematoma in more than half of the cases. Intraperitoneal rupture (85.7%) was more common. These were managed by repair of the bladder rent with suprapubic cystostomy. Five patients with grade-V renal injury were managed with nephrectomy. A case of urethral injury was managed by suprapubic cystostomy. The overall mortality rate for urinary tract injuries was 15.4%.

Three cases of diaphragmatic injuries were managed with primary repair using non-absorbable suture material. A case of gastric injury was managed by primary suture repair. A case of duodenal injury (third part) was managed by primary closure of perforation, tube duodenostomy, gastrojejunostomy, jejunojejunostomy and feeding jejunostomy. The patient recovered well.

A case of grade-III pancreatic injury was managed by spleen preserving distal pancreatectomy. Another case was managed by Roux-en-Y pancreatojejunostomy to the distal transected stump and suture closure of proximal stump. Both patients developed postoperative pancreatic fistula which resolved with conservative management.^{21,22}

The case of uterine injury was associated with pelvic fracture and bladder injury. At laparotomy, the uterus was found to be transected at the internal os level and was hence managed with subtotal hysterectomy and the bladder injury was repaired. The patient died due to coagulopathy and sepsis.

The overall postoperative morbidity was 30%, similar to other studies.^{18,23} Wound infection was the most common complication seen in 53.5% of these cases. Other complications included wound dehiscence, intraabdominal collection, abscess formation and pancreatic fistula. Four patients required reinterventions to manage these complications.

The overall mortality was 20.9%. The mortality rate among cases who underwent operative management was 27.4%. This is significantly high compared to other studies.^{11,17,18} This may be due to delayed presentation and higher grade of injuries in our study. The factors associated with significantly increased mortality in our study were older age, shock at presentation, features of peritonitis, delay in surgery, prolonged duration of surgery, increased blood product requirement, and need for postoperative mechanical ventilation.^{2,10,11}

CONCLUSION

Blunt trauma abdomen is associated with significantly high morbidity and mortality. Spleen, liver, small bowel and urinary tract are the most common organs injured. Non-operative management is successful in the majority of hemodynamically stable cases with solid organ injuries. The factors associated with increased mortality are older age, shock at presentation, features of peritonitis, delayed presentation, increased blood product requirement, and need for mechanical ventilation. Rapid diagnosis, timely referral, close monitoring, early decision on the mode of management and excellent postoperative care can help to improve the outcomes in these patients.

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REFERENCES

1. van der Vlies CH, Olthoff DC, Gaakeer M, Ponsen KJ, van Delden OM, Goslings JC. Changing patterns in diagnostic strategies and the treatment of blunt injury to solid abdominal organs. *Int J Emerg Med.* 2011;4:47
2. Gholipour S, Roozbahany MM, Baharvand P. Spectrum and outcome of blunt trauma abdomen at Sardar Patel Medical College and PBM and Associate Group of Hospitals. *Int J Review Life Sci.* 2014;4(9):31-7

3. Hassan R, Abd Aziz A. Computed Tomography (CT) Imaging of Injuries from Blunt Abdominal Trauma: A Pictorial Essay. *Malays J Med Sci MJMS*. 2010;17(2):29-39
4. Jansen JO, Yule SR, Loudon MA. Investigation of blunt abdominal trauma. *BMJ*. 2008;336(7650):938-942
5. Ahmed R. Frequency and Pattern of Intra-Abdominal Injuries in Patients with Blunt Abdominal Trauma. *J Trauma Treat*. 2014;03
6. Scalea TM, Rodriguez A, Chiu WC, et al. Focused Assessment with Sonography for Trauma (FAST): results from an international consensus conference. *J Trauma*. 1999;46(3):466-472
7. Whitehouse JS, Weigelt JA. Diagnostic peritoneal lavage: a review of indications, technique, and interpretation. *Scand J Trauma Resusc Emerg Med*. 2009;17:13
8. Justin V, Fingerhut A, Uranues S. Laparoscopy in Blunt Abdominal Trauma: for Whom? When? and Why? *Curr Trauma Rep*. 2017;3(1):43-50
9. Schroeppe TJ, Croce MA. Diagnosis and management of blunt abdominal solid organ injury. *Curr Opin Crit Care*. 2007;13(4):399-404
10. Gad MA, Saber A, Farrag S, Shams ME, Ellabban GM. Incidence, Patterns, and Factors Predicting Mortality of Abdominal Injuries in Trauma Patients. *North Am J Med Sci*. 2012;4(3):129
11. Sisodiya S, Malpani P. A retrospective study of blunt trauma abdomen in a tertiary center in central India: evaluation, management and outcome. *Int Surg J*. 2020;7(8):2696-2701
12. Injury Scoring Scale. The American Association for the Surgery of Trauma. Published August 27, 2009. Accessed April 11, 2022. <https://www.aast.org/resources-detail/injury-scoring-scale>
13. Arumugam S, Al-Hassani A, El-Menyar A, et al. Frequency, causes and pattern of abdominal trauma: A 4-year descriptive analysis. *J Emerg Trauma Shock*. 2015; 8(4): 193-198
14. Kalstone CE, Laros RK. Traumatic Rupture of The Nonpregnant Uterus. *JAMA*. 1969;208(12):2338
15. Stassen NA, Bhullar I, Cheng JD, et al. Nonoperative management of blunt hepatic injury: an Eastern Association for the Surgery of Trauma practice management guideline. *J Trauma Acute Care Surg*. 2012;73(5 Suppl 4):S288-293
16. Stassen NA, Bhullar I, Cheng JD, et al. Selective nonoperative management of blunt splenic injury: an Eastern Association for the Surgery of Trauma practice management guideline. *J Trauma Acute Care Surg*. 2012;73(5 Suppl 4):S294-300
17. Ahmed MHS, Tamgadge LV, Gurav PD, Dalavi SB, Bankar S, Parmar R. Blunt abdominal trauma: the experience in rural India and review of literature. *Int J Res Med Sci*. 2019;8(1):322-326
18. Mehta N, Babu S, Venugopal K. An Experience with Blunt Abdominal Trauma: Evaluation, Management and Outcome. *Clin Pract*. 2014;4(2):599
19. Fakhry SM, Watts DD, Luchette FA, EAST Multi-Institutional Hollow Viscus Injury Research Group. Current diagnostic approaches lack sensitivity in the diagnosis of perforated blunt small bowel injury: analysis from 275,557 trauma admissions from the EAST multi-institutional HVI trial. *J Trauma*. 2003;54(2):295-306
20. Magu S, Agarwal S, Gill RS. Multi Detector Computed Tomography in the Diagnosis of Bowel Injury. *Indian J Surg*. 2012;74(6):445-450
21. Menahem B, Lim C, Lahat E, et al. Conservative and surgical management of pancreatic trauma in adult patients. *Hepatobiliary Surg Nutr*. 2016;5(6):470-477
22. Muthalampet K. Management of pancreatic trauma – A single center experience. *HPB*. 2018;20:S675
23. Sharma MK, Bhargava DA. SPECTRUM AND OUTCOME OF BLUNT ABDOMINAL TRAUMA. *Int J Med Biomed Stud*. 2020;4(1)