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Original Research Article

Prospective observational study of blunt abdominal trauma and hemoperitoneum

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ABSTRACT

Background: The early recognition and appropriate management of solid organ injuries in blunt abdominal trauma are pivotal in improving patient outcomes. The aim of this study was to evaluate the factors affecting outcome of solid organ injury with blunt abdominal trauma and hemoperitoneum.
Methods: A prospective observational study was conducted over a period of two years at a tertiary care centre providing advanced trauma and emergency surgical services in Western Maharashtra. A total of 44 patients presenting with blunt abdominal trauma and radiological or clinical evidence of solid organ injury with hemoperitoneum were included. Demographic characteristics, mechanism of injury, clinical presentation, imaging findings, associated injuries, management strategies, and outcomes were analysed.
Results: Among the 44 patients, the majority (38.6%) were aged 16–30 years, and males constituted 84.1% of the cohort. Road traffic accidents were the most common cause of injury (61.4%). Associated injuries were present in 38.6% of patients. Computed tomography revealed mild intraperitoneal fluid collection in 22.7% of cases. Only 6.8% of patients required operative management, with intraoperative findings showing liver injury in two patients and splenic injury in one patient. The overall mortality rate was 4.5%. Younger age and associated head injury were significantly associated with mortality. Clinical shock at presentation significantly influenced the management approach.
Conclusion: Blunt abdominal trauma with solid organ injury predominantly affects young males and is most commonly caused by road traffic accidents. Mortality is mainly associated with high-grade splenic injury and concomitant head injury. Continuous monitoring of haemoglobin levels and clinical signs of shock is essential for guiding management and predicting outcomes rather than relying solely on the patient’s condition at admissions.

Keywords: Blunt abdominal trauma, Solid organ injury, Hemoperitoneum, Road traffic accidents, Clinical shock, Trauma outcomes

INTRODUCTION

“Between stimulus and response is a space, and in that space lies the last and most sacred of human freedoms- the freedom to choose one's response.” - Dr. Victor E. Frankl.

That choice is our privilege in the trauma bay and its consequences can often be life or death. This is a study on how to refine and optimize that response to best utilize our freedom in blunt abdominal trauma. Blunt abdominal trauma (blunt abdominal trauma) remains a significant cause of morbidity and mortality worldwide, with hemoperitoneum—accumulation of blood within the peritoneal cavity—representing a critical clinical concern due to its association with solid organ injuries sand the potential for rapid hemodynamic deterioration.

The early recognition and appropriate management of solid organ injuries in blunt abdominal trauma are pivotal in improving patient outcomes. As such, the clinical evaluation and management of hemoperitoneum in the setting of blunt trauma have become focal points in trauma care and surgical decision-making.[1,2]

Globally, blunt abdominal trauma accounts for 75–85% of all abdominal trauma, with 60-70% due to road traffic accidents. In India, blunt abdominal trauma constitutes about 20% of trauma-related hospital admissions, with a national mortality rate 10–20%.[3,4] This study is conducted in a tertiary health centre in India with high incidence of trauma.

The aim of this study was to evaluate the factors affecting outcome of solid organ injury with blunt abdominal trauma and hemoperitoneum.

Objectives

The objectives of the study were to study the incidence of operative intervention in patients of blunt abdominal trauma, to study the mortality rates of patients in blunt abdominal trauma, to study the impact of age, haemoglobin levels, shock, and computed tomography (CT) findings on the mortality in blunt abdominal trauma and to study the impact of age, haemoglobin levels, shock, and CT findings on operative intervention in blunt abdominal trauma.

METHODS

This was a prospective observational study, conducted at a tertiary care centre providing advanced trauma and emergency surgical care over a period of two years. Study was approved by the Institutional Ethics Committee (IEC). Patients over five years of age presenting with blunt abdominal trauma, with or without associated injuries or present with ultrasonography (USG) proven hemoperitoneum after taking informed consent were enrolled in this study.

A total of 156 patients of blunt abdominal trauma were screened and exclusion criteria were applied. Patients of penetrating abdominal trauma, or having hollow visceral trauma or without sonographically demonstrated hemoperitoneum were excluded from the study, and the final sample size comprised 44 patients.

After presentation to the emergency department, patients underwent a primary survey followed by clinical examination and relevant radiological investigations. Initial assessments included vital signs, and physical examination of the abdomen. Patients were then evaluated by abdominal USG to detect intra-abdominal fluid. In cases where further detail was needed, non-contrast or contrast enhanced computed tomography (CT) scans were performed. Fluid resuscitation and blood product transfusion were started as clinically indicated under close observation. Patients responding to this with rising blood pressures, settling tachycardia and good urine output were continued on conservative management.

Operative management was indicated for those who were unstable or showed deterioration with falling blood pressure, refractory tachycardia or dropping haemoglobin trends. Such patients were taken up for exploratory laparotomy with principles of damage control surgery as the main aim.

Each patient was followed up for six weeks post-injury, which allowed for adequate observation of both short-term outcomes and complications, including the need for surgical intervention and any mortality events including repeat USG scans to monitor resolution or progression.

Data collection was done prospectively using a standardized proforma that captured comprehensive patient information. This included demographic details, mode and mechanism of injury, clinical findings, imaging results, treatment details (resuscitation measures, surgical procedures), and outcomes. All adverse events, operative findings, postoperative outcomes, and follow-up results were recorded. Data from imaging modalities were compared for diagnostic concordance. The six-week follow-up visits included repeat USG scans and assessment of residual pathology.

The collected data were analysed using statistical package for the social sciences (SPSS) version 20. Descriptive statistics were used to summarize demographic and clinical characteristics. Frequencies and percentages were calculated for categorical variables, while mean and standard deviation were used for continuous variables. Diagnostic modalities were compared using sensitivity and specificity analysis. The outcomes of conservative versus surgical management were analysed for success rates, complications, and mortality. Statistical significance was assessed where applicable, and results were graphically represented to identify trends.

RESULTS

Total 44 patients enrolled in this study. About 17 (38.6%) were aged 16–30 years followed by 14 (31.8%) aged 30–45 years. Blunt abdominal trauma showed a predominantly Male demographic with 37 (84.1%) patients being male. Road traffic accidents (RTAs) were the leading cause 27 (61.4 %) of blunt trauma.

Only a small subset of patients 3 (6.8%) required laparotomy, with intraoperative confirmation of organ injuries. Specifically, 2 patients (4.5 %) had liver injuries and 1 patient (2.3 %) had a splenic injury identified during surgery.

Associated injury present in 17 (38.6%) patients. On CT images, only 10 (22.7%) patients show mild fluid collection. Only 2 deaths of the 44 patients were recorded, showing a 4.5% mortality (Table 1).

Table 2 shows, organ injuries diagnosed on CT and USG show multiple cases of liver, right kidney and splenic injuries diagnosed on CT which were not picked up on initial USG. Organ injury grades: liver injuries were predominantly grade 3 (6/11;54.5%) with few high-grade lesions (one grade 4) (Table 3).

Splenic injuries showed a broader spread: grade 2 (6/18; 33.3%), grade 3 (5/18; 27.8 %), and grade 4 (7/18; 38.9%). Renal injuries were mostly low-grade, though a single grade 5 right-kidney injury occurred. A solitary pancreatic injury was grade 2. Table 4 shows that younger age of the patient and associated head injury significantly associated with death of the patients. Table 5 shows, management plan significantly depend on presence of clinical shock.

Table 1: Distribution of patients according to clinic-social parameter.

Clinico-social parameter		Frequency	Percentage
Age group (years)	5-15	7	15.9
	16-30	17	38.6
	30-45	14	31.8
	45-60	4	9.1
	>60	2	4.5
Gender	Male	37	84.1
	Female	7	15.9
Management plan	Operative	3	6.8
	Non-operative	41	93.2
Volume of fluid in CT findings	Mild free fluid	10	22.7
	Moderate to gross fluid	34	77.3
Outcome	Died	2	4.5
	Discharge	42	95.5

Table 2: Injured organ on Imaging tool.

Injured organ	CT findings		USG findings	
	Frequency	Percentage	Frequency	Percentage
Left kidney	3	8.3	0	0
Liver	11	30.6	4	25.0
Right kidney	3	8.3	3	18.8
Spleen	18	50.0	9	56.3
Pancreas	1	2.8	0	0

Table 3: Distribution of patients according to grade of injury on CT.

CT grade	Grade 1 (%)	Grade 2 (%)	Grade 3 (%)	Grade 4 (%)	Grade 5 (%)
Left kidney	0 (0)	1 (33.3)	2 (66.7)	0 (0)	0 (0)
Liver	1 (9.1)	3 (27.3)	6 (54.5)	1 (9.1)	0 (0)
Right kidney	0 (0)	1 (33.3)	1 (33.3)	0 (0)	1 (33.3)
Spleen	0 (0)	6 (33.3)	5 (27.8)	7 (38.9)	0 (0)
Pancreas	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)

Table 4: Association between clinic-social parameter and outcome.

Clinico-social parameter		Discharge (%)	Death (%)	P value
Age group (years)	5-15	5 (11.9)	2 (100)	0.026
	16-30	17 (40.5)	0 (0)	
	30-45	14 (33.3)	0 (0)	
	45-60	4 (9.5)	0 (0)	
	>60	2 (4.8)	0 (0)	
	Female	6 (14.3)	1 (50)	
Mode of injury	Accidental Injury	2 (4.8)	0 (0)	0.725
	Physical assault	5 (11.9)	0 (0)	
	Road traffic accident	25 (59.5)	2 (100)	
	Self fall	10 (23.8)	0 (0)	
USG and CT findings	Fluid mod to gross fluid	33 (78.6)	1 (50)	0.57
	Severe grade organ injury	15 (35.7)	1 (50)	

Continued.

Clinico-social parameter		Discharge (%)	Death (%)	P value
Associated injury (n=8)	Nil	27 (62.29)	0 (0)	0.0059
	BT chest	6 (14.29)	0 (0)	
	BT head	3 (7.14)	2 (100)	
	BT to head and chest	3 (7.14)	0 (0)	
	Thermal burn	2 (4.76)	0 (0)	
	Fracture of any bone	1 (2.38)	0 (0)	
Hb (gm/dl)	<7	19 (45.2)	0 (0)	0.317
	>7	23 (54.8)	2 (100)	
Clinical shock	No	27 (64.3)	2 (100)	0.429
	Yes	15 (35.7)	0 (0)	

Table 5: Association between clinico-social parameter and management plan.

Clinico-social parameter		Non-operative intervention (%)	Operative intervention (%)	P value
Mode of injury	Accidental injury	0 (0)	2 (66.6)	0.125
	Physical assault	5 (12.2)	0 (0)	
	Road traffic accident	26 (63.4)	1 (33.4)	
	Self-fall	8 (19.5)	2 (66.6)	
Clinical shock (n=15)	Responsive to fluid	12 (100)	1 (33.4)	0.002
	Refractory	0 (0)	2 (66.6)	
Hb (gm/dl)	<7	17 (41.5)	2 (66.6)	0.117
	>7	24 (55.5)	1 (33.4)	
Volume of fluid (CT finding)	Mild free fluid	10 (24.4)	0 (0)	0.33
	Moderate to gross fluid	31 (75.6)	3 (100)	
Injury grade on CT (n=16)	Moderate to high grade splenic injury	6 (37.5)	1 (33.4)	0.33
	Moderate to high grade liver injury	10 (62.5)	2 (66.6)	

DISCUSSION

This study demonstrates that blunt abdominal trauma predominantly affects young males and is most commonly caused by road traffic accidents. Non-operative management was successful in the majority of patients, with only a small proportion requiring surgical intervention.

The age distribution in our 44-patient cohort showed a concentration in young adults: 70.4% aged under 45 years and mortality varied markedly across age brackets in our cohort (p=0.026).

Operative intervention was maximum in the paediatric age group under 15 years of age (4.5%) with one young adult gentleman of 30 years (2.2%) also requiring laparotomy for liver injury. Sirlin et al found a similar age distribution (mean 31±14 years) and noted a secondary peak in the elderly (>65 years) comprising 8 % of their 2,693-patient cohort.[5] Holmes et al's paediatric meta-analysis highlighted that children are susceptible to serious injuries and the exposure of this age group to high-risk situations predisposing to trauma.[6]

In contrast, Sirlin et al observed no significant age effect on FAST sensitivity but did report longer time-to-imaging in children, potentially delaying diagnosis.[5] The study parameters were primarily imaging based, and hence the study did not reveal significant age association with mortality when time-to-imaging was reduced.

To conclude, international research data suggests that a non-operative management is successful in young children but due to refractory shock, and falling haemoglobin in high grade solid organ injury, the decision was taken to explore the abdomen in 4.5% of cases in our study.

In our cohort of 44 blunt abdominal trauma patients, there was a pronounced male predominance (84.1 %). Natarajan et al's 320-patient evaluation echoed these findings (80 % male; mean age 32 years) and highlighted that younger adult males engage disproportionately in high-risk activities such as speeding and contact sports.[7] The consistency across these studies underscores' socio-behavioural factors—occupational exposure, risk-taking, and mobility—driving male vulnerability to Blunt abdominal trauma. A study by Zhang and colleagues (2009), found that women were more likely to present with higher rates of complications such as delayed bleeding or coagulopathy requiring operative intervention.[8]

RTAs were most common (61.4 %) cause of blunt abdominal trauma. This is in keeping with other studies done at national and international level Sirlin et al similarly reported RTAs as the principal mechanism in 60% of their level I trauma cohort. Also reported that unstable RTA patients had higher FAST fluid volumes and intervention rates, yet ultimate mortality depended more on injury severity (e.g., CT blush) than mechanism per sec.[5] Mahmood et al likewise found no independent effect of mechanism on death, with admission hemoglobin and CT findings being stronger predictors.[9]

All patients underwent USG and CT. Of the 44 patients, 36 had at least one organ injury identified on CT that was missed on FAST ultrasound. Among the 40 patients who underwent CT, 9 (22.5 %) had missed injuries on their initial FAST, although this difference did not reach statistical significance (p=0.205). These findings were similar to Sirlin et al.[5] Varied literature had a 25% rate of missed injuries, and meta-analysis showed a 60-85% missed injury rate.

Our study had a 22.5% rate of missed injury, and the major missed finding has been retroperitoneal bleeding. Thus, integration of FAST as a rapid screen with confirmatory CT in all stable patients remains essential to minimize diagnostic lapses, optimize treatment planning, and improve outcomes in blunt abdominal trauma.

Overall mortality in our 44-patient cohort was low at 4.5% (2/44) but both deaths occurred in the paediatric subgroup (ages 4–15 years), yielding a subgroup mortality of 28.6% (2/7; p=0.026). No adult fatalities were observed despite 34.1% presenting in shock and 27.8% harbouring high-grade organ injuries. Zarzaur et al's SPLINT trial (n=1,028) found overall splenic injury mortality of 5%, but a disproportionate share in patients. Hence, mortality in our study was slightly lower than its international counterparts, which might be due to the false low institutional mortality caused by a delay in presentation to casualty resulting in a larger proportion of on-site or in transit deaths.[10]

Non-operative management was successful in 93.2% (n=41). The injuries were predominantly splenic and of low grade without shock in this study. Fikry et al demonstrated 82% non-operative management success in grade IV–V liver trauma, attributing failures to contrast blush and transfusion >4 units/24 hours.[11] Furthermore, as evidenced by the data from our study, 22% of patients with organ injuries of grade 4 and greater were taken up for operative intervention, which is much higher than the 6.8% operative rate for the whole cohort. The most commonly operated organ was the spleen.

Isolated abdominal injuries were the most common in our study with associated chest injuries being the most common additional finding. mortality had associated head injury as the main cause of death, and one mortality had only isolated abdominal trauma. Hence, our study could not give a significant association between mortality and associated injury due to low sample size. However, according to other studies, associated injuries is a very significant finding. Sirlin et al reported isolated abdominal injury in 60%, with chest trauma in 20% and head injuries in 15%.[5] Finally, it can be concluded that associated injuries have been found to have an increased mortality in research data, and the most common associated injury is chest injury. Which is mirrored by our study finding.

In our study, admission Hb did not significantly predict mortality (p=0.317). About 10.5% of patients with Hb less than 7 got operated and only 4 % of those with Hb greater than 7%. Although this finding was not found to be statistically significant, it might be an indicator that monitoring of the potentially declining trend of Hb might be more significant than the single low value of Hb on admission in predicting mortality or need for operative intervention. Becker et al reported no significant difference in mortality between patients with Hb<8 g/dl and those with higher values but identified CT contrast extravasation and clinical deterioration as stronger mortality predictors.[12] Mahmood et al noted that small-volume hemoperitoneum patients sometimes presented with near-normal Hb yet developed delayed hollow viscus injuries, further decoupling initial Hb from outcome.[9] In a 2010 study, Davis et al found that lower Hb levels (especially <9 g/dl) were associated with a higher failure rate of non-operative management and a greater likelihood of needing surgery .

In this study, among our 44 patients, 34.1% (n=15) presented in clinical shock. Conversely, both deaths occurred in the 29 hemodynamically stable on-arrival patients. About 7.7% of fluid-responsive patients in shock requiring operative intervention (due to falling Hb) and 100% of refractory shock were taken for operative exploration. This counterintuitive finding echoes Becker et al's report of 145 hemoperitoneum patients, where early aggressive resuscitation in shocked patients led to similar or better survival than initially stable patients who later deteriorated.[12] The authors concluded that hemodynamic instability was a clear indication for surgical exploration. In our study, about 2.94% (n=1) patients of moderate to gross free fluid in abdomen died; and 6.25% (n=1) in patients of severe grades of organ injury.

USG findings and CT findings of gross hemoperitoneum were found in 37% of the cohort, and 1 of the 2 mortalities came from this group of gross hemoperitoneum. Further, high grade injuries were consistently found to be associated with high mortality particularly in the studies of Sirlin et al.[5] About 3 (8.8%) of patients with moderate to Gross free fluid were operated in this study. In a study published in 2010, Davis et al found that patients with significant amounts of free fluid on their initial CT scans were more likely to require surgical intervention with a p=0.02. Exploratory laparotomy with no Intraperitoneal finding was not seen in this study, and has been likely avoided due to the copious use of CT imaging which has reliably confirmed findings before patient is taken for exploration.

The present study is limited by a relatively small sample size and single-centre design, which may restrict the generalizability of the findings.

Overall, the study results demonstrated irrefutable evidence that early identification of hemodynamic instability and associated head injury, with follow-up monitoring is crucial in predicting outcomes in patients with blunt abdominal trauma.

CONCLUSION

From this study we conclude that, blunt abdominal trauma with solid organ injury is more common in younger males with higher mortality due to high grade injury to spleen due to RTAs, with associated head injury majorly affecting mortality. Hb and clinical shock should be monitored rather than relying solely on condition on admission as a prognostic factor. Non-operative management was largely successful, with exploration being required predominantly in paediatric patients and those with refractory shock. CT findings of grade of injury and volume of hemoperitoneum were an accurate guide for deciding non-operative management, and predicting mortality. Early recognition of shock, associated head injury, high grade injury or falling trend of Hb is the key in improving long term outcome in patients of blunt abdominal trauma.

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REFERENCES

1. Shah SM, Shah KS, Joshi PK, Somani RB, Gohil V, Dakhda SM. To study the incidence of organ damage and post-operative care in patients of blunt abdominal trauma with haemoperitoneum managed by laparoscopy. J Minim Access Surg. 2011;7:169-72.
2. Radwan M, Abu-Zidan F. Focused assessment sonograph trauma (FAST) and CT scan in blunt abdominal trauma: surgeon's perspective. Afr Health Sci. 2006;6(3):187-90.
3. Brooks A, Davies B, Connolly J. Prospective evaluation of handheld ultrasound in the diagnosis of blunt abdominal trauma. J R Army Med Corps. 2002;148:19-21.
4. Au H, Mak Y, Luk S, Cheung CC, Kam C, Lee ACW. Chronic myeloid leukemia presenting as traumatic haemoperitoneum and duodenal injury. Hong Kong J Emerg Med. 2000;7:236-7.
5. Sirlin CB, Brown MA, Andrade-Barreto OA, Deutsch R, Fortlage DA, Hoyt DB. Blunt abdominal trauma: screening US in 2,693 patients. Radiology. 2007;244(3):789-98.
6. Holmes JF, Gladman A, Chang CH. Performance of abdominal ultrasonography in paediatric blunt trauma patients: a meta-analysis. J Pediatr Surg. 2010;45(5):987-94.
7. Natarajan B, Gupta PK, Cemaj S, Sorensen M, Hatzoudis GI, Forse RA. FAST scan: is it worth doing in hemodynamically stable blunt trauma patients? Surgery. 2010;147(1):51-5.
8. Zhang Q, Jin W, Deng L, Lv H, Zhu J. Mechanisms of blunt liver trauma patterns: an analysis of 53 cases. Exp Ther Med. 2012;5:395-8.
9. Mahmood I, Abdelrahman H, Al-Hassani A, Nabir S, Sebastian M, Maull KI. Clinical implications of isolated free intra-abdominal fluid on computed tomography scan in blunt abdominal trauma. World J Emerg Surg. 2013;8(1):37.
10. Zarzaur BL, Kozar R, Myers JG, Claridge JA, Scalea TM, Neideen TA. The splenic injury outcomes trial: an American Association for the Surgery of Trauma multi institutional study. J Trauma Acute Care Surg. 2015;79(3):335-42.
11. Fikry K, Velmahos GC, Bramos A, Janjua S, de Moya M, King DR. Successful nonoperative management of the most severe blunt liver injuries. Arch Surg. 2016;151(5):423-8.
12. Becker A, Leiderman DB, Lockary V, Rowell S, Hyatt S, Shaves S. Hemoperitoneum in stable blunt trauma patients: is laparotomy always necessary? J Trauma Acute Care Surg. 2011;70(3):701-5.

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