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Research Article

Clinical Profile and Outcome of Blunt Abdominal Trauma at a Rural Tertiary Care Centre in Andhra Pradesh: A Prospective Observational Study

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ABSTRACT

Background: Blunt abdominal trauma (BAT) is a major contributor to morbidity and mortality in patients presenting to emergency department and inexpensive, reliable tools for rapid triage are particularly valuable in resource-limited rural settings.

Objectives: To describe the clinical profile and outcome of patients with BAT at a rural tertiary care centre, to determine the frequency of a positive Extended Focused Assessment with Sonography in Trauma (E-FAST), and to assess the utility of the Clinical Abdominal Scoring System (CASS) in predicting the need for laparotomy.

Methods: A prospective observational study was conducted over 22 months in the Department of General Surgery at a tertiary care hospital in Kuppam, Andhra Pradesh. Thirty-nine patients aged 18-70 years with BAT were enrolled by purposive sampling. Clinical, laboratory and E-FAST findings were recorded on a structured proforma incorporating CASS, and data were analysed using SPSS version 26.0.

Results: The cohort was predominantly male (71.8%) with a mean age of 37.8 years; road traffic accidents accounted for 71.8% of injuries. E-FAST was positive in 94.9% of patients. Liver and splenic injuries were each present in 25.6% of cases. Conservative management succeeded in all 23 patients selected for it, with zero mortality, whereas 16 patients required surgery, among whom mortality was 25.0%. Overall mortality was 10.3%, and alcohol intoxication was associated with a 7.6-fold higher mortality (27.3% vs 3.6%). All patients with a CASS score ≥12 required laparotomy, whereas none with a score of 9 did.

Conclusion: Selective non-operative management guided by CASS and E-FAST achieved excellent outcomes in this rural cohort, and alcohol intoxication emerged as a key modifiable risk factor for mortality.

Keywords: Blunt Abdominal Trauma, Clinical Abdominal Scoring System, E-FAST, Non-Operative Management, Rural Trauma, Laparotomy.

INTRODUCTION

Blunt abdominal trauma (BAT), defined as injury to the abdominal viscera caused by blunt force without breach of the abdominal wall, is one of the most frequent emergency surgical presentations worldwide. Abdominal injuries rank third after head and chest trauma, and their insidious nature means that a substantial proportion of patients with significant intra-abdominal injury present without obvious external signs, making early and accurate assessment essential.[1,2]

Trauma contributes 16% of the global disease burden and is projected to become one of the leading causes of years of productive life lost by 2030, with a disproportionate share of injury-related deaths occurring in South-East Asia.[2,3] In India, road traffic accidents remain the leading cause of BAT, and nearly 60% of the roughly 140,000 people who die of trauma-related injuries each year fall within the

productive 15-55-year age group.[2,4] Autopsy-based series report the liver as the most frequently injured organ in fatal BAT (up to 89% of cases), followed by the spleen and kidneys, with haemorrhagic and neurogenic shock as the leading causes of early death.[5] Comparable state-level data from Andhra Pradesh remain sparse, although rural tertiary centres in the region encounter a substantial trauma caseload, compounded by delayed presentation and limited pre-hospital care.[6]

Management of BAT has shifted over the past three decades from routine surgical exploration to selective non-operative management in haemodynamically stable patients, with reported success rates of 80-90% in appropriately selected cohorts. This shift has been supported by two complementary bedside tools. The Extended Focused Assessment with Sonography in Trauma (E-FAST) allows rapid, radiation-free detection of intraperitoneal and intrathoracic free fluid, with reported sensitivity above 85% for haemoperitoneum in Indian cohorts.[7] The Clinical Abdominal Scoring System (CASS), which combines time since injury, systolic blood pressure, pulse rate, Glasgow Coma Scale (GCS) and abdominal examination findings into a single physiological score, has been validated as a highly sensitive predictor of the need for laparotomy without reliance on cross-sectional imaging.[8]

Most published evidence on BAT originates from urban trauma centres with established protocols and ready access to imaging. Rural tertiary hospitals, which often serve as the only accessible surgical facility for large catchment populations, face distinct challenges, including delayed presentation, limited imaging infrastructure and a different injury mix that includes occupational and animal-related trauma. Prospective outcome data from such settings remain limited, restricting the ability to tailor trauma protocols to rural-specific needs. This study was therefore undertaken to characterise the clinical profile and outcome of BAT at a rural tertiary care centre, to determine the frequency of a positive E-FAST, and to evaluate the utility of CASS in predicting the need for laparotomy.

MATERIALS AND METHODS

Study Design and Setting

This prospective observational study was conducted in the Department of General Surgery, PES Institute of Medical Sciences and Research (PESIMSR), Kuppam, Andhra Pradesh, over a period of 22 months (April 2024 to February 2026).

Study Population and Sampling

All patients admitted to the general surgery ward with blunt trauma to the abdomen during the study period were considered for inclusion. A purposive sampling technique was used. The sample size of 39 was calculated from the reported 3.8% prevalence of intra-abdominal injury among BAT victims,[9] using a 95% confidence level and 6% precision ($n = Z^2p(1-p)/d^2$).

Inclusion Criteria: patients aged 18-70 years admitted with BAT.

Exclusion Criteria: patients with associated head or chest injury; patients with a CASS score >9 who declined contrast-enhanced computed tomography (CECT) of the abdomen; and patients with penetrating abdominal injury.

Data collection

Following institutional ethics committee approval and written informed consent, each patient underwent a detailed history and clinical examination, with documentation of vital signs and systemic findings on a structured proforma incorporating the CASS parameters. Baseline investigations included haemoglobin and platelet count, erect abdominal radiography, and abdominal ultrasonography with E-FAST; CECT of the abdomen was performed for patients with a CASS score >9. Management (conservative or surgical) was determined by hemodynamic status, CASS score, E-FAST findings and clinical course, and patients were followed through to discharge or death.

Statistical analysis

Data were entered in Microsoft Excel 2007 and analysed using SPSS version 26.0 (SPSS Inc., Chicago, IL, USA). Categorical variables are presented as frequencies and percentages, and continuous variables as mean ± standard deviation. The independent samples t-test was used to compare continuous variables and the chi-square test for categorical variables, with $p<0.05$ considered statistically significant.

Ethical considerations

The study was approved by the Institutional Human Ethics Committee, PESIMSR, Kuppam [approval number to be inserted by the corresponding author], and written informed consent was obtained from all participants prior to enrolment.

RESULTS AND DISCUSSION

Thirty-nine patients with BAT were evaluated during the study period. The cohort comprised 28 men (71.8%) and 11 women (28.2%), a male predominance consistent with global and Indian data and closely comparable to the male-to-female ratios reported by Mehta et al. and Rao et al. (both 3.7:1), though lower than the ratios described in autopsy-based series, which by design capture only fatal outcomes.[10,11] The mean age at presentation was 37.8 years (range 15-79 years), and 76.9% of patients were between 15 and 60 years old, confirming that BAT continues to affect the economically productive population most heavily (Table 1).

Table 1. Demographic and Clinical Characteristics of the Study Population (N = 39)

Variable	Category	N	%
Age (Years) (Mean 37.8, Range 15-79)	15-30	12	30.8
	31-45	10	25.6
	46-60	8	20.5
	>60	9	23.1
Gender	Male	28	71.8
	Female	11	28.2
Time To Presentation (Mean 2.3 H)	<1 Hour	18	46.2
	1-3 Hours	13	33.3
	3-6 Hours	8	20.5
Alcohol Intoxication	Present	11	28.2
	Absent	28	71.8
Glasgow Coma Scale	15 (Alert)	25	64.1
	13-14	5	12.8
	11-12	7	17.9
	3 (Severe)	2	5.1
Haemoglobin (Mean 11.9 G/Dl)	>12 G/Dl (Normal)	15	38.5
	10-12 G/Dl (Mild Anaemia)	11	28.2
	8-10 G/Dl (Moderate Anaemia)	8	20.5
	<8 G/Dl (Severe Anaemia)	5	12.8

Road traffic accidents (RTA) accounted for 28 of 39 injuries (71.8%), a proportion consistent with the 63-83% reported across Indian series.[10,12] Motorcycle riders (38.5%) and pillion riders (20.5%) together made up more than half of all cases, reflecting the heavy reliance on two-wheeled transport in rural areas and limited use of protective equipment. Notably, animal-related trauma (bull and cow stampede) accounted for 10.3% of injuries, a mechanism rarely reported in urban or autopsy-based series and one that appears specific to the rural agricultural setting of this cohort (Table 2).

Table 2. Mode of Injury in Patients with Blunt Abdominal Trauma (N = 39)

Mode of Injury	N	%
RTA - Motorcycle Rider	15	38.5
RTA - Pillion Rider (Two-Wheeler)	8	20.5
RTA - Four-Wheeler Occupant	3	7.7
RTA - Pedestrian Struck By Vehicle	2	5.1
Fall From Height	4	10.3
Bull Stampede	2	5.1
Cow Stampede	2	5.1
Assault	1	2.6

Alcohol intoxication at the time of injury, documented in 11 patients (28.2%), was strongly associated with mortality: 3 of 11 intoxicated patients died (27.3%) compared

with 1 of 28 non-intoxicated patients (3.6%), a roughly 7.6-fold increase in mortality risk. This pattern is consistent with experimental and clinical evidence that acute alcohol intoxication blunts the compensatory tachycardic response to haemorrhage and worsens haemodynamics after blunt bowel and mesenteric injury.[13] All three alcohol-related deaths in this series occurred in patients who ultimately required surgery, suggesting that impaired physiological compensation is particularly deleterious when superimposed on significant abdominal injury.

E-FAST, performed in all 39 patients as part of the primary survey, was positive in 37 (94.9%), a sensitivity at the upper end of the 87-93% range reported in Indian series and likely reflecting selective referral of symptomatic patients to this tertiary centre.[7,14] Both patients with a negative E-FAST were managed without surgery and recovered without complication, supporting the reliability of a negative E-FAST for excluding clinically significant haemoperitoneum in stable patients.

CASS scores in this cohort ranged from 9 to 14 (mean 10.5) and correlated closely with the eventual need for laparotomy. None of the 9 patients with a CASS score of 9 required surgery, whereas all 7 patients with a score of 12 or higher underwent laparotomy, and the laparotomy rate rose progressively with score (Table 3). This gradient mirrors the original validation cohort of Peyman et al., who reported 100% sensitivity and 88% specificity of CASS for laparotomy in 400 patients, and is consistent with more recent comparative work showing CASS to have the strongest discriminative performance among physiological scoring systems for predicting laparotomy, in-hospital mortality and length of stay.[8,15] A contemporary comparison by Anandi et al., however, found the BAT Scoring System (BATSS) to outperform CASS in avoiding missed diagnoses among patients initially classified as low risk, suggesting that CASS, while highly useful, may benefit from being combined with newer physiological scores in future protocols.[16]

Table 3. CASS Score Distribution and Correlation with Need for Laparotomy (N = 39)

CASS Score	Patients (N)	Laparotomy Performed (N)	Laparotomy Rate (%)
9	9	0	0.0
10	12	3	25.0
11	11	5	45.5
≥12	7	7	100.0
Total	39	15	38.5

Solid organ injury was common, with the liver and spleen each affected in 10 patients (25.6%) (Table 4). This prevalence is lower than the 32-53% for splenic injury and up to 89% liver involvement reported in autopsy-based series, a difference that is expected given that the present prospective cohort captured both fatal and non-fatal injuries, whereas autopsy studies by definition include only deaths.[5,17] Renal injuries occurred in 7 patients (17.9%) and were uniformly managed conservatively, consistent with contemporary practice reserving surgery for high-grade renal trauma with vascular compromise. Pancreatic injury was rare (2 patients, 5.1%) but clinically significant, with both cases involving pancreatic transection. Hollow viscus injury, present in 6 patients (15.4%), carried disproportionate clinical weight: every hollow viscus injury required surgical repair or resection, underscoring the importance of serial abdominal examination and a low threshold for laparotomy when free fluid is seen without a corresponding solid organ injury on imaging.[18]

Table 4. Pattern of Abdominal Organ Injury (N = 39)

Organ	Grade / Type	N	% Of Cohort
Liver (10 Patients, 25.6%)	Grade I / II / III / IV	1 / 5 / 3 / 1	2.6 / 12.8 / 7.7 / 2.6
Spleen (10 Patients, 25.6%)	Grade II / III / IV / V	1 / 4 / 2 / 3	2.6 / 10.3 / 5.1 / 7.7
Kidney (7 Patients, 17.9%)	Grade II / III / IV	2 / 4 / 1	5.1 / 10.3 / 2.6
Pancreas (2 Patients, 5.1%)	Transection	2	5.1

Hollow Viscus (6 Patients, 15.4%)	Colon / Jejunum / Stomach	4 / 2 / 1*	10.3 / 5.1 / 2.6*
Urinary Bladder	Rupture	1	2.6
No Solid-Organ Injury Identified	-	3	7.7

*One patient had concurrent gastric and pancreatic injury; percentages for hollow viscus subtypes are therefore not mutually exclusive with the pancreatic injury total.

Conservative management was selected for 23 patients (59.0%), all of whom were haemodynamically stable with low-to-moderate grade solid organ injury and no peritoneal signs. Every one of these patients was managed successfully without escalation to surgery, and there were no deaths in this group, a 100% success rate that compares favourably with the 89.98% reported by Raza et al. in a 10-year, 1,285-patient review and the 95.2% reported by Osman et al. in hemodynamically stable patients with splenic injury.[19,20] Surgical intervention was required in 16 patients (41.0%) - 15 exploratory laparotomies and 1 isolated bladder repair - most commonly for hemodynamic instability, peritonitis, or confirmed hollow viscus injury. Diagnostic laparotomy without a therapeutic procedure accounted for 6 of 15 laparotomies (40%), a non-therapeutic rate broadly in keeping with published figures of 30-40% and reflecting an appropriately low threshold for surgery in a setting where serial re-examination and advanced imaging may not always be readily available (Table 5).

Table 5. Management Modality and Surgical Procedures Performed

Management / Procedure	N	% Of Relevant Group
Conservative (Non-Operative) Management	23	59.0 (Of N=39)
Surgical Management (Laparotomy + Bladder Repair)	16	41.0 (Of N=39)
Diagnostic Laparotomy Only	6	37.5 (Of N=16 Operated)
Laparotomy + Bowel Repair / Resection-Anastomosis	5	31.3 (Of N=16 Operated)
Laparotomy + Splenectomy	2	12.5 (Of N=16 Operated)
Laparotomy + Nephrectomy	1	6.3 (Of N=16 Operated)
Laparotomy + Multiple Organ Repair	1	6.3 (Of N=16 Operated)
Urinary Bladder Repair (Isolated)	1	6.3 (Of N=16 Operated)

Overall mortality was 10.3% (4 of 39 patients), and every death occurred in the surgically managed group, giving a surgical mortality of 25.0% (4 of 16) against zero mortality in the conservatively managed group (Table 6). This overall mortality is somewhat higher than the 4-4.6% reported in some prospective urban series but comparable to the 12.7% reported by Pal et al., and it likely reflects the greater proportion of high-grade and multi-organ injury among patients selected for surgery, together with the referral pattern typical of a rural tertiary centre.[10,21]

Table 6. Outcome According To Management Modality and Gender

Group	Total (N)	Survived (N)	Died (N)	Mortality (%)
Conservative Management	23	23	0	0.0
Surgical Management	16	12	4	25.0
Male	28	25	3	10.7
Female	11	10	1	9.1
Overall	39	35	4	10.3

The four fatal cases shared a consistent risk profile (Table 7): three (75%) had documented alcohol intoxication, two presented with a GCS of 3, three had haemoglobin below 8 g/dL at admission, and all had either high-grade solid organ injury (AAST grade IV-V) or combined solid organ and hollow viscus injury. Mean time to presentation among fatal cases was longer than among survivors (3.5 hours vs 2.1 hours), suggesting that delayed presentation may compound the effect of injury severity. These findings, taken together, identify alcohol intoxication, depressed GCS, severe anaemia and delayed presentation as clinically actionable markers of high risk that merit heightened vigilance and earlier escalation of care.

Table 7. Clinical Profile of the Four Fatal Cases

Case	Age / Timing Of Death	Key Findings	Alcohol
1	GCS 3; Died Intra-Operatively	Grade V Splenic Injury, Transverse Colon Injury	Yes
2	Age 55; Died On Post-Operative Day 2	High-Grade Splenic Injury	Yes
3	Age 79; Died On Post-Operative Day 3	Grade III Splenic Injury With Colonic And Jejunal Injury	No
4	Age 24; GCS 3; Died 6 Hours Post-Admission	Pancreatic Transection	Yes

Taken together, these findings support three practical conclusions for rural trauma care. First, E-FAST performs reliably as a first-line, radiation-free screening tool where computed tomography may be delayed or unavailable. Second, CASS provides a simple, reproducible bedside score that closely tracks the need for laparotomy and could reasonably anchor triage protocols in similar settings. Third, selective non-operative management, when applied to appropriately selected, haemodynamically stable patients with adequate monitoring, can achieve outcomes equal to or better than those reported from better-resourced urban centres, while alcohol intoxication stands out as a modifiable target for public health intervention.

Limitations

This study is limited by its small sample size (n = 39) from a single rural centre, which restricts statistical power and generalisability; the absence of a comparator diagnostic strategy; in-hospital outcome ascertainment only, without longer-term follow-up; and the lack of a head-to-head comparison between CASS and newer scores such as BATSS. These limitations should be considered when extrapolating the findings to other settings.

CONCLUSION

In this prospective study of 39 patients with blunt abdominal trauma at a rural tertiary care centre in Andhra Pradesh, selective non-operative management guided by CASS and E-FAST achieved a 100% success rate with zero mortality among conservatively managed patients, while overall mortality remained 10.3%, concentrated in the surgically managed group. E-FAST and CASS both performed as reliable, low-cost bedside tools for triage in a resource-limited setting, and alcohol intoxication emerged as a major modifiable risk factor associated with a 7.6-fold increase in mortality. These findings support the incorporation of structured physiological scoring and point-of-care ultrasound into rural trauma protocols and highlight alcohol intoxication as a priority target for preventive intervention.

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Dr. G. CHAITANYA KRISHNA

Ethical Approval

This study was conducted following formal approval from the Institutional Ethics Committee, P.E.S Institute of Medical Sciences and Research, Kuppam, Andhra Pradesh, in accordance with ICMR ethical guidelines for human research.

Approving Body: Human Ethics Committee, PES Institute of Medical Sciences and Research

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The authors declare no conflict of interest.

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