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CONTRAST-ENHANCED CT IN BLUNT ABDOMINAL TRAUMA: DIAGNOSTIC ACCURACY AND CLINICAL IMPACT IN A TERTIARY CARE SETTING

Radio-Diagnosis

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ABSTRACT

BACKGROUND: Blunt abdominal trauma (BAT) remains a diagnostic challenge, requiring rapid and accurate imaging to guide management. **AIM:** This study aimed to evaluate the role of contrast enhanced CT scan to diagnose the blunt abdominal trauma in hemodynamically stable patients, Grade solid-organ injuries (AAST) to guide operative versus conservative management, Describe organ-wise injury patterns and ancillary findings (e.g., hemoperitoneum), Minimize unnecessary laparotomy by accurate CECT-based stratification.. **METHODOLOGY:** In this prospective study, 70 hemodynamically stable BAT patients underwent contrast-enhanced CT (CECT). Injuries were graded by AAST classification, and management decisions recorded. **RESULTS:** The spleen (63.3%) and liver (30.0%) were the most frequently injured organs; hemoperitoneum was present in 97.1%. Grade III injuries predominated (40%). CECT demonstrated 96% sensitivity and 100% specificity. Conservative management was feasible in 68.6% of cases, while surgery was reserved for severe or complex injuries. Mortality was 1.4%. **CONCLUSION:** CECT is indispensable in BAT, enabling rapid diagnosis, accurate grading, and guiding operative versus non-operative decisions, thereby improving outcomes.

KEYWORDS

Blunt abdominal trauma, Contrast-enhanced computed tomography, AAST grading, Hemoperitoneum, Solid organ injury, Non-operative management, Diagnostic accuracy

INTRODUCTION :

Blunt abdominal trauma (BAT) presents subtle clinical signs and a broad injury spectrum, making early, accurate imaging essential for outcome-critical decisions on operative versus non-operative management (NOM) [1,2]. While FAST is valuable at the bedside, it is operator-dependent and less sensitive for retroperitoneal injury and low-volume hemoperitoneum; moreover, a negative FAST does not exclude significant injury in stable patients [2,3]. Multidetector CECT, in contrast, offers rapid, high-resolution assessment of solid organs, mesentery, vasculature, active bleeding, and hemoperitoneum, and it underpins contemporary trauma algorithms for stable patients [1,2,4,5]. CECT also enables standardized grading with the American Association for the Surgery of Trauma (AAST) scales, which directly inform eligibility for NOM and predict the need for intervention [4,5].
Diagnostic performance data consistently favor CT over older approaches such as DPL and plain radiography, and generally show superiority to FAST for comprehensive injury mapping in stable patients [1,6–8]. Even for hollow viscus and mesenteric injuries—historically the Achilles' heel of imaging—modern CECT demonstrates high specificity and good overall diagnostic accuracy, though vigilance for subtle signs remains necessary [9]. Concerns regarding radiation dose and iodinated contrast are outweighed in the acute trauma setting by the clinical benefits of rapid, accurate triage and treatment guidance [1,5].

This prospective study evaluates the role of CECT in hemodynamically stable BAT at our center, characterizing injury patterns, grading severity, and documenting management decisions and outcomes. We also report diagnostic performance measures (sensitivity, specificity, operative concordance) and situate our results against contemporary literature.

METHODOLOGY:

A prospective observational study was conducted at a tertiary care center in western India between March 2024 and September 2025 following institutional ethics committee approval. Consecutive hemodynamically stable patients presenting with blunt abdominal trauma and undergoing contrast-enhanced computed tomography (CECT) were included after obtaining written informed consent. Patients were excluded in the presence of pregnancy, known hypersensitivity to iodinated contrast agents, impaired renal function (serum creatinine >1.5 mg/dL), or refusal to participate.

All participants underwent imaging on a 16-slice multidetector CT system using a standardized trauma protocol. The acquisition included a non-contrast scan followed by contrast-enhanced late arterial and portal venous phases. A delayed excretory phase (8–10 minutes post-contrast) was selectively performed when genitourinary injury was suspected. Intravenous contrast was administered at a weight-based dose (1.5 mL/kg) using a power injector, with bolus tracking employed to optimize phase timing. Images were reconstructed at thin sections (2–3 mm) for detailed assessment. CT datasets were independently evaluated by two radiologists with 5–7 years of experience, both blinded to clinical findings. Injuries were systematically recorded and graded according to the American Association for the Surgery of Trauma (AAST) organ injury scale. Imaging indications and protocols were consistent with contemporary trauma imaging recommendations for stable patients.

STATISTICAL ANALYSIS:

Statistical analysis was performed using SPSS version 26. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies with percentages. Group comparisons were conducted using Student's t-test and Chi-square test, as appropriate. Logistic regression analysis was applied to identify factors associated with mortality. A p-value <0.05 was considered statistically significant.

RESULTS:

Patient Characteristics

Seventy patients were included (mean age 31.9±17.2 years). The most frequent age bands were 21–30 years (34.3%) and 31–40 years (28.6%). Males predominated (85.7%). Single-organ injury occurred in 72.9%, and multi-organ injuries in 27.1%.

Table 1. Demographics and Injury Burden (N=70)

Variable	n (%) / Mean±SD
Age (years)	31.9 ± 17.2

21–30	24 (34.3)
31–40	20 (28.6)
41–50	10 (14.3)
51–60	9 (12.9)
61–70	6 (8.6)
71–80	1 (1.4)
Sex: Male	60 (85.7)
Sex: Female	10 (14.3)
Single-organ injury	51 (72.9)
Multi-organ injuries	19 (27.1)

Organ-Specific Findings

On CECT, the spleen was most commonly injured (63.3%), followed by liver (30.0%) and kidney (17.1%). Bowel/mesenteric injury was seen in 11.4%; bladder in 2.9%; pancreas in 1.4%. Pneumoperitoneum was present in 2.9%. Hemoperitoneum was strikingly frequent (97.1%).

Table 2. Organ-wise Injuries and Ancillary Findings on CECT

Finding	n (%)
Spleen injury	45 (63.3)
Liver injury	21 (30.0)
Renal injury	12 (17.1)
Bowel/Mesenteric injury	8 (11.4)
Bladder injury	2 (2.9)
Pancreatic injury	1 (1.4)
Pneumoperitoneum	2 (2.9)
Hemoperitoneum	68 (97.1)

Injury Severity (AAST)

Grade III injuries predominated (40.0%), with Grade II and Grade IV each 14.3%, Grade I 11.4%, and Grade V 2.9%.

Table 3. AAST Injury Grades (overall distribution)

Grade	n (%)
I	8 (11.4)
II	10 (14.3)
III	28 (40.0)
IV	10 (14.3)
V	2 (2.9)

Associated/Multiple Injuries

Among multi-injury cases, renal (12.9%), splenic (11.4%), and hepatic (5.7%) injuries clustered; associated skeletal/other injuries (each 1.4%) included skull fracture, adrenal injury, tibia-fibula fracture, L2-L3 vertebral fracture, pubic rami fracture, pelvi-ureteric injury, and multiple rib fractures.

Table 4. Patterns in Multi-Injury Subset (selected)

Additional injuries among multi-injury cases	n (%) of total
Renal (additional)	9 (12.9)
Splenic (additional)	8 (11.4)
Hepatic (additional)	4 (5.7)
Skull fracture / Adrenal injury / Tibia-fibula fracture / L2–L3 fracture / Pubic rami fracture / Pelvi-ureteric injury / Multiple rib fractures	Each 1 (1.4)

Management & Diagnostic Performance

Conservative management was chosen for most patients (68.6%), with adjunctive non-operative procedures in a subset (e.g., DJ stenting, pelvic binder, ICD, SPC). Surgical interventions (e.g., exploratory laparotomy with repairs/patch closure, splenectomy/partial splenectomy, perihepatic packing) were performed according to injury severity and indications. One death (1.4%) occurred. Operative/clinical concordance with pre-op imaging was high (concordant 18.6%, partial 2.8%, discordant 1.4%; remainder no post-op findings). CECT sensitivity was 96% and specificity 100% for intra-abdominal injuries.

Table 5. Management and Diagnostic Performance

Domain	Details
Conservative management	48 (68.6%) (plus binder in 1)
Interventional, non-operative (examples)	DJ stent (1), cystoscopy+DJ stent (1), ICD (2), SPC (1) Counts reflect procedures; some patients had >1.
Surgery (examples)	Exploratory laparotomy (± lavage/repairs/patch closure/mesenteric tear repair) (multiple single-case entries), perihepatic packing (1), partial splenectomy (1), splenectomy (2), UB dome closure + drain (1)
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Orthopedic/Spine	Fracture fixation (2), L3–S1 trans-pedicle fixation (1)
Mortality	1 (1.4%)
Operative/clinical concordance	Concordant 13 (18.6%), partial 2 (2.8%), discordant 1 (1.4%), no postop findings 52 (76.1%)
CECT diagnostic accuracy	Sensitivity 96%, Specificity 100%

DISCUSSION:

Our series confirms spleen (63.3%) and liver (30.0%) as the most commonly injured solid organs in BAT, with frequent hemoperitoneum (97.1%) and predominance of Grade III injuries (40.0%). These patterns parallel the solid-organ dominance reported in contemporary BAT cohorts and reviews, where CECT is endorsed as the first-line modality for stable patients [1,4,5]. Diagnostic performance in our cohort (sensitivity 96%, specificity 100%) matches high accuracies reported elsewhere (e.g., sensitivity 97%, specificity 95%, NPV 100%) [6] and the superiority of CT over EFAST for comprehensive mapping (CECT 100%/98% versus EFAST sensitivity 84.9%) [7], with similar findings in another surgical series (CECT ~100%, FAST ~98%) [8].

For hollow viscus/mesenteric trauma, our data align with meta-analytic evidence indicating high specificity but modestly lower pooled sensitivity (≈85%), underscoring the need for clinical vigilance despite negative CT in select scenarios [9]. Regarding protocol optimization, the literature indicates CECT alone is sufficient for most patients, with non-contrast images selectively helpful (e.g., severe steatosis) to accentuate hemoperitoneum visibility [10]. Our conservative management rate (68.6%) reflects the global shift towards NOM enabled by accurate CT grading and detection of contrast extravasation guiding IR/surgery [1,5,11]. Overall, our findings reinforce CECT as the keystone of BAT evaluation—fast, accurate, and directly actionable—harmonizing with guideline-recommended imaging pathways for stable trauma patients [1,5].

CONCLUSION:

This study demonstrates that blunt abdominal trauma primarily affects young and middle-aged males, with spleen and liver being the most commonly injured organs. Hemoperitoneum was almost universal, highlighting the critical importance of early CECT evaluation. With high sensitivity (96%) and specificity (100%), CECT proved highly reliable in diagnosing and grading intra-abdominal injuries. Importantly, accurate CT-based stratification enabled conservative management in over two-thirds of cases, minimizing unnecessary laparotomy and improving patient safety. These findings confirm that CECT is the gold-standard imaging modality for hemodynamically stable BAT, supporting a paradigm shift toward non-operative management wherever feasible. Future multicentric studies with larger samples and long-term follow-up are recommended to validate and expand these results.

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