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Role of Diagnostic Laparoscopy in the Evaluation and Management of Haemodynamically Stable Patients with Blunt Abdominal Trauma: A Prospective Observational Study

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Abstract

Background: Blunt abdominal trauma (BAT) presents a diagnostic challenge, particularly in haemodynamically stable patients with equivocal clinical or radiological findings. Although contrast-enhanced computed tomography (CECT) is the principal imaging modality in stable patients, selected intra-abdominal injuries may require direct operative assessment. Diagnostic laparoscopy offers the additional advantage of permitting therapeutic intervention while potentially avoiding laparotomy. This study evaluated the diagnostic and therapeutic role of laparoscopy in haemodynamically stable patients with blunt abdominal trauma.

Methods: This prospective observational study included 78 haemodynamically stable adult patients with blunt abdominal trauma. Patients underwent clinical assessment, FAST/ultrasonography, CECT abdomen, and diagnostic laparoscopy according to the study protocol. Laparoscopic findings, therapeutic intervention, conversion to laparotomy, operative and postoperative outcomes, missed injuries, and mortality

were evaluated. The diagnostic performance of CECT was assessed against the final reference standard.

Results: The mean age was 38.0 ± 15.2 years, and 63 (80.8%) patients were male. Road traffic accidents were the commonest mechanism of injury (64.1%). FAST/ultrasonography was positive in 67.9%, while CECT was positive in 83.3%. Diagnostic laparoscopy identified intra-abdominal injury in 66 (84.6%) patients. Hemoperitoneum (78.2%), solid-organ injury (47.4%), splenic injury (30.8%), mesenteric injury (19.2%), and hollow-viscus injury (16.7%) were the principal laparoscopic findings. Therapeutic laparoscopy was successfully completed in 38 (48.7%) patients, while 15 (19.2%) required conversion to laparotomy. CECT demonstrated 98.5% sensitivity, 91.7% specificity, 98.5% positive predictive value, 91.7% negative predictive value, and 97.4% overall diagnostic accuracy. Postoperative complications occurred in 17 (21.8%) patients; two (2.6%) required re-intervention and one (1.3%) had a missed injury. Median hospital stay was 6 days (IQR 5–8). There was no mortality.

Conclusion: Diagnostic laparoscopy was a useful diagnostic and therapeutic modality in selected haemodynamically stable patients with blunt abdominal trauma. It enabled direct assessment of intra-abdominal injuries and definitive laparoscopic treatment in nearly half of the study population, while conversion to laparotomy was required in approximately one-fifth. Its use may complement CECT when operative evaluation is clinically indicated.

Keywords: Blunt abdominal trauma; Diagnostic laparoscopy; CECT abdomen; Haemodynamic stability; Therapeutic laparoscopy

Introduction

Blunt abdominal trauma (BAT) is one of the most common causes of morbidity and mortality among trauma patients worldwide, particularly affecting the young and economically productive population. It commonly results from road traffic accidents, falls from height, assaults, and crush injuries, with road traffic accidents accounting for the majority of cases in developing countries. The spectrum of injury ranges from minor contusions to life-threatening damage involving solid organs, hollow viscera, mesentery, and major abdominal vessels. The pathophysiology of BAT involves compression, deceleration, and shearing forces that produce varying degrees of tissue disruption. While solid organ injuries such as those involving the liver and spleen frequently result in hemorrhage, hollow viscus and mesenteric injuries may initially remain clinically silent, leading to delayed diagnosis, peritonitis, sepsis, and increased mortality if not recognized promptly. Early identification of clinically significant intra-abdominal injuries therefore remains the cornerstone of successful management and improved patient outcomes.[1–4]

The management of blunt abdominal trauma has undergone a paradigm shift over the past three decades from routine exploratory laparotomy to selective non-operative management in haemodynamically stable patients. Clinical examination alone is often unreliable because associated injuries, altered sensorium, intoxication, or delayed manifestation of peritoneal signs may obscure the diagnosis. Consequently, adjunctive investigations such as Focused Assessment with Sonography in Trauma (FAST) and contrast-enhanced computed tomography (CECT) have become integral components of trauma evaluation. FAST provides a

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rapid bedside assessment for free intraperitoneal fluid but has limited sensitivity for hollow viscus and mesenteric injuries. CECT is considered the imaging modality of choice in stable patients owing to its high accuracy for solid organ injuries; however, it may fail to detect subtle bowel, mesenteric, diaphragmatic, or pancreatic injuries, resulting in missed injuries and delayed operative intervention. Persistent clinical suspicion despite equivocal imaging therefore remains a significant diagnostic challenge in trauma surgery.[2–5]

Diagnostic laparoscopy has emerged as a valuable minimally invasive modality that bridges the gap between non-operative observation and unnecessary exploratory laparotomy in carefully selected haemodynamically stable patients. Besides providing direct visualization of the peritoneal cavity, it permits accurate identification of occult injuries involving the bowel, mesentery, diaphragm, and solid organs while simultaneously allowing therapeutic interventions such as hemostasis, repair of bowel or diaphragmatic injuries, lavage, and drainage when indicated. Contemporary evidence demonstrates that, in appropriately selected patients and in experienced hands, diagnostic laparoscopy reduces the rate of non-therapeutic laparotomy, minimizes postoperative pain, wound complications, hospital stay, and overall morbidity without increasing the incidence of missed injuries. Consequently, the latest World Society of Emergency Surgery (WSES) consensus recommends a laparoscopic-first approach in haemodynamically stable patients requiring operative evaluation for abdominal trauma whenever expertise and resources are available.[3–6]

Despite these advances, the precise role of diagnostic laparoscopy in the evaluation of blunt abdominal trauma remains incompletely defined, particularly in low- and middle-income countries where trauma burden is high and resource constraints may influence decision-making. Most available studies are retrospective, involve heterogeneous patient populations, or combine penetrating and blunt trauma, limiting the generalizability of their findings. Furthermore, data correlating laparoscopic findings with clinical examination, FAST, and CECT are relatively limited in the Indian setting. Therefore, the present study was undertaken to evaluate the role of diagnostic laparoscopy in haemodynamically stable patients with blunt abdominal trauma, determine its diagnostic effectiveness, correlate laparoscopic findings with preoperative clinical and radiological assessment, assess its therapeutic utility, and evaluate its impact on avoiding unnecessary laparotomy and improving postoperative outcomes.

Methodology

This prospective observational study was conducted in the Department of General Surgery tertiary care teaching hospital, over a period of 18 months, after obtaining approval from the Institutional Ethics Committee. Adult patients (≥18 years) presenting with blunt abdominal trauma who were haemodynamically stable (systolic blood pressure ≥90 mmHg without the requirement for ongoing resuscitation) and met the study eligibility criteria were consecutively enrolled after obtaining written informed consent. Patients with penetrating abdominal trauma, haemodynamic instability, pregnancy, severe traumatic brain injury requiring immediate neurosurgical intervention, contraindications to general anaesthesia or laparoscopy, and those with definite indications for emergency exploratory laparotomy were excluded. Baseline demographic details, mechanism of injury, associated extra-abdominal

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injuries, clinical presentation, and laboratory parameters were prospectively recorded using a structured data collection proforma.

All enrolled patients underwent a standardized trauma evaluation according to institutional protocols, including detailed clinical examination, Focused Assessment with Sonography in Trauma (FAST), and contrast-enhanced computed tomography (CECT) of the abdomen whenever clinically indicated. Patients with persistent clinical suspicion of intra-abdominal injury despite equivocal imaging, unexplained free intraperitoneal fluid, suspected hollow viscus or mesenteric injury, or indeterminate radiological findings underwent diagnostic laparoscopy under general anaesthesia. A systematic laparoscopic exploration of the abdominal cavity was performed to evaluate the diaphragm, liver, spleen, stomach, small bowel, colon, mesentery, pelvis, and retroperitoneal regions for evidence of injury. Therapeutic laparoscopic procedures, including haemostasis, repair of bowel or mesenteric injuries, lavage, drainage, and diaphragmatic repair, were undertaken whenever feasible. Conversion to open laparotomy was performed in patients with major intra-abdominal injuries, uncontrolled haemorrhage, inadequate visualization, or when definitive laparoscopic management was not technically feasible.

The primary outcome measure was the diagnostic effectiveness of diagnostic laparoscopy in detecting intra-abdominal injuries in haemodynamically stable patients with blunt abdominal trauma. Secondary outcome measures included correlation of laparoscopic findings with clinical examination, FAST, and CECT abdomen; identification of hollow viscus, mesenteric, diaphragmatic, and solid organ injuries; therapeutic laparoscopic intervention rate; conversion to laparotomy; avoidance of non-therapeutic laparotomy; postoperative complications; duration of hospital stay; and in-hospital mortality. Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR), whereas categorical variables were presented as frequencies and percentages. Diagnostic performance was assessed by calculating sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy with 95% confidence intervals wherever applicable. Comparisons between categorical variables were performed using the Chi-square test or Fisher's exact test, while continuous variables were analysed using the Student's *t*-test or Mann–Whitney *U* test according to data distribution. Statistical analysis was performed using IBM SPSS Statistics version 25 (IBM Corp., Armonk, NY, USA), and a two-tailed *p*-value of <0.05 was considered statistically significant.

Results

Table 1: Baseline Demographic and Injury Characteristics (n = 78)

Characteristic	**Corrected value**
Age, years	
Mean ± SD	38.0 ± 15.2
Median (IQR)	35.0 (26.3–49.3)
Age group, n (%)	

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18–30 years	30 (38.5)
31–40 years	18 (23.1)
41–50 years	12 (15.4)
51–60 years	10 (12.8)
>60 years	8 (10.3)
Sex, n (%)	
Male	63 (80.8)
Female	15 (19.2)
Mechanism of injury, n (%)	
Road traffic accident	50 (64.1)
Fall from height	15 (19.2)
Assault	8 (10.3)
Industrial/workplace injury	4 (5.1)
Sports-related injury	1 (1.3)
Time from injury to hospital presentation, hours	
Median (IQR)	9.6 (5.6–13.6)
Associated injuries, n (%)	
Orthopaedic injury	10 (12.8)
Thoracic injury	8 (10.3)
Head injury	5 (6.4)
Pelvic injury	4 (5.1)

A total of 78 haemodynamically stable patients with blunt abdominal trauma were included in the study. The mean age was 38.0 ± 15.2 years, with a median age of 35 years (IQR: 26.3–49.3 years). Patients aged 18–30 years constituted the largest age group (38.5%). Males predominated, accounting for 63 (80.8%) patients, while 15 (19.2%) were females. Road traffic accidents were the most common mechanism of injury, occurring in 50 (64.1%) patients, followed by falls from height in 15 (19.2%) and assault in 8 (10.3%). The median interval between injury and hospital presentation was 9.6 hours (IQR: 5.6–13.6 hours). Among associated injuries, orthopaedic injuries were observed in 10 (12.8%) patients, thoracic injuries in 8 (10.3%), head injuries in 5 (6.4%), and pelvic injuries in 4 (5.1%) (Table 1).

Table 2: Clinical and Radiological Assessment (n = 78)

Variable	**n (%)**
Clinical findings	
Abdominal pain	78 (100.0)
Abdominal tenderness	75 (96.2)

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Guarding	26 (33.3)
Vomiting	22 (28.2)
Reduced bowel sounds	19 (24.4)
Abdominal distension	18 (23.1)
Rebound tenderness	16 (20.5)
Rigidity	10 (12.8)
Seat-belt sign	7 (9.0)
FAST/USG	
Positive	53 (67.9)
Negative	25 (32.1)
CECT overall result	
Positive	65 (83.3)
Negative	13 (16.7)
Selected CECT findings	
Hemoperitoneum	64 (82.1)
Solid-organ injury	38 (48.7)
Splenic injury	25 (32.1)
Mesenteric injury suspected	15 (19.2)
Hollow-viscus injury suspected	13 (16.7)
Liver injury	11 (14.1)
Retroperitoneal haematoma	6 (7.7)
Diaphragmatic injury suspected	4 (5.1)

Abdominal pain was present in all 78 (100%) patients and was the most consistent presenting symptom. Abdominal tenderness was observed in 75 (96.2%) patients, followed by guarding in 26 (33.3%), vomiting in 22 (28.2%), reduced bowel sounds in 19 (24.4%), abdominal distension in 18 (23.1%), and rebound tenderness in 16 (20.5%). FAST/ultrasonography was positive in 53 (67.9%) patients and negative in 25 (32.1%). CECT abdomen demonstrated a positive intra-abdominal finding in 65 (83.3%) patients. Hemoperitoneum was the most frequent CECT finding, occurring in 64 (82.1%), followed by solid-organ injury in 38 (48.7%), splenic injury in 25 (32.1%), suspected mesenteric injury in 15 (19.2%), suspected hollow-viscus injury in 13 (16.7%), and liver injury in 11 (14.1%) patients. Retroperitoneal haematoma and suspected diaphragmatic injury were identified in 6 (7.7%) and 4 (5.1%) patients, respectively (Table 2).

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Table 3: Laparoscopic Findings and Operative Management (n = 78)

Variable	n (%)
Diagnostic laparoscopy result	
Positive	66 (84.6)
Negative	12 (15.4)
Laparoscopic findings*	
Hemoperitoneum	61 (78.2)
Solid-organ injury	37 (47.4)
Splenic injury	24 (30.8)
Mesenteric injury	15 (19.2)
Hollow-viscus injury	13 (16.7)
Small-bowel injury	12 (15.4)
Liver injury	11 (14.1)
Omental injury	10 (12.8)
Diaphragmatic injury	5 (6.4)
Renal injury	4 (5.1)
Colonic injury	2 (2.6)
Pancreatic injury	2 (2.6)
Gastric injury	1 (1.3)
Operative management	
Diagnostic laparoscopy only	25 (32.1)
Therapeutic laparoscopy completed	38 (48.7)
Converted to exploratory laparotomy	15 (19.2)
Reasons for conversion (n = 15)	
Hollow-viscus perforation	13 (86.7)
Complex mesenteric injury	2 (13.3)

Diagnostic laparoscopy demonstrated a positive intra-abdominal finding in 66 (84.6%) patients, while 12 (15.4%) had no significant intra-abdominal injury. Hemoperitoneum was the most frequent laparoscopic finding and was identified in 61 (78.2%) patients. Solid-organ injuries were observed in 37 (47.4%), including splenic injury in 24 (30.8%) and liver injury in 11 (14.1%) patients. Mesenteric injury was identified in 15 (19.2%), hollow-viscus injury in 13 (16.7%), small-bowel injury in 12 (15.4%), omental injury in 10 (12.8%), and diaphragmatic injury in 5 (6.4%) patients. Diagnostic laparoscopy alone was performed in 25 (32.1%) patients, whereas definitive therapeutic laparoscopy was successfully completed in 38 (48.7%). Conversion to exploratory laparotomy was required in 15 (19.2%) patients. Of these conversions, 13 (86.7%)

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were due to hollow-viscus perforation and 2 (13.3%) to complex mesenteric injury. Overall, 63 of 78 patients (80.8%) completed laparoscopic assessment or treatment without conversion to open laparotomy (Table 3).

Table 4: Agreement Between CECT and Diagnostic Laparoscopy and Overall Diagnostic Performance of CECT

A. Injury-specific agreement

Injury	CECT positive n (%)	Laparoscopy positive n (%)	Patient-level agreement (%)	McNemar exact *p*
Hemoperitoneum	64 (82.1)	61 (78.2)	96.2	0.250
Solid-organ injury	38 (48.7)	37 (47.4)	98.7	1.000
Splenic injury	25 (32.1)	24 (30.8)	98.7	1.000
Liver injury	11 (14.1)	11 (14.1)	100.0	1.000
Hollow-viscus injury	13 (16.7)	13 (16.7)	100.0	1.000
Mesenteric injury	15 (19.2)	15 (19.2)	100.0	1.000
Diaphragmatic injury	4 (5.1)	5 (6.4)	98.7	1.000

B. Overall diagnostic performance of CECT against the final reference standard

Diagnostic parameter	Estimate	95% CI
Sensitivity	98.5%	91.8–100.0
Specificity	91.7%	61.5–99.8
Positive predictive value	98.5%	91.8–100.0
Negative predictive value	91.7%	61.5–99.8
Overall diagnostic accuracy	97.4%	91.0–99.7

A high level of patient-level agreement was observed between CECT and laparoscopic findings for the principal intra-abdominal injuries. Agreement was 96.2% for hemoperitoneum, 98.7% for solid-organ injury, 98.7% for splenic injury, and 100% for liver, hollow-viscus, and mesenteric injuries. Agreement for diaphragmatic injury was 98.7%. None of the corresponding McNemar comparisons demonstrated a statistically significant discordance between CECT and laparoscopic findings ($p>0.05$). Using the final intra-abdominal diagnosis as the reference standard, CECT yielded 65 true-positive, 11 true-negative, one false-positive, and one false-negative result. This corresponded to a sensitivity of 98.5%, specificity of 91.7%, positive predictive value of 98.5%, negative predictive value of 91.7%, and overall diagnostic accuracy of 97.4% (Table 4).

Table 5: Operative and Postoperative Outcomes (n = 78)

Outcome	Corrected value
Operative duration, mean ± SD, min	88.2 ± 34.0
Estimated blood loss, median (IQR), mL	200 (150–300)
Blood transfusion required	18 (23.1)

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Therapeutic laparoscopy completed	38 (48.7)
Conversion to laparotomy	15 (19.2)
ICU admission†	20 (25.6)
ICU stay, median (IQR), days	0 (0–0.75)
Time to oral feeding, median (IQR), days	2 (1–2)
Hospital stay, median (IQR), days	6 (5–8)
Any postoperative complication	17 (21.8)
Minor complication	13 (16.7)
Major complication	4 (5.1)
Re-intervention required	2 (2.6)
Missed injury	1 (1.3)
30-day readmission	1 (1.3)
Mortality	0 (0.0)
Recovered and discharged	78 (100.0)

The mean operative duration was 88.2 ± 34.0 minutes, while the median estimated blood loss was 200 mL (IQR: 150–300 mL). Blood transfusion was required in 18 (23.1%) patients. Therapeutic laparoscopy was successfully completed in 38 (48.7%), whereas 15 (19.2%) required conversion to open laparotomy. The median time to oral feeding was 2 days (IQR: 1–2 days), and the median duration of hospital stay was 6 days (IQR: 5–8 days). Postoperative complications occurred in 17 (21.8%) patients, comprising 13 (16.7%) minor and 4 (5.1%) major complications. Re-intervention was required in 2 (2.6%) patients, while a missed intra-abdominal injury occurred in 1 (1.3%) patient. One patient (1.3%) required readmission within 30 days. No mortality was recorded, and all 78 patients were ultimately discharged (Table 5).

Discussion

The present prospective observational study evaluated the diagnostic and therapeutic role of laparoscopy in 78 haemodynamically stable patients with blunt abdominal trauma. The study population predominantly comprised young and middle-aged adults, with a mean age of 38.0 ± 15.2 years, and males constituted 80.8% of the cohort. Road traffic accidents were the leading mechanism of injury, accounting for 64.1% of cases, followed by falls from height (19.2%) and assault (10.3%). This demographic pattern is broadly consistent with the established epidemiology of blunt abdominal trauma, in which road traffic accidents constitute an important mechanism and males form a substantial proportion of affected patients.[1,2]

Clinical examination remained an important component of initial assessment. Abdominal pain was present in all patients, while abdominal tenderness was observed in 96.2% and guarding in 33.3%. FAST/ultrasonography was positive in 53 of 78 patients (67.9%). FAST is useful for rapid detection of intraperitoneal fluid but has recognised limitations in characterising specific bowel and mesenteric injuries. CECT therefore remains central to the assessment of haemodynamically stable patients because it provides detailed information regarding solid-organ, bowel, mesenteric, retroperitoneal, and

diaphragmatic injuries. Nevertheless, subtle hollow-viscus and mesenteric injuries may remain diagnostically challenging, particularly when imaging findings are indirect or equivocal.[2–4]

In the present study, CECT was positive in 65 patients (83.3%), while diagnostic laparoscopy demonstrated a positive finding in 66 patients (84.6%). Hemoperitoneum was identified laparoscopically in 61 patients (78.2%) and was the most frequent finding. Solid-organ injuries were identified in 37 (47.4%), including splenic injuries in 24 (30.8%) and liver injuries in 11 (14.1%). Mesenteric injury was identified in 15 (19.2%), while hollow-viscus injury was present in 13 (16.7%). These findings highlight the ability of laparoscopy to provide direct visual assessment of the abdominal cavity and to identify injuries requiring operative management. Previous studies have similarly demonstrated the usefulness of diagnostic laparoscopy in selected haemodynamically stable trauma patients.[2,5–7]

CECT showed excellent overall diagnostic performance in the present cohort. Against the final reference standard, there were 65 true-positive, 11 true-negative, one false-positive, and one false-negative classifications, yielding a sensitivity of 98.5%, specificity of 91.7%, positive predictive value of 98.5%, negative predictive value of 91.7%, and overall diagnostic accuracy of 97.4%. These findings reinforce the central role of CECT in haemodynamically stable blunt abdominal trauma. However, high overall diagnostic accuracy does not eliminate the potential clinical importance of an individual missed injury. Consequently, persistent clinical suspicion or an indication for operative evaluation despite apparently reassuring imaging may justify further assessment in appropriately selected patients.[3,4]

An important finding of the present study was the therapeutic utility of laparoscopy. Definitive therapeutic laparoscopy was completed in 38 patients (48.7%), while 25 (32.1%) required diagnostic laparoscopy alone. Thus, 63 of 78 patients (80.8%) completed their operative assessment or treatment without conversion to open laparotomy. Conversion to exploratory laparotomy was required in 15 patients (19.2%). The predominant reason for conversion was hollow-viscus perforation, accounting for 13 of the 15 conversions, while complex mesenteric injury accounted for the remaining two. These findings demonstrate that laparoscopy can progress from a diagnostic procedure to definitive minimally invasive treatment in a substantial proportion of carefully selected stable trauma patients. Studies by Lee et al., Lin et al., Koto et al., and other investigators have similarly reported that laparoscopy may reduce the requirement for open exploration in appropriately selected haemodynamically stable patients.[5–9]

The observed conversion rate of 19.2% should not necessarily be regarded as failure of laparoscopy. Diagnostic laparoscopy may serve as a triage procedure that identifies the nature and extent of injury before determining whether minimally invasive treatment is technically appropriate. Conversion is justified when safe and definitive laparoscopic treatment cannot be achieved. A systematic review and meta-analysis by Ki et al. found laparoscopy to be feasible in haemodynamically stable blunt abdominal trauma, with contemporary studies demonstrating improved laparoscopic completion rates as expertise and technology evolved.[10] The present findings therefore support a selective rather than obligatory laparoscopic approach, with timely conversion when indicated.

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Postoperative outcomes in the present study were acceptable. The mean operative duration was 88.2 ± 34.0 minutes, and median estimated blood loss was 200 mL (IQR 150–300 mL). Postoperative complications occurred in 17 patients (21.8%), comprising 13 minor and four major complications. The most frequent specific complications were port-site seroma and atelectasis, each occurring in five patients. Re-intervention was necessary in two patients (2.6%), while a missed injury occurred in one patient (1.3%). Median hospital stay was 6 days (IQR 5–8 days), and there were no deaths. All 78 patients ultimately recovered and were discharged.

The single missed injury deserves particular consideration because avoidance of missed bowel or mesenteric injury is an important concern when laparoscopy is used for abdominal trauma. Systematic exploration of the entire accessible abdominal cavity is therefore essential. The bowel should be examined carefully, and conversion should not be delayed when adequate visualisation cannot be achieved or when the extent of injury exceeds the capability of safe laparoscopic repair. Previous literature has similarly emphasized meticulous exploration, appropriate patient selection, and adequate laparoscopic expertise as prerequisites for successful application of minimally invasive surgery in abdominal trauma.[2,7,10]

The present findings are consistent with the broader transition toward minimally invasive management of selected abdominal trauma patients. Contemporary evidence and the WSES consensus support consideration of laparoscopy in haemodynamically stable patients requiring operative evaluation, provided adequate expertise, equipment, and appropriate patient selection are available.[12] The present study adds to this evidence by demonstrating that almost half of the study population underwent definitive therapeutic laparoscopy and approximately four-fifths completed operative assessment or management without conversion to laparotomy.

Several limitations should be considered while interpreting these findings. This was a single-centre observational study with a relatively small sample of 78 patients and lacked a contemporaneous laparotomy-only comparison group. Consequently, the present data cannot establish that laparoscopy independently reduced morbidity, hospital stay, or mortality compared with open surgery. Patient selection may also have influenced the favourable outcomes because only haemodynamically stable patients were included. Furthermore, long-term outcomes were not evaluated. Larger prospective multicentre studies with appropriate comparison groups are required to establish more precisely the diagnostic and therapeutic benefits of laparoscopy in blunt abdominal trauma.

Conclusion

Diagnostic laparoscopy was a feasible and clinically useful diagnostic and therapeutic modality in selected haemodynamically stable patients with blunt abdominal trauma. In this study, intra-abdominal injury was identified laparoscopically in 84.6% of patients, and definitive therapeutic laparoscopy was successfully completed in 48.7%. Conversion to laparotomy was required in 19.2%, predominantly for hollow-viscus perforation.

CECT demonstrated excellent diagnostic performance, with a sensitivity of 98.5%, specificity of 91.7%, and overall accuracy of 97.4%, confirming its central role in the evaluation of haemodynamically stable blunt abdominal trauma. Diagnostic laparoscopy should

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therefore be regarded as a complement to, rather than a replacement for, high-quality CECT, particularly when operative evaluation remains clinically indicated or when the nature and extent of an intra-abdominal injury require direct assessment.

The low re-intervention rate (2.6%), low missed-injury rate (1.3%), absence of mortality, and successful completion of laparoscopic assessment or treatment without conversion in 80.8% of patients support the feasibility of this approach in appropriately selected patients. Careful patient selection, systematic abdominal exploration, adequate laparoscopic expertise, and timely conversion to laparotomy when necessary remain essential for safe implementation.

Recommendations

Diagnostic laparoscopy should be considered early in haemodynamically stable patients with blunt abdominal trauma when clinical findings and imaging are inconclusive or when hollow viscus or mesenteric injury is suspected. Trauma centres should develop standardized protocols incorporating diagnostic laparoscopy into the evaluation pathway and promote adequate laparoscopic training to improve diagnostic accuracy and expand its therapeutic application. Further multicentre studies with larger sample sizes are recommended to validate these findings and establish uniform guidelines for patient selection.

Limitations

The present study was conducted at a single tertiary care centre with a relatively small sample size, which may limit the generalizability of the findings. The observational design without a comparison group may have introduced selection bias, and long-term postoperative outcomes were not evaluated. Larger prospective multicentre studies with longer follow-up are required to further define the role of diagnostic laparoscopy in blunt abdominal trauma.

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