

# Advancing Trauma Care: The Emerging Role of Diagnostic Laparoscopy in Blunt Abdominal Injury

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**Abstract:** *This study aimed to study the role of laparoscopy in blunt trauma abdomen and its benefits over other imaging techniques. This study included patients with blunt abdominal trauma admitted to surgical units of IGGMCH and Mayo Hospital Nagpur between March 2022 and August 2024. 30 cases of blunt trauma to the abdomen were taken into consideration. Among the 50 patients, most of the patients belonged to the 21-30 age group. Males are more commonly affected by Blunt trauma to the abdomen (76.67%) with the most common etiology being road traffic accidents. Pain was the most common symptom occurring in all 50 patients followed by vomiting. 83% of patients presented with intra-abdominal organ injuries, and 30% of the patients were having splenic involvement as diagnosed on both CECT (30%) and diagnostic laparoscopy (30%). The liver was the second most affected organ with the second most common injury (13.3% on CT and 16.67% on diagnostic laparoscopy) followed by small bowel injury and mesenteric injury. 74% of patients were managed by diagnostic laparoscopy with conservative management and 24% of patients were managed by diagnostic laparoscopy converted to exploratory laparotomy with a total mortality of 6.7%. Rest all patients recovered. Diagnostic laparoscopy offers significant therapeutic advantages; it is minimally invasive, helps achieve timely diagnoses, and reduces the incidence of negative laparotomies. Limiting unnecessary investigations and shortening hospital stays, not only enhances cost efficiency but also improves satisfaction for both patients and surgeons. Furthermore, it allows for effective visualization of intra-abdominal injuries, reducing the need for non-therapeutic laparotomies and minimizing the reliance on serial examinations.*

**Keywords:** Diagnostic laparoscopy, blunt abdominal trauma, spleen

## 1. Introduction

Blunt abdominal trauma is a significant health issue in India, leading to high morbidity and mortality rates across all age groups. This type of trauma accounts for a large percentage of injuries, primarily due to road traffic accidents, assaults, falls from height, and work-related incidents. It represents 6% to 14% of all traumatic injuries and is present in 7% to 10% of trauma victims, often co-occurring with orthopedic, thoracic, or central nervous system injuries in severe cases. Given that trauma is a leading cause of death in individuals under 35, addressing these injuries is critical for public health and safety initiatives.

Identifying serious intra-abdominal injuries in blunt abdominal trauma can be challenging, often leading to misdiagnosis or delays that contribute to increased morbidity and mortality. When imaging techniques like ultrasonography and CT scans yield inconclusive results, the decision-making process for surgeons becomes complex.

Diagnostic laparoscopy has emerged as a valuable tool for assessing and managing these cases, offering a less invasive option than traditional laparotomy. While laparotomy remains the standard approach, especially in cases of hemodynamic instability, laparoscopy may be considered for its diagnostic and therapeutic advantages. Specific indications for surgical intervention should be carefully evaluated to optimize patient outcomes.

Deciding between surgical intervention and non-operative management for blunt abdominal trauma often hinges on accurate diagnosis, which imaging alone may not provide. In such cases, diagnostic laparoscopy has become an effective

alternative for evaluating and treating intra-abdominal injuries.

The role of laparoscopy has expanded significantly in recent years, demonstrating its ability to improve surgical outcomes. It can be performed safely in stable patients and has shown a sensitivity of 90-100% in detecting abdominal trauma. This high sensitivity helps reduce unnecessary laparotomies and their associated complications, making laparoscopy a valuable tool in the management of blunt abdominal injuries.

## 2. Materials and Methods

This prospective study will include patients with blunt abdominal trauma admitted to surgical units of IGGMCH and Mayo Hospital Nagpur between March 2022 and August 2024. 30 cases of Blunt trauma to the abdomen will be taken into consideration.

### Inclusion Criteria

- Hemodynamically stable patient with blunt abdominal trauma
- USG showing hemoperitoneum
- Suspected cases of diaphragmatic injury
- Cases of intraperitoneal rupture of urinary bladder

### Exclusion Criteria

- Patients requiring immediate surgical intervention because of evidence of severe, continuous internal bleeding
- Established peritonitis
- Patients with penetrating abdominal wound
- Nontraumatic abdominal emergencies
- Patients with head injury/intracranial pressure
- Patients who are unfit for general anesthesia

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- Cardiac failure/pulmonary failure
- Chronic obstructive pulmonary diseases/ Chronic obstructive airway disease

**Study Design:** Prospective study

### **Investigations**

- Blood: Hb %, hematocrit, TLC, Blood Coagulation studies, Serum amylase, LFT, KFT, Arterial blood gas analysis
- Urine: Microscopy and analysis
- Plain x-ray of chest and abdomen
- USG Abdomen and pelvis and CT scan
- Diagnostic laparoscopy

### **3. Operative Procedure**

Preoperative protocol comprises of detailed history, general examination, per abdominal examination, laboratory investigation, and radiological investigation including X-ray chest and abdomen, USG, and CT followed by Diagnostic Laparoscopy which is the mainstay operative procedure in blunt trauma abdomen in this study.

Diagnostic laparoscopy helps in direct visualization of abdominal contents.

After initial resuscitation with IV fluids, antibiotics, analgesics, and blood transfusion, the diagnostic laparoscopy with a standard technique of 10 mm umbilical port (Hassan's open technique) and another working port of 5 mm for suction of blood and irrigation will be performed. The organs injured with grading and the type of injuries, the amount of blood in the peritoneal cavity, and associated gut or diaphragmatic injuries will be noted on the diagnostic laparoscopy.

Performing a comprehensive examination of the entire abdomen is a major limitation, particularly retroperitoneum. An important disadvantage is the requirement for General Anesthesia.

### **Contraindication:**

- Risk of tension pneumothorax.
- Suspected diaphragmatic injury
- Risk of injury to major blood vessels.
- Risk of air embolism.

Following are some procedural and intraoperative figures/images during Diagnostic Laparoscopy:



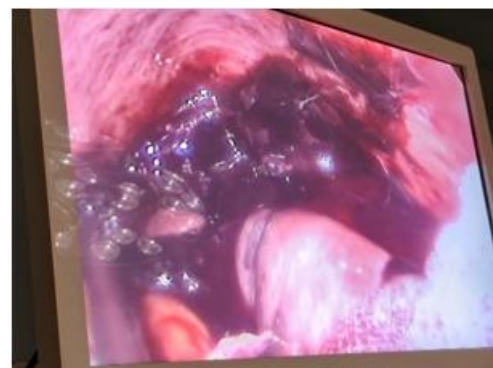
**Figure 1:** Laparoscopic Ports Insertion



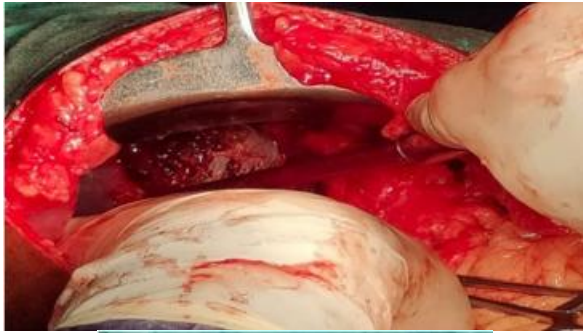
**Figure 2:** Hemoperitoneum secondary to blunt trauma to abdomen



**Figure 3:** Hemoperitoneum secondary to blunt trauma to abdomen



**Figure 4:** Hemoperitoneum secondary to blunt trauma to the abdomen



**Figure 5:** Diagnostic Laparoscopy converted to exploratory laparotomy with Splenectomy



**Figure 6:** Diagnostic Laparoscopy converted to exploratory laparotomy with resection and anastomoses

**Study Factor:** The study focuses on assessing the role and effectiveness of laparoscopy in managing patients with blunt abdominal trauma.

**4. Results**

**Table 1:** Age Distribution of the Patients

Age Interval	Number of patients & percentage (%)
11-20	5 (18%)
21-30	8 (27%)
31-40	5 (16%)
41-50	5 (16%)
51-60	4 (13%)
61-70	2 (8%)
71-80	1 (4%)

**Table 2:** Sex Distribution of the Patients

Sex	Patients
Male	23
Female	7

**Table 3:** Mode of Injury

Mode of Injury	Number of patients/Percentage
Motor Vehicle Collision	15 (50%)
Blow With Blunt Object	9 (30%)
Fall From Height	6 (20%)

**Table 4:** Latent Period

Time Interval	Number of patients/Percentage
0-4 hrs	15 (50%)
4-8 hrs	7 (23%)
8-16 hrs	4 (15%)
16-24 hrs	3 (10%)
>24 hrs	1 (2%)

**Table 5:** Signs and Symptoms

Signs and Symptoms	No. of patients (%)
Pain	30 (100%)
Vomiting	15 (50%)
Distension	27 (90%)
Urinary symptoms	3 (10%)
Tenderness	30 (100%)
Tachycardia	30 (100%)

**Table 6:** Pulse Rate

Pulse (per minute)	No. of patients	Percentage (%)
100-105	4	15%
106-110	6	18%
>110	20	66.66%

**Table 7:** Individual Organ Injured

Injured Organs	Number of patients	Percentage %
Spleen	9	30
Liver	5	16.67
Mesentery	2	6.67
Small intestine	3	10
Kidney	2	6.67
Large intestine	2	6.7
Pancreas	1	3.3
Urinary bladder	1	3.3
Diaphragm	2	6.67

**Table 8:** Finding on USG

USG Findings	Number of patients (%)
Hemoperitoneum	26 (86.6)
Free fluid in pelvis	1 (2)



**Table 9:** Findings on CECT Abdomen

Findings on CECT abdomen	
Findings	Number of patients (%)
Normal study	3 (10)
Hepatic injury	4 (13.3)
Large bowel injury	2 (6.67)
Small bowel injury	3 (10)
Splenic injury	9 (30)
Renal injury	1 (3.3)
Mesenteric tear	0 (0)
Bladder injury	1 (3.3)
Diaphragmatic injury	0 (0)
Pancreatic injury	1 (3.3)

**Table 10:** Findings on Diagnostic Laparoscopy Missed on CT

Findings on diagnostic laparoscopy	
Findings	Number of patients (%)
Normal study	3 (33)
Hepatic injury	5 (12)
Large bowel injury	2 (8)
Small bowel injury	3 (8)
Splenic injury	9 (23)
Renal injury	1 (3.3)
Mesenteric tear	2 (6.67)
Bladder rupture	1 (3.3)
Diaphragm injury	3 (10)
Pancreatic injury	1 (3.3)

**Table 11:** Line of Management

Line of management	Cases	Percentage
DL with Conservative management	22	74
DL converted to exploratory laparotomy	8	26

**Table 12:** Duration of Hospital Stay and Outcome:

Duration of hospital stay	
Duration and outcome	Cases n (%)
Duration (Days)	
0-3	21 (76)
3-6	8 (20)
6-9	1 (4)
Outcome	
Recovered	28 (93.3)
Expired	2 (6.7)
Total	30 (100)

## 5. Discussion

### 1) Distribution of Age

In this study, most of the patients belonged to the 21-30 age group, similar to the results obtained by N. Mehta et al (35). In the study by Suhas et al (37) and Sreenidhi et al (36), the 11-20 age group was the most commonly involved age, the second most common age group in our study. 77% of the patients belonged to 11-50 years of age. Thus in general most of the victims belonged to the young and working community.

### 2) Distribution of Sex

Males are more commonly affected by Blunt trauma to the abdomen. 76.67% were males in our study 79% in N. Mehta et al (35) study and 79.4% in the Fazili et al (38) study. The

ratio of males to females was found to be 3:1. In the study done by Suhas et al (37) and Sreenidhi et al (36), 90% of males were involved. All studies (35,36,37,38) showed a male preponderance. There is a male preponderance as they are the ones involved in outdoor activities including travel.

### 3) Mode of Injury

In all the series (35,36,37,38), a road traffic accident was the most common etiology. It was the reason for Blunt trauma to the abdomen in 50% of patients in this study and 53% of patients in N. Mehta et al (35) study. This is due to modernization and an increase in personal automobile use. Prevention of road traffic accidents can significantly decrease the incidence of Blunt trauma to the abdomen. This is followed by blows with blunt objects (30%) which is comparable to that obtained in Fazili et al study (38) (28.4%).

### 4) Latent Period (LP)

In all 50% patients presented in the first 4 hours of injury and 23% presented in the next 4 hours, in this study. In study conducted by N.Mehta et al (35) , 53.5% presented in the first 4 hours of injury. 25% patients presented after 8 hours which resulted in clinical deterioration and increased morbidity. The lesser the latent period, better the prognosis.

### 5) Signs and Symptoms

Pain was the most common symptom in our series presenting in 100% cases while it was present in 92.9% in N. Mehta et al study (35), which was similar to the other 2 studies (36,37). Vomiting was present in 50%. Pain is a reliable symptom and it should not be overlooked. Localized pain may also be indicative of possible organ injury. Tenderness was the most common sign present in 100% of patients in this study. In other studies (35,36,37,38) also, it was the commonest sign present in greater than 80% of cases.

### 6) Injured Organs

83% of patients presented with intra-abdominal organ injuries, and 30% of the patients were having splenic involvement. The spleen was the most common injured organ in the three series (35,36,38), though the percentages are variable, which is consistent with the international series (28). The reason for the difference is the inclusion and exclusion criteria. In this study, we excluded all head, chest, and orthopedic injuries requiring immediate intervention as they might affect morbidity and mortality. The spleen was followed by the liver in this series. Solid organ injury was commoner than hollow viscus injury, the spleen being the commonest among solid organs and the small intestine being common among hollow viscus injuries. In the genito-urinary tract, the kidney was most commonly injured. Among retroperitoneal organs, the kidney was the most common.

### Findings of Diagnostic Laparoscopy Missed on CT Abdomen

In this study most common organ involved and the most common injury was splenic injury as diagnosed on both CECT (30%) and diagnostic laparoscopy (30%). The liver was the second most affected organ with the second most common injury (13.3% on CT and 16.67% on diagnostic laparoscopy) followed by small bowel injury and mesenteric injury. These observations were comparable with a study held

by R Sahu et al (39) in which the most common injured organ and most common injury were to the spleen (45%) followed by the liver (40%).

### Line of Management

74% of patients were managed by diagnostic laparoscopy with conservative management and 24% of patients were managed by diagnostic laparoscopy converted to exploratory laparotomy.

### Hospital Stay and Outcome

A total of 2 patients died in our series. Twenty-eight patients were recovered after diagnostic laparoscopy. Therefore, mortality in the present study is 6.7%.

At the end of our discussion, we found that young male patients are particularly susceptible to abdominal trauma, with road traffic accidents (RTA) being the most common cause of injury. The spleen and liver are the organs most frequently injured, while bowel injuries are more prevalent among those who have undergone surgery. Mortality rates are higher in operated patients and those who present later for treatment. Overall, conservative management is more effective, yielding better outcomes than surgical intervention.

## 6. Conclusion

Laparoscopy and Contrast-Enhanced Computed Tomography (CECT) are vital in diagnosing blunt abdominal trauma (BAT), especially when conventional methods fail. Diagnostic laparoscopy (DL) offers significant therapeutic advantages; it is minimally invasive, helps in achieving timely diagnoses, and reduces the incidence of negative laparotomies. By limiting unnecessary investigations and shortening hospital stays, DL not only enhances cost efficiency but also improves satisfaction for both patients and surgeons. Furthermore, it allows for effective visualization of intra-abdominal injuries, reducing the need for non-therapeutic laparotomies and minimizing the reliance on serial examinations.

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