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Role of diagnostic laparoscopy in comparison with CT scan finding of patients presenting with abdominal trauma-A cross-sectional study

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ABSTRACT

Background: Trauma is a critical and urgent surgical condition that we encounter on a regular basis. Blunt trauma mechanisms account for 78.9–95.6% of all injuries, with the abdomen being affected in 6.0–14.9% of all traumatic injuries. Diagnostic laparoscopy (DL) for blunt abdominal trauma (BAT) is safe and feasible. Prerequisites are the hemodynamic stability of the patient and surgical expertise in advanced laparoscopy. **Aims and Objectives:** To find out the role of DL in the diagnosis and management of abdominal trauma patients. Effect on the length of hospital stay and rate of reduction of non-therapeutic laparotomy in the patients with trauma abdomen. **Materials and Methods:** This cross-sectional study was conducted with 50 patients of abdominal trauma with pre-structured pro forma and Written informed consent. A contrast-enhanced computed tomography (CECT) scan of the abdomen was done in hemodynamically stable patient and injury was noted. Patients meeting the inclusion criteria underwent DL. **Results:** The duration of hospital stay was lower in laparoscopically managed patients than in laparotomy patients. Most of the patients were managed conservatively 37 (74%) and thus by reducing non-therapeutic laparotomy. Overall recovery was 86% which signifies the reduction in mortality rate with the use of DL. In this study, clear diagnosis was obtained in 88% of the cases, so the efficacy is 88%. **Conclusion:** Laparoscopy and CECT abdomen has an effective diagnostic and management role in patients with BAT. The therapeutic value of DL is also accepted, well appreciated, and it cannot be underestimated.

Key words: Abdominal trauma; CT scan; Diagnostic laparoscopy

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INTRODUCTION

Trauma is a critical and urgent surgical condition that we encounter regularly. The majority of fatalities worldwide in people under the age of 35 years are caused by trauma. Blunt mechanisms account for 78.9–95.6% of all injuries, with the abdomen being affected in 6.0–14.9% of all traumatic injuries.[1] Abdominal injuries are the cause of considerable morbidity and mortality in both penetrating and blunt trauma.[2]

In the case of intra-abdominal organ damage, it is critical to determine whether or not surgery is required. An incorrect diagnosis might result in unneeded surgery. Every unnecessary surgical procedure carries the risk of increased mortality and morbidity.

Diagnostic laparoscopy (DL) allows direct visualization of intra-abdominal organs to confirm the damage and determine if laparotomy is required. DL can be performed under general anesthesia. Its advantages are minimal invasiveness, ease of use, direct visualization of organs, and primary laparoscopic repair options when possible.[3]

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For patients with blunt abdominal trauma (BAT), the role of laparoscopy is less clear than for those with penetrating abdominal trauma due to few reports. With advances in imaging and treatment, such as trans-arterial embolization, of bleeding vessels in solid organ injury in abdominal trauma has become the treatment of choice for most hemodynamically stable patients with BAT.[4] DL for BAT is safe and feasible. Prerequisites are the hemodynamic stability of the patient and surgical expertise in advanced laparoscopy. Early DL provides accurate confirmation of the absence of injury and allows patients to be discharged as early as 6 h after the procedure.[5]

DL modality allows for direct visualization of the peritoneal cavity and its contents, possible intervention, and conversion to an open approach should it be necessary. Furthermore, this treatment approach minimizes the invasiveness and inherent risks that exist when a patient is immediately subjected to laparotomy.[6] A study conducted by Hughes et al., showed that DL was negative in 33% of blunt trauma and 52% of penetrating trauma patients. The sensitivity/Specificity of laparoscopy in patients with blunt and penetrating trauma was 92%/100% and 90%/100%, respectively.[7]

Despite the significant improvements in emergency laparoscopy for trauma patients in developed countries, the adoption of laparoscopy in developing countries has been sporadic and minimal as it requires enhanced surgical expertise.[7] this study was conducted to know the role of DL in the diagnosis and management of BAT patients and also to highlight related challenges faced.

Aims and objectives

Aims

The aim of this study was to investigate the role of DL in the diagnosis and management of abdominal trauma patients and to highlight related challenges.

Objectives

To find out the

1. Role of laparoscopy in diagnosis and management of abdominal trauma
2. Comparison of laparoscopy versus CT scan finding
3. Effect of DL on the length of hospital stay
4. Rate of reduction of non-therapeutic laparotomy in the patients with trauma abdomen.

MATERIALS AND METHODS

This cross-sectional study was conducted in the Department of Surgery, Sanjay Gandhi Memorial hospital, associated with Shyam Shah medical college, Rewa, from April 2021 to June 2022 after clearance from the Medical College Ethical Committee [IEC No. 489].

50 patients with abdominal trauma were enrolled in this study. A pre-structured proforma was used. Written informed consent was obtained from all the study participants. The sample size was calculated by standard formula with a confidence interval of 95% and an error margin of less than 5%. The calculated sample size was 195. The study was designed during the COVID-19 pandemic, which resulted in a relatively small sample size.

Complete demographic profiles, along with the mode of injury, mechanism of injury, and type of injury, were entered in a pre-structured pro forma. Patients who were hemodynamically stable or responders after the primary survey and were fit enough to undergo a laparoscopic procedure were assessed.

Baseline investigations such as hemogram and renal function tests were recorded. Chest X-ray and X-ray of scout abdomen were done. A contrast-enhanced computed tomography (CECT) scan of the abdomen was done in patients who were hemodynamically stable Figure 1. Notes were made on the findings of the CECT scan abdomen, such as the presence of solid organ injury, grade of injury, presence of free fluid, pneumoperitoneum, mesenteric injury, retroperitoneal hematoma, etc. Patients who met the inclusion criteria underwent laparoscopic procedures Figure 2.

Inclusion criteria

Patients with abdominal trauma were found hemodynamically stable.

Exclusion criteria

Patients with the following criteria will be excluded:

(i) Hemodynamic instability,
(ii) Patients have a head injury and polytrauma
(iii) Pregnant women
(iv) Patients who were not fit for general anesthesia due to other comorbidities.

RESULTS

Average duration of hospital stay 10.56±8.60 days Table 6.

Above table shows that the maximum number of duration of hospital stay is 38 (76.0%) cases in 0–10 days, 10 (20.0%) cases were in 11–20 days of hospital stay, and only 4.0% cases were in more than 20 days of hospital stay. Total 7 patients expired out of 50.

DISCUSSION

The duration of hospital stay was lower in laparoscopically managed patients than in laparotomy patients. The overall

Table 1: Findings on CECT abdomen

Operative findings	Number of patients (%)
Normal study	18 (36.0)
Hepatic injury	04 (08.0)
Large bowel injury	03 (06.0)
Small bowel injury	05 (10.0)
Splenic injury	05 (10.0)
Hemoperitonium	03 (6.0)
Renal injury	03 (6.0)
Mesenteric tear	03 (6.0)
Bladder injury	02 (4.0)
Pneumoperitoneum	04 (8.0)

CECT: Contrast-enhanced computed tomography

Table 2: Findings on diagnostic laparoscopy (n=48)

Operative findings	Surgery	Number of patients (%)
Normal Study	Conservative	16 (33.0)
Hepatic injury	Conservative	03 (06.0)
Large bowel injury	Primary repair	06 (12.5.0)
Small bowel injury	Primary repair	07 (14.5.0)
Splenic injury	3 Conservative 1 Splenectomy	04 (08.0)
Hemoperitonium	Conservative	04 (8.0)
Mesenteric tear	Primary repair	05 (14.5.0)
Bladder rupture	Primary repair	03 (6.0)

Table 3: Comparison of CT abdomen versus diagnostic laparoscopy

Findings	CT abdomen (50)	Diagnostic (48) laparoscopy	P
Normal Study	18	16	0.1535
Hepatic injury	04	03	0.0912
Large Bowel injury	03	06	0.0623
Small bowel injury	05	07	0.102
Splenic injury	05	04	0.223
Hemoperitonium	03	04	0.1223
Renal injury	03	00	-
Mesenteric tear	03	05	0.0826
Bladder injury	02	03	0.1225
Pneumoperitoneum	04	00	-

P=0.396845, CT: Computed tomography

Table 4: Effect on management

Conservative (%)	Laparotomy (%)	P
37 (74)	13 (26)	0.0423

outcome in this series was positive; most of the patients were managed conservatively and thus by reducing non-therapeutic laparotomy Table 4.

All patients with hepatic injury (4 patients) underwent conservative treatment. Out of them positive outcomes were seen in 3 patients (75.0%) after 3 months of follow-up and 1 patient did not give consent for DL Table 1.

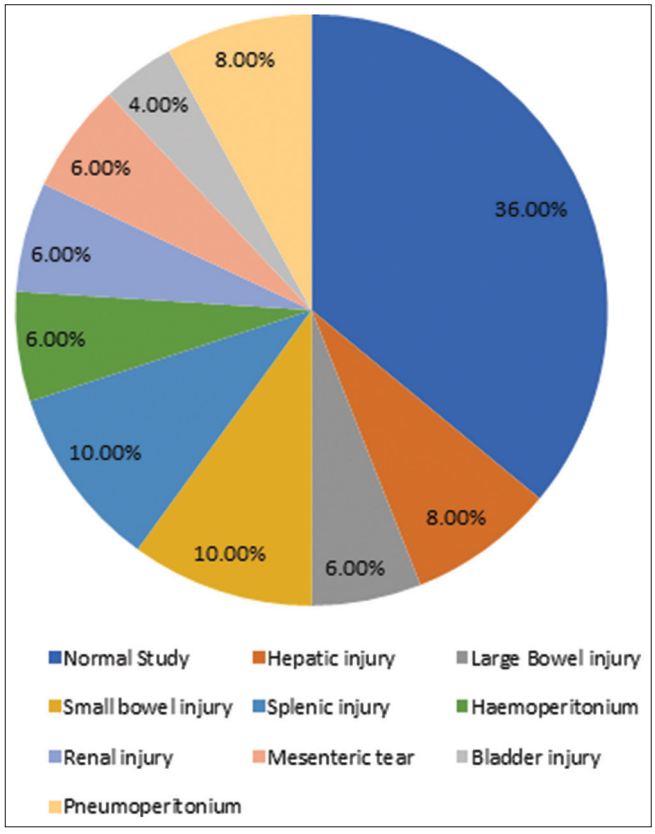
Table 5: Comparative analysis of organ injury

Organ injury	CT abdomen (%)	Diagnostic laparoscopy (%)
Solid organ injury	12 (24.0)	07 (14.5)
Bowel injury with mesenteric tear	11 (22.0)	18 (37.5)
Hemoperitonium	03 (06.0)	04 (8.3)
Other injuries	06 (12.0)	03 (06)
Normal study	18 (36.0)	16 (33.3)
Total	50	48

CT: Computed tomography

Table 6: Duration of hospital stay

Duration and outcome	Cases n (%)
Duration	
0–10	38 (76.0)
11–20	10 (20.0)
>20	2 (4.0)
Outcome	
Recovered	43 (86.0)
Expired	07 (14.0)
Total	50 (100.0)



Graph 1: Findings on contrast enhanced computed tomography abdomen

Thirteen patients have bowel injuries undergone primary repair, out of them, positive outcomes were seen in 12 patients (88.3%) after 3 months of follow-up Graph 1.

Table 7: Comparison of diagnostic efficacy of laparoscopy in various studies

Study	Efficacy	Number of cases	Year of study	Outcome (Pain response) (%)
Miller et al.[13]	89.8	59	1996	89.3
Salky and Edge[14]	76	265	1998	-
Raymond et al.[15]	85.7	70	2003	71.4
Maussa and Mahfiaz [16]	78.6	56	2004	80.2
El-Labban and Hokkam	83.3	30	2010	80
Talaskar et al.	82.8	35	2013	81.8
Present study	88	50	2022	86

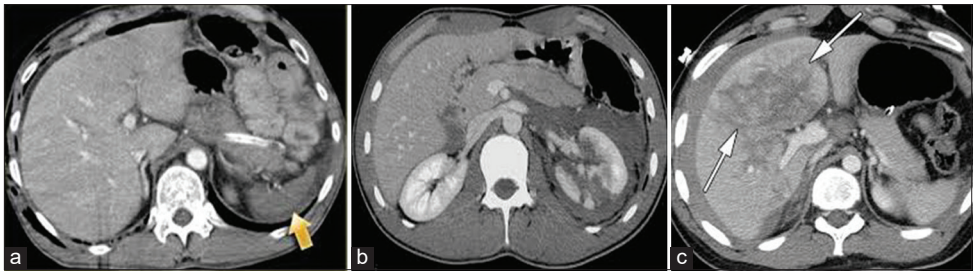


Figure 1: Different intra-abdominal findings on computed tomography scan. (a) Splenic laceration (b) Renal laceration. (c) Liver contusion

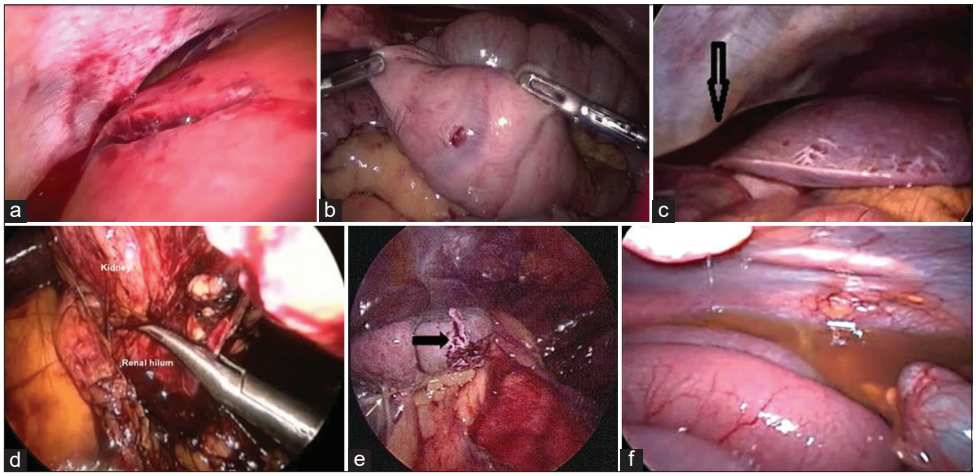


Figure 2: Different intra-abdominal findings on diagnostic laparoscopy. (a) Liver laceration. (b) Bowel perforation. (c) Hemoperitonium. (d) Renal injury. (e) Splenic injury. (f) Intraperitoneal fluid collection

All patients with renal injury (3 patients) underwent conservative treatment. Positive outcome was 100% Table 5.

All patients with hemoperitoneum and mesenteric tear (9 patients) underwent primary repair treatment; out of them, positive outcomes seen in 8 patients (88.8%) after 3 months of follow-up Table 2.

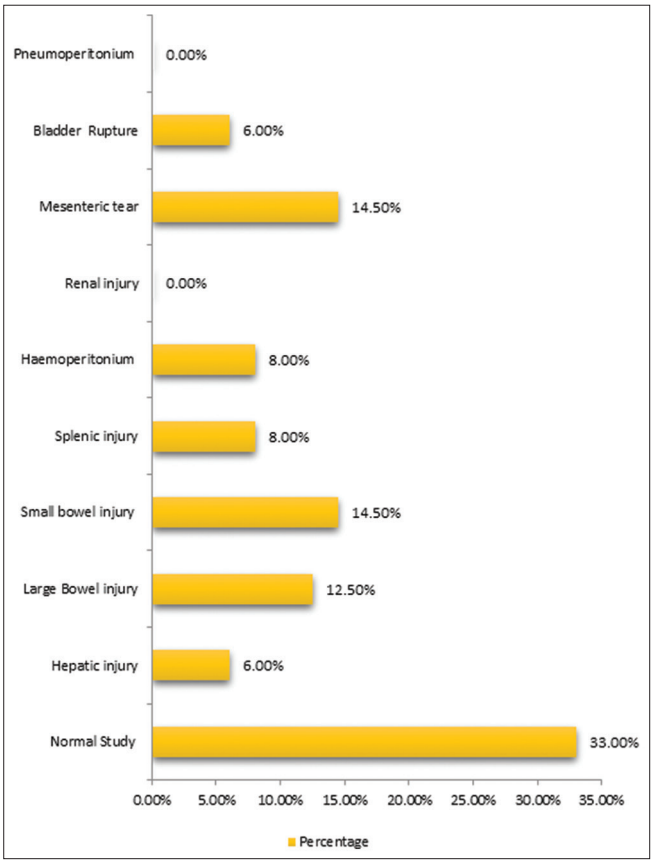
03 patients (06%) with bladder rupture underwent primary repair. The positive outcome was 100%. 4 (8.0%) patients with splenic injury, 3 (75%) managed conservatively 1 (25%) patient underwent splenectomy. 1 patient did not give consent for DL Graph 2.

In this study, clear diagnosis was obtained in 88% of the cases, so the efficacy is 88% Table 7.

The overall efficacy of our study was 88%. The efficacy of these studies was >80% giving an indication that DL has got a considerable impact in managing this difficult group of patients Table 3. The overall positive outcome seen in the above-mentioned studies after DL compares favorably with the results obtained by us. Hence, it can be concluded that it has an effective role in evaluating patients with acute abdominal pain due to trauma, in whom conventional methods of investigation have failed to elicit certain causes. The therapeutic value of DL is also accepted, well appreciated, and it cannot be underestimated.

Mortality

A total of 7 patients died in our series. Forty-three patients were recovered after DL. Therefore, mortality in the present study is 14% Table 6.



Graph 2: Findings on diagnostic laproscopy

The mortality rate in DiVincenti et al.'s[8] study was 23%.

Cox[9] study reports mortality of 10% and in Davis et al.'s study, it was 13.3%.

Hospital stay

In our study, mean duration of hospital stay in patients that were managed laparoscopically was 10.56±8.60 days and in those who underwent laparotomy was 17.8 days.

In the study of Taner et al.,[10] the mean hospitalization time was 2.75±1.20 days in patients who were managed laparoscopy, whereas it was 7.4±2.20 days in patients who underwent laparotomy.

In the study of Lee et al.,[11] the mean hospital stays of patients who managed laparoscopically was 11 days and who required laparotomy, was 21 days.

Koto et al.,[12] observed that the mean length of hospital stay was 11 days in both patient groups who were managed either laparoscopically or required laparotomy. In our study, the duration of hospital stay was comparable to the other studies.

Limitations of the study

Small sample size.

CONCLUSION

Laparoscopy and CECT abdomen have an effective diagnostic role in evaluating patients with BAT in whom conventional methods of investigations have failed to elicit a certain cause. The therapeutic value of DL is also accepted, well appreciated and it cannot be underestimated. Being minimally invasive laparoscopy has solved the problem of delay in the definitive diagnosis and had led to a considerable reduction in the number of negative laparotomies. It has also significantly reduced the number of investigations and days of hospital stay, which leads to a substantial reduction in the cost of treatment. DL also serves the problem of dissatisfaction of both surgeon and the patient, which is one of the main issues in the management of these problems. It accurately visualizes intra-abdominal injuries, and decreases and avoids non-therapeutic laparotomies. It removes the anxiety of serial examination in the setting of limited workhours and same-surgeon availability.

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REFERENCES

1. Centre's for Disease Control and Prevention, National Centre for Injury Prevention and Control. Web-based Injury Statistics Query and Reporting System (WISQARS). Available from: http://www.cdc.gov/injury/wisqars [Last accessed on 2020 Jul].
2. Federle MP and Jeffrey RB Jr. Hemoperitoneum studied by computed tomography. Radiology. 1983;148(1):187-192. https://doi.org/10.1148/radiology.148.1.6856833
3. Federle MP, Goldberg HI, Kaiser JA, Moss AA, Jeffrey RB and Mail JC. Evaluation of abdominal trauma by computed tomography. Radiology. 1981;138(3):637-644. https://doi.org/10.1148/radiology.138.3.6450962
4. Shuman WP. CT of blunt abdominal trauma. Radiology. 1997;205(2):297-306. https://doi.org/10.1148/radiology.205.2.9356606
5. Rhea JT. The frequency and significance of thoracic injuries detected on abdominal CT scans of multiple trauma patients. J Trauma. 1989;29(4):502-505. https://doi.org/10.1097/00005373-198904000-00015
6. Vadodariya KD, Hathila VP and Doshi SM. The role of Computed Tomography in blunt abdominal trauma as investigative tool conducted at tertiary level hospital, Vadodara. Int J Med Sci Public Health. 2014;3:433-435.
7. Hughes TM and Elton C. The pathophysiology and management of bowel and mesenteric injuries due to blunt trauma. Injury. 2002;33(4):295-302. https://doi.org/10.1016/s0020-1383(02)00067-0
8. DiVincenti FC, River JD, Laborde EJ, Fleming ID and Cohn I Jr.

Blunt abdominal trauma. J Trauma. 1986;8(6):1004-1013.
https://doi.org/10.1097/00005373-196811000-00002

9. Cox EF. Blunt abdominal trauma: A 5 year Analysis of 870 patients requiring celiotomy. Ann Surg. 1984;199(4):467-474.
https://doi.org/10.1097/00000658-198404000-00015
10. Taner AS, Topgul K, Kucukel F, Demir A and Sari S. Diagnostic laparoscopy decreases the rate of unnecessary laparotomies and reduces hospital costs in trauma patients. J Laparoendo Adv Surg Tech A. 2001;11(4):207-211.
https://doi.org/10.1089/109264201750539718
11. Lee PC, Lo C, Wu JM, Lin KL, Lin HF and Ko WJ. Laparoscopy decreases the laparotomy rate in hemodynamically stable patients with blunt abdominal trauma. Surg Innov. 2014;21(2):155-165.
https://doi.org/10.1177/1553350612474496
12. Koto MZ, Matsevych OY, Mosey F, Patel S, Aldous C and Balabyeki M. Laparoscopy for blunt abdominal trauma: A challenging endeavor. Scand J Surg. 2018;108:1457496918816927.
13. Karl Miller MD, Edith Mayer MD, Erich Moritz HD: The role of laparoscopy in chronic& recurrent abdominal Pain. Am J. Surg: 1996:172; 353-7.
14. Salky BA, Edye MB: The role of laparoscopy in the diagnosis and treatment of abdominal Pain syndromes; Surg Endosc: 1998; 12(7):911-4.
15. Raymond P, Onders MD, Elizabeth A, Mittendorf MD: Utility of laparoscopy in chronic abdominal Pain. Surg : 2003; 134(4): 549-54.
16. Moussa, Amal E Mahfouz. Role of laparoscopy in the management of unexplained chronic abdominal pain. Egyptian Journal of Surgery, Jan 2004; Vol (23), No 1.

Authors Contribution:
SSY- Definition of intellectual content, literature survey, prepared first draft of manuscript, implementation of study protocol, data collection, data analysis, manuscript preparation and submission of article; **LS-** Concept, design, clinical protocol, manuscript preparation, editing, and manuscript revision; **RG**- Design of study, statistical analysis and interpretation; review manuscript; **AHM**- Literature survey and preparation of figures; **EJ**- Coordination and manuscript revision.

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