

Role of Diagnostic Laparoscopy in the Evaluation of Blunt Injury to Abdomen in Haemodynamically Stable Patients**Reethika Thatikonda¹, Komararagiri Ramachandra Rao², A. Sashidhara Rao³, Preerana Bhandari⁴, Sridhar Punyapu⁵, Gorthi Sathyanarayana⁶**¹Assistant Professor, Department of General Surgery, Kamineni Academy of Medical Sciences and Research Centre, Hyderabad, Telangana²Classified Specialist, Command Hospital, Northern Command, Udhampur³Associate Professor, Department of General Surgery, Kamineni Academy of Medical Sciences and Research Centre, Hyderabad, Telangana⁴Assistant Professor, Department of General Surgery, Kamineni Academy of Medical Sciences and Research Centre, Hyderabad, Telangana⁵Professor and HOD, Department of General Surgery, Kamineni Academy of Medical Sciences and Research Centre, Hyderabad, Telangana⁶Senior Consultant Surgeon, Department of General Surgery, Kamineni Hospital, LB Nagar, Hyderabad, Telangana

Received: 10-09-2023 Revised: 23-10-2023 / Accepted: 26-11-2023

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Conflict of interest: Nil

Abstract

Patients with blunt injury abdomen who are haemodynamically stable selective non-operative management has shown good results. Diagnostic Laparoscopy is a minimally invasive procedure that allows rapid and thorough inspection of whole abdominal cavity. Surgical intervention can also be done, if necessary, in the same procedure. This reduces the incidence of emergency laparotomies which decreases the mortality and morbidity of these patients.

Aim and Objectives: To assess the role of Diagnostic Laparoscopy in the management of Blunt Injury to Abdomen in Hemodynamically stable patients. To assess the incidence of Hollow viscus Injury, Mesenteric injury and persistent bleeding not detected by clinical or radiological assessment.

Material and Methods: 30 patients of Blunt Trauma of Abdomen, who were haemodynamically stable and were subjected to Diagnostic Laparoscopy were analyzed for clinically and radiologically missed injuries.

Results: A total of 30 patients were studied. The Male to female ratio was 11:4 and the mean age was 33.46 years. Common age group affected was 20-40 with a 59.94 % prevalence. Most common organ injured in blunt trauma to abdomen was Liver (79.92%). One case of Hollow viscus injury (3.33%) was discovered on Diagnostic Laparoscopy which could not be detected on CT scan. Two cases of Mesenteric tear (prevalence of 6.66%) were detected, ongoing bleed was detected in three patients (prevalence of 9.99%) on diagnostic Laparoscopy. The liver injuries were managed laparoscopically. Diagnostic Laparoscopy to Open Laparotomy Conversion was required only in 2 cases (6.66%). Therapeutic Laparoscopy was performed for 4 patients (13.32%). Wound infection was the only complication seen in two patients, (6.66%) and there were no missed organ injuries post diagnostic laparoscopy.

Conclusion: Diagnostic Laparoscopy can be a recommended modality in the diagnosis and management of haemodynamically stable patients with blunt trauma to abdomen.

Keywords: Blunt injury of Abdomen, Diagnostic Laparoscopy, Missed Organ Injuries.

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Introduction

Injury management has been an important assignment of the practicing surgeons. The treatment of trauma demands a mastery of diverse skills spanning all areas of anatomy and physiology. Because of the great disease burden due to injury sustained in conflict, care for the trauma patient has been advanced most profoundly during wartime. Common themes that have evolved

over time include improvements in wound management, resuscitation, and systems of care. The common causes for blunt trauma to abdomen include road traffic accidents, assaults, fall from height and industrial accidents. The most common cause of being road traffic accident [2]. Common organs to be injured during such accidents include liver, spleen, kidney, and pancreas, stomach, small

bowel and large bowel. Spleen being the most common organ to be injured. CT SCAN is an acceptable method of investigation in patients with blunt trauma of abdomen [3]. CT scan has the highest sensitivity for detecting the injuries to liver (100%) and spleen (86.6%). The accuracy of CT imaging to detect the injuries to spleen, liver, kidney and retroperitoneal hematoma was reported to be 96.1%, 94.4%, 91.6% and 91.6% respectively [4].

But ongoing bleed, mesenteric tear is difficult to identify on CT scan. CT SCAN has an accuracy of 75% on diagnosing mesenteric injury and accuracy of 84% for diagnosing bowel injury. Computed tomographic scan are not fully sensitive in detecting hollow viscus and diaphragmatic injuries. [5, 6]

The usual complications of patients being treated conservatively are re-bleed, peritonitis due to hollow viscus perforation and ischemia of bowel due to undetected mesentery injuries. Diagnostic laparoscopy has been proposed for trauma patients to prevent unnecessary exploratory laparotomies, with their associated higher morbidity and cost [7].

Clinical symptoms and signs of the usual complications like hypotension, guarding and rigidity maybe masked since the patient is treated with IV fluids, IV analgesics and antibiotics. These symptoms also take some time to manifest, almost 24-48 hours after the injury. Hence there might be a delay of diagnosis. Delay in operative intervention is associated with an increased morbidity and mortality. A high index of suspicion is needed to make a timely diagnosis and minimize risk [8]. Exploratory laparotomies in trauma, in patients with suspected intra-abdominal injuries are associated with a high negative laparotomy rate and significant morbidity. Diagnostic laparoscopy has been proposed for trauma patients to prevent unnecessary exploratory laparotomies. Many studies have documented the feasibility and safety of the procedure in trauma patients. Diagnostic Laparoscopy gives a chance of early detection of clinically and radiologically missed conditions. It might help in timely therapeutic intervention which reduces morbidity and mortality.

Materials and Methodology

The present study is a Prospective Observational Clinical case study conducted in Department of General Surgery, Kamineni Academy of Medical Sciences and Research Centre, L.B. NAGAR, Hyderabad. From September 2019- August 2021, for a total period of 2 years.

Study Sample

30 cases clinically diagnosed as Blunt Trauma of Abdomen and confirmed radiologically, have been

studied. Sample size has been calculated using single proportion formula. $n = Z^2 P (1-P)/d^2$ n – sample size Z – 1.96 P – expected prevalence of proportion (5 %) d – precision (5 %, d=0.05).

Inclusion Criteria

1. All cases of blunt abdomen trauma who are haemodynamically stable.
2. Patients who do not have evidence of hollow viscus injury on radiological assessment.

Exclusion Criteria

1. Patients in whom CT scan was not done.
2. Patient with more than 2L of IV fluids for resuscitation.
3. Heart rate >100.
4. Respiratory rate >28/min.
5. Patients refusing for diagnostic laparoscopy.
6. Patients with severe pneumo-thorax and GCS less than 4.

A detailed history and thorough clinical examination were done and a provisional diagnosis was obtained. Diagnostic Laparoscopy is performed under general anaesthesia. We have used low insufflation pressures (8–12 mmHg). The pneumoperitoneum is created through a periumbilical incision by open technique using Hasan's Trocar. A 30° laparoscope is used, and additional trocars are used for organ manipulations. The peritoneal cavity is examined systematically with changing of patient positioning and manipulations. The colon is mobilized and the lesser sac is inspected. Suction/irrigation is used for optimal visualization. All the Organs of abdomen Liver, Spleen, Mesentery, Kidney, Pancreas, Hollow Viscus injury, any vascular injury and ongoing bleed were diagnosed. Therapeutic intervention through laparoscopy is performed whenever it was necessary and converted to laparotomy when therapeutic laparoscopy is not feasible. Exploratory laparotomies in trauma patients with suspected intra-abdominal injuries are associated with a high negative laparotomy rate and significant morbidity. Diagnostic laparoscopy has been proposed for trauma patients to prevent unnecessary exploratory laparotomies. The findings were noted down in the proforma designed for the study. Data was entered in Microsoft Excel and analysis was done using SPSS version 20. Descriptive statistical analysis was done. Simple mathematical expressions like percentage were also used. Statistical analyses were performed using statistical package for social science (SPSS) software, latest version.

Ethical approval

The study was approved by the Institutional Ethics Committee institution and was informed consent obtained from study participants

(IECECR/58/Inst/AP/2013/RR-19 and date-29/10/2019). Study was in line with the Declaration of Helsinki.

Results

The Mean age group was 32.1667 +/- 12.511 and range from 7 -61years). Majority of the study population were in the age group of third and fourth decade. Males were more 73.33% (22) compared to females 26.66% (8) in this study with male to female ratio 11:4.

Table 1: Age distribution of patients

Age in Years	Total N=30	Percentage
<10	2	6.66%
10-19	2	6.66%
20-29	9	29.97%
30-39	9	29.97%
40-49	4	13.32%
50-59	3	9.99%
>60	1	3.33%

In the present study most common mode of injury was Road Traffic Accidents (23 cases) 76.66%, followed by fall from height (3 cases) 9.99%. Then Accidents and Assault which were (2 cases) 2.22% each.

Table 2: Mode of Injury

Mode of Injury	Total (N=30)	Percentage
RTA	23	76.66%
Fall From Height	3	9.99%
Industrial Accidents	2	6.66%
Assault	2	6.66%

Organs Injured Based on CT scan Findings and Laproscopic Findings

In the Present Study Liver was the most commonly injured organ 79.92% (24 cases) followed by Spleen 36.33% (11 cases) both on CT and Intra-operatively. Followed by Kidney 6.66% (2 cases) and Pancreas 6.66% (2 cases). There were no vascular injuries at all. Hollow Viscus injury in one case (3.33%) and Mesenteric Injuries in 2 cases (6.66%) were only detected on diagnostic laparoscopy. On Going bleed from solid organ injuries was seen on diagnostic laparoscopy in 3 cases (9.99%). P value=0.0237 was calculated using Fischer Exact Test and was found to be significant P<0.05. In this study a total of 6 Therapeutic Procedures were done after diagnostic laparoscopy.

Out of which 4 were carried out in Laparoscopy 66.66% and two were converted from Laparoscopy to Laparotomy 33.33%.

Laparoscopy assisted procedures

Intra-corporeal sutures were used to repair Mesenteric Injuries in 2 cases and ongoing bleed from Liver was stopped using gel foam application and Omental packing in 2 cases.

Laparotomy

One Splenectomy was done and one Perforation was repaired for Hollow viscus Injury. Only surgical site infection was a complication noted in 2 patients (7.14%). There were no other complications found in the present study. There was no mortality in this study.

Table 3: Organs Injured Based on CT scan Findings and Laproscopic Findings

Organ Injured	Total N=30 On CT Findings	Percentage	Intra-Operative	Percentage
Liver	24	79.92%	24	79.92%
Spleen	11	36.33%	11	36.33%
Mesentry	Nil	Nil	2	6.66%
On Going Bleed	Nil	Nil	3	9.99%
Kidney	2	6.66%	2	6.66%
Pancreas	2	6.66%	2	6.66%
Hollow Viscus	Nil	Nil	1	3.33%
Vascular	Nil	Nil	Nil	Nil

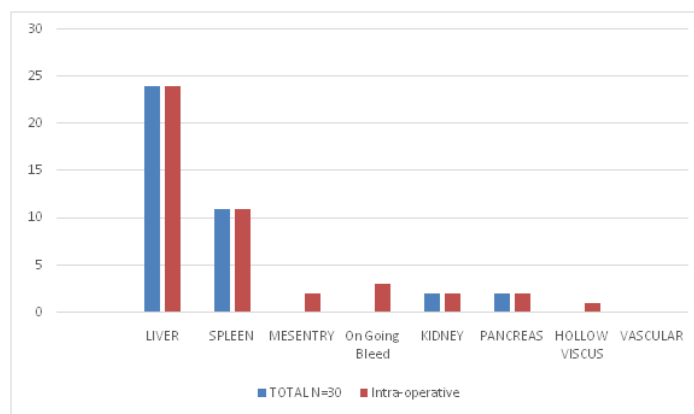


Figure 1: Showing Different organs injured based on Intra-operative and CT findings

In the present study CT scan grading of solid organs, based on AAST Grading. Most common Grade of Liver injury was Grade 1- 37.75 % followed by Grade 3 – 33.33%, then Grade 2-20.8% and Grade 4 -8.33%. There were no Grade 5 and Grade 6 injuries in this study. In this study Grade 1 and Grade 2 splenic injuries were more common with 36.36% (4 cases) each. Followed by Grade 3, 27.27% (3 cases) there were no Grade 4 and Grade 5 injuries in this study.

Table 4: Different organ injuries noted on diagnostic laparoscopy when compared with CT scan findings

Organ injury	CT scan findings	Intra-operative findings n=30	Percentage
Mesentry	Nil	2	6.66%
Hollow Viscus	Nil	1	3.33%
On Going Bleed	Nil	3	9.99%

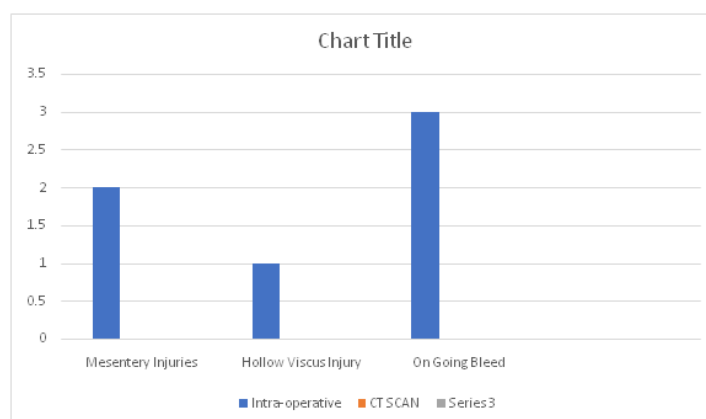


Figure 2: Organ injuries noted on diagnostic laparoscopy when compared with CT scan findings

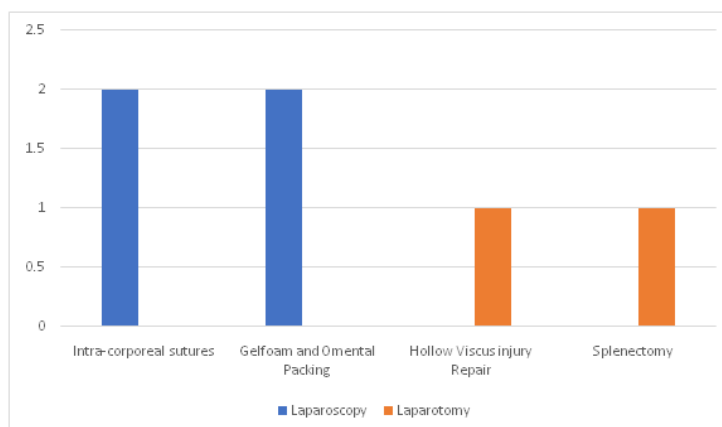


Figure 3: showing different kinds of therapeutic interventions performed

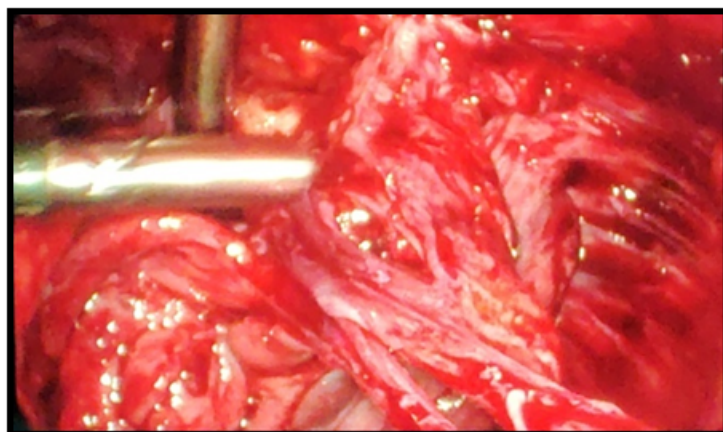


Figure 4: Mesenteric Injury

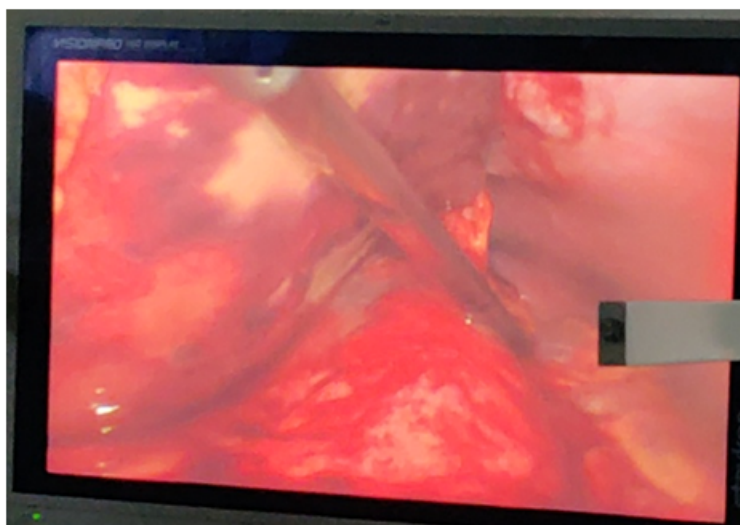


Figure 5: Drainage of Clots and collected blood in peritoneum

Discussion

Our study population included 30 patients of Blunt Trauma of Abdomen, who were haemodynamically stable and did not have any radiological or clinical evidence of hollow viscus injury were subjected to Diagnostic Laparoscopy. The mean age \pm standard deviation (range) in our study was 32.17 \pm 12.5 (range 7-61 years). There were 22 males (73.33%) and 2 females (26.66%) in our study. Similar age and gender distribution was observed in studies done by Po Chu Lee et al, [9] J.J. Johnson et al [10] and Heng-Fu Lin et al.[11]

In this study most common cause for blunt trauma Abdomen was Road Traffic Accident 23 cases (76.66%) followed by fall from height 3 (9.99%) and assault and industrial accidents 2 each (6.66%). In all the previous studies Road Traffic Accident was shown to be the most common cause of Blunt Trauma of Abdomen. M.Z. Koto et al [12] showed RTA as the most common cause 16 (59%). Lee et al [9] showed RTA 39 (81.3%), Fall 5 (10.4%), Assault 3 (6.3%). Lim et al¹³ showed RTA as a most common cause 23 (56.2%), Fall 3 (7.3%), Work-related injury 3 (7.3%) Assault 1 (2.4%).

Organs Injured Based on CT scan Findings and Laproscopic Findings

In our study the most common organ injured was Liver 24 cases with a prevalence of 79.92%, followed by Spleen 11 cases (36.33%). Followed by kidneys and pancreas 2 cases (6.66%) each. Lee et al [9] reported Liver and bowel injury to be most common followed by Mesenteric injury. Whereas M.Z. Koto et al [12] showed bowel injuries as the most common organ injured followed by mesenteric injuries. Lim et al [13] also showed bowel injury as the most common organ to be injured followed by Mesenteric injuries. This variation can be explained by demographic variations and relatively small sample size in the present study.

In the present study Grade 1 and Grade 2 injuries were more common with 36.36% (4 cases) each. Followed by Grade 3. 27.27% (3 cases) there were no Grade 4 and Grade 5 injuries in this study. Bhansod AN et al [14] reported Grade 3 and Grade 4 injuries 28.57% as most common, followed by Grade 1 and Grade 2 injuries 21.43%. In this study Grade 1 and Grade 2 splenic injuries were more

common with 36.36% (4 cases) each. Followed by Grade 3. 27.27% (3 cases) there were no Grade 4 and Grade 5 injuries in this study. Bhansod AN et al [14] noted grade 3 injury as the most common prevalence 73.91%, followed by Grade 2 and 4 with 13.04% each. CT scan was not able to pick up 2 cases of Mesenteric Injury, 1 case of Hollow viscus Perforation, 3 cases of ongoing bleed in two cases of Liver Injury and one case of Splenic Injury, which were picked up by Diagnostic Laparoscopy in our study. The P value is 0.00237 which is shown to be significant. (P value <0.05.) The previous studies no one had studied the missed organ specific injuries.

In the present study out of 30 cases of Blunt trauma of abdomen who underwent Diagnostic laparoscopy, 6 patients which is 20 %, underwent definitive therapeutic procedures. Definitive treatment was done by Therapeutic Laparoscopy in 4 cases which was 13.3%. Lim et al [13] reported that 24.3%, Wafa et al [15] reported 33.3 % and Koto et al [12] reported 56% of their patients underwent Therapeutic Laparoscopy.

2 cases of Mesenteric Tears 6.66% were repaired laparoscopically by Intra-corporeal Sutures. Koto et al [12] reported 3 patients (30%) underwent laparoscopic therapeutic Procedures for Mesenteric tear repair. Cirrochio et al [16] reported 6.6% of Mesenteric Injuries being repaired by Laparoscopy. Lim et al [13] showed seven cases of Mesenteric Injury being repaired by Laparoscopy. Mesenteric tears were present more towards the bowel and not towards the root of mesentery, hence repaired with sutures as there was no active bleed and this was done to prevent future internal herniation. 2 cases of on-going Liver Bleed were managed with laparoscopy. Cirrochio et al [16] reported 12.9% of Liver injuries being controlled by Laparoscopy. Mild to Moderate bleed was identified in two cases with collected blood of 150-200ml, Liver injuries noted were of Grade 2 and Grade 3. application of pressure was tried and was successful in controlling the bleed. Gel foam and Omental Packing was done for these patients. Drains placed showed no evidence of frank bleed post-operatively, they were removed after two days.

2 Patients who underwent diagnostic laparoscopy were converted to laparotomy, which is 6.66%. Koto et al [12] reported 23 % conversion rate. Small bowel Perforation was converted to Laparotomy to Repair the bowel perforation. One patient Open Splenectomy was done as the injury was Grade 3 Splenic Injury with ongoing bleed. Only surgical site infection was a complication noted in 2 patients (7.14%). There were no other complications found in the present study. There was no mortality in this study. No Missed Injuries were found in this study. Lee et al [9] reported 4.2% of Wound infections and 4.2% of Intra-

Abdominal Abscess. J Johnson et al [10] reported complications in 3 of the cases.

There were no Missed Injuries post diagnostic laparoscopy in the present study. Lim et al [13] showed missed injuries of 0.9%. Cirrochi et al showed missed injuries of 1.5% [16].

Summary

This prospective observational study conducted at department of General Surgery in Kamineni Academy of Medical Sciences and Research Centre on patients with Blunt Injury to Abdomen who are haemodynamically stable for a period of two years from September 2019 to September 2021. A total of 30 patients were included in this study. Male to female ratio was 11:4. The mean age was 33.46 years (range 7-62) and most common age group affected was 20-40 years with a 59.94% prevalence. Most common organ injured in blunt trauma to abdomen was found to be Liver which was 79.92%. Hollow viscus injury was discovered on Diagnostic Laparoscopy in one of the patients 3.33%, Mesenteric tear was detected in two of the patients on Diagnostic Laparoscopy with prevalence of 6.66%, Ongoing bleed was detected in three of the patients on diagnostic Laparoscopy, with a prevalence of 9.99% which could not be detected on CT Scan.

The liver injuries were managed laparoscopically with cauterization and Gel-foam application and Omental Packing. Diagnostic Laparoscopy to Open Laparotomy Conversion was required only in 2 cases (6.66%). Therapeutic Laparoscopy was performed for 4 patients (13.32%). Wound infection was seen in two patients, (6.66%) they were, managed with antibiotics and drainage. There were no missed injuries post diagnostic laparoscopy.

Study limitations

A RCT with a bigger sample size, would give definitive results about the role of Laparoscopy in Patients with Blunt Trauma Abdomen.

Prospects for further research

Combining with different Trauma Scoring systems and Imaging modalities, the role of laparoscopy for predicting the outcome including morbidity and mortality in blunt trauma of abdomen shall be validated.

Conclusion

Diagnostic Laparoscopy can be carried out in patients of Blunt Trauma of Abdomen, who are Haemodynamically stable without any increase in morbidity or mortality. It is a highly useful tool to detect injuries which could not be detected on CT scan. Laparoscopic surgery can be used both as a diagnostic and therapeutic modality. Laparoscopy

helps in reducing the negative Laparotomies and significant decrease in both morbidity and mortality.

With advances in Technology and increasing in expertise in Laparoscopy, it can be concluded that Diagnostic Laparoscopy is a valuable modality in the diagnosis and management of patients with blunt trauma to abdomen.

Conflict of interest

The authors declare there is no conflict of interests.

Financing

The study was conducted with no financial support.

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