



E-ISSN: 2616-3470  
P-ISSN: 2616-3462  
© Surgery Science  
[www.surgeryscience.com](http://www.surgeryscience.com)  
2021; 5(1): 338-342  
Received: 24-12-2020  
Accepted: 09-02-2021

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## Role of diagnostic laparoscopy in blunt abdominal trauma

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**DOI:** <https://doi.org/10.33545/surgery.2021.v5.i1f.633>

### Abstract

**Background:** The appropriate treatment for patients with blunt abdominal trauma depends on the precise diagnosis of the presence and severity of intra-abdominal injuries. Laparotomy, however, has remained the management of choice in certain situations following blunt abdominal trauma such as in patients who have free intraperitoneal fluid of uncertain origin, signs indicating intestinal ischemia caused by mesenteric bleeding, and signs indicating hollow viscus perforation. The objective of the study is to determine the role of diagnostic laparoscopy in blunt abdominal injuries.

**Method:** A prospective study was conducted in general surgery department in Sree Mookambika Institute of Medical Sciences, kulasekharan, Tamil Nadu., a tertiary care center including all patients with blunt trauma abdomen who underwent diagnostic laparoscopy during the time period from June 2019 to December 2020.

**Results:** 27 males and 3 females were selected in this study. The most common mode of injury was vehicle collision. Out of 30 diagnostic laparoscopies, 12 patients had solid organ injury, 5 patients had bleeding with no organ injury, 2 patients had mesenteric vascular injury, 2 patients had small bowel perforation. There were no findings in laparoscopy in 7 patients. Laparoscopy was converted to open Laparotomy in 3 patients. Therapeutic Laparoscopy were done in 20 patients.

**Conclusion:** Laparoscopy can play an important role in diagnosis and treatment of blunt and penetrating trauma in hemodynamically stable patients. Low missed injury rates, reduced duration of hospital stay, faster recovery and reduced cost make it an attractive and safe alternative to classical trauma laparotomy.

**Keywords:** Diagnostic laparoscopy, blunt injury abdomen, therapeutic laparoscopy

### Introduction

The majority of fatalities worldwide in people under the age of 35 years are caused by trauma. Blunt mechanisms account for 78.9 to 95.6% of injuries, with the abdomen being affected in 6.0 to 14.9% of all traumatic injuries [1]. Non operative management (NOM) has been widely implemented, especially in blunt abdominal trauma. However, apart from hemodynamic instability, other specific indications call for proactive surgical diagnosis and treatment. While laparotomy has been the standard procedure for these settings, laparoscopy may be considered as an alternative. laparoscopy may help to avoid unnecessary laparotomies, provide accurate diagnosis and helps to plan surgical treatment.

The main function of laparoscopic evaluation is to detect the presence or absence of intra-abdominal organic lesion, it allows, not only direct inspection of the abdominal cavity, but also surgical intervention, if needed. Diagnostic Laparoscopy is a minimally invasive surgical procedure that allows the visual examination of intra-abdominal organs in order to detect pathology. Diagnostic Laparoscopy was first introduced in 1901, when the German surgeon George Kelling performed a peritoneoscopy in a dog, which was called "celioscopy". A Swedish internist named H. C. Jacobaeus is credited with performing the first 2 diagnostic laparoscopy in humans in 1903 [2]. The diagnostic value of emergency laparoscopy has been proved since the 1950s and 1960s, but emergency diagnostic laparoscopy with surgical intervention is recent.

It was first proposed by Philippe Moment in 1990. Despite new X-ray techniques, or scans, and ultrasound, the diagnosis of acute abdomen can be difficult at times. So far, the cost-effective non-invasive method of diagnosis is ultrasound, but that is not reliable as it is operator dependent. History and physical examination will generally lead to correct diagnosis occasionally but diagnostic laparoscopy when compared to open laparotomy is better in the

absence of adhesions where whole of the peritoneal cavity can be visualized but in case of retroperitoneal lesions, due to lack of tactile sensations, the lesion cannot be palpated which is possible by open laparotomy. The procedure allows rapid and thorough inspection of the paracolic gutters and pelvic cavity that is not possible with the open approach. The emergency laparoscopic approach for patients with acute abdomen improves the diagnostic accuracy and is therefore nowadays recommended and accepted worldwide [3]. Hence diagnostic Laparoscopy should be considered for hemodynamically stable patients with blunt trauma abdomen, as it is minimally invasive, safe, efficacious and effective diagnostic modality and can be performed rapidly, safely with minimal sequel. Other than physical examination, various diagnostic methods, including abdominal ultrasound, diagnostic peritoneal lavage, and computed tomography (CT), are used for the evaluation of patients with blunt abdominal trauma. Urgent laparotomy can be life saving for hemodynamically unstable patients with signs of massive intra-abdominal hemorrhage. The laparoscopic approach has become the method of choice for many abdominal surgeries and has begun to be used in the trauma situations.

### Materials and methods

This was a prospective study done on patients in department of General Surgery, Sree Mookambika Institute of Medical Science, Kulasekharam, Kanyakumari Dist., India, from June 2019 to December 2020, after approval of the hospital ethical and research committee. All patients presenting to the casualty with blunt trauma abdomen with the following criteria are included in the study:

1. Moderate ongoing bleeding, with increase of intraperitoneal fluid volume >200 mL/h but <500 ml/h in serial ultrasound examinations.
2. Impossibility to exclude hollow organ injuries.
3. Bladder injury
4. Spleen injury grade I to II

All patients who required immediate laparotomy (such as hemodynamically unstable patients, patients with peritonitis, or patients with ongoing bleeding, when expected rate of bleeding exceeded 500 mL/h) were excluded from the study. Patients who successfully underwent conservative treatment were excluded from the study as well. Preoperative investigations like complete blood count, renal function test, serology, random blood sugar, chest X-ray and ECG were done. The laparoscopy with standard technique of 10mm supraumbilical port and another working port of 5mm for suction and irrigation was performed. The organs injured with grading and type of injuries, the amount of blood in the peritoneal cavity and associated gut or diaphragmatic injuries were noted. Diagnostic laparoscopy is proceeded with therapeutic repair or open laparotomy. The findings were (i) minimal hemoperitoneum (static amount of blood in either

paracolic gutter or pelvis), ii, the moderate hemoperitoneum (obvious pooling in the laparoscopic drainage of about 500cc to 2 litres of peritoneal gutters and/or pelvis), (iii) severe hemoperitoneum (generalized collection of blood throughout the peritoneal cavity) and (iv) solid organ trauma and/or perforation of hollow organ. Postoperatively patient is shifted to surgical intensive care unit. Once the general condition improved patient was shifted to ward.

### Result

Out of 30 patients 27 were males and 3 were females. The age group ranged from 20 to 60 years. The most common mechanism of injury was motor vehicle collision which occurred in about 13 individuals (43%). It was followed by automobile pedestrian injury in 7 individuals (23%). Fall from height occurred in about 5 patients (16.6%) and the least was assault which occurred in about 3 individuals (10%). Road traffic accidents were the most common cause of blunt trauma abdomen. The most common findings during laparoscopy were injury to the solid organs (both spleen and liver) which occurred in about 14 patients. Spleen is the most commonly injured organ. Grade I and II splenic injuries occurred in about 10 patients (10%). Grade I and II liver injuries occurred in about 4 patients (13.2%). Retroperitoneal hematoma, along with omental bleeding and mesenteric bleeding was found in about 5 patients (16%). Mesenteric vascular injury and small bowel perforation was found each in 2 patients (6.6%). There was no findings in laparoscopy in about 7 patients (23%). Laparoscopy was converted to open laparotomy in about 3 patients (10%). The conversion to open laparotomy was done for small bowel injuries. Jejunal injury being the most common among the small bowel injuries, Primary repair of the same was done. In the remaining 27 patients, laparoscopic drainage of blood & irrigation of peritoneal cavity with normal saline were done. In Grade I and II solid organ injuries hemostasis was achieved by using AbGel. In the rest 7 patients there was no active bleeding and required no intervention. Laparoscopy was found to be therapeutic in about 20 patients (66.6%). No post operative bleeding or mortality occurred during the study period.

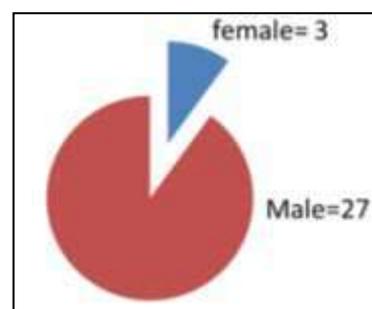


Fig 1: Sex Distribution

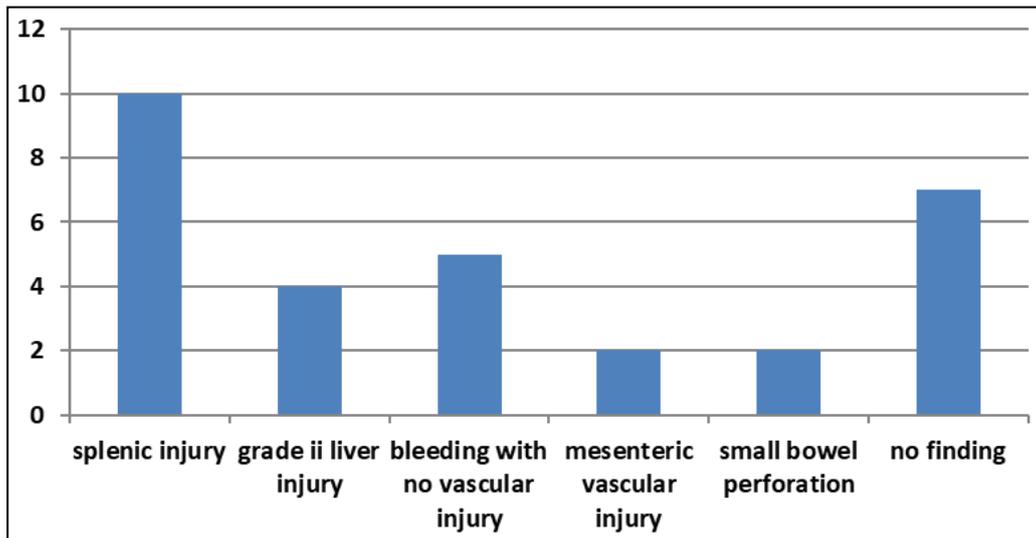


Fig 2: Findings

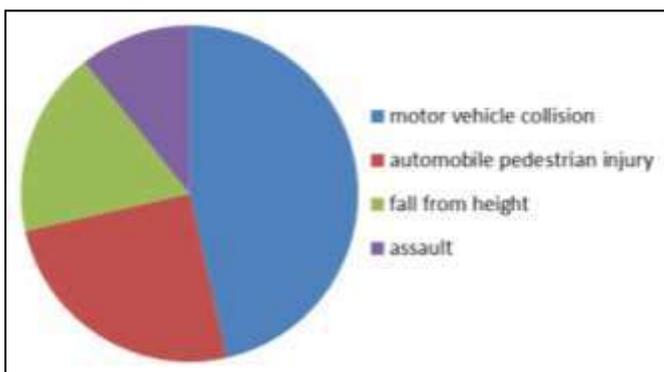


Fig 3: Mode of Injury

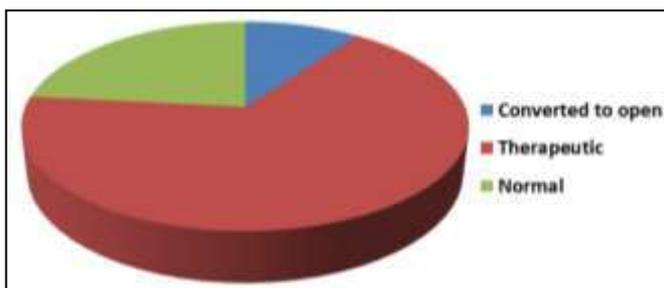


Fig 4: Conclusion

**Discussion**

In my study the sex distribution has male predominance, out of 30 patients 27 were males and 3 were females. Increased incidence of trauma in male is attributed to their work outside house, frequent traveling, more social activities, and influence of alcohol sometimes. This goes in accordance with Ahmed A. Abdeshafy *et al.* [4]. Laparoscopy is found to be therapeutic in about 20 patients (66%). Laparoscopy was converted to open laparotomy in about 3 (10%) of patients. Laparoscopy is useful in selected patients with blunt abdominal trauma who have equivocal findings on clinical examination and imaging investigations in order to clarify the diagnosis, thus avoiding unnecessary laparotomies. Laparoscopy was found to decrease the time for definitive repair by the early diagnosis, reducing the rate of morbidity and mortality and length of hospitalization when combined with therapeutic laparoscopy. There are many other studies which implies the same. Road traffic accidents are the commonest cause of blunt

abdominal trauma followed by fall from height and assault. Trauma due to motor vehicle collision occurred in about 13(43%) patients. On the contrary, Al-Ayoubi *et al.* [5] reported that fall from height was the most common mechanism.

The most common finding in laparoscopy was injury to solid organs like liver and spleen. Grade 1 and grade II injuries of the spleen being the most common occurred in about 10 patients. Liver injuries occurred in about 4 patients (13%). Our findings correlates with the laparoscopic findings in the study done by muhammed rafique memom *et al.* [6].

M. Z. Koto *et al.* [7] conducted a study on 35 stable patients who underwent laparoscopy. Therapeutic laparoscopy was performed in 15 (56%) and diagnostic in 12 (44%) patients. Eight (23%) patients were converted to therapeutic laparotomy. Intraoperative bleeding, complex injuries, visualization problem, and equipment failure necessitated conversion. Three (30%) patients with negative computed tomography scan had therapeutic laparoscopy for mesenteric injuries. There were no missed injuries. He concludes that the laparoscopy for stable patients is feasible and safe. Multiple injuries make laparoscopy more difficult, and advanced laparoscopic skills are required.

Alexander Feliz *et al.* [8] conducted a study with 7127 trauma admissions, of which 113 had abdominal explorations for blunt (88%) and penetrating (12%) trauma. Thirty-two (28%) patients had laparoscopy performed. Laparotomy was avoided in 56% of these patients. Laparoscopic therapeutic interventions were performed in 6 (19%) patients. Laparoscopy assisted in the diagnosis and subsequent conventional repair of perforated viscera in 10, diaphragmatic rupture in 3, and distal pancreatic injury in 1. Patients who had a laparoscopic procedure of any kind were less severely injured leading to significantly lower number of intensive care unit (0.6 F 1.6, P = .0004) and hospital days (7.4 F 5.6, P = .002) than patients who had a laparotomy (3.7 F 7.1 and 12.5 F 11.4). No injuries were missed, or technical complications occurred, as a result of laparoscopic explorations. There were 6 deaths in the laparotomy group. No patients who underwent laparoscopy died. He concluded that laparoscopy in pediatric trauma is a safe method for the evaluation and treatment of selective blunt and penetrating abdominal injuries in hemodynamically stable patients. Laparoscopy serves as a diagnostic tool in abdominal trauma, which reduces the morbidity of a negative laparotomy.

Jeremy J. Johnson *et al.* [9] studied a total of 131 patients, 22 of whom sustained blunt injuries. Patients suffering from blunt

injuries were more severely injured (Injury Severity Score 18.0 vs 7.3,  $P = 5.0001$ ). The most common indication for DL after blunt injury was a computed tomographic scan concerning for bowel injury (59.1%). The rate of nontherapeutic laparotomy for patients sustaining penetrating vs blunt injury was 1.8% and nil, respectively. He concluded that diagnostic laparoscopy, when coupled with computed tomographic findings, is an effective tool for the initial management of patients with blunt injuries.

Gordie K. Kaban *et al.*<sup>[10]</sup> studied 43 patients (18 blunt trauma/25 penetrating trauma) over a period of 4-year who underwent a diagnostic laparoscopy. Conversion to laparotomy occurred in 9 (50%) blunt trauma and 9 (36%) penetrating trauma patients. Diagnostic laparoscopy was negative in 33% of blunt trauma and 52% of penetrating trauma patients. Sensitivity/specificity of laparoscopy in patients with blunt and penetrating trauma was 92%/100% and 90%/100%, respectively. Overall, laparotomy was avoided in 25 (58%) patients. Use of laparoscopy in selected patients with blunt and penetrating abdominal trauma is safe, minimizes nontherapeutic laparotomies, and allows for minimal invasive management of selected intra-abdominal injuries.

Mogeli Sh. Khubutiya *et al.*<sup>[11]</sup> studied a total of 628 patients with blunt and penetrating abdominal trauma were included in this retrospective 12-year survey (2000 to 2011). All patients in the study underwent either laparotomy (280 patients) or urgent laparoscopy (348 patients). There was no difference in the demographic data and trauma severity between the 2 groups. Conversion to open surgery was performed in 130 cases (37.3%). Diagnostic laparoscopy without therapeutic manipulations was used in 160 patients (46%) and therapeutic laparoscopy was carried out in 58 patients (16.7%). Quicker recovery time, less pain, shorter hospital stay, and lower complication rate were observed in patients after laparoscopic surgery compared with patients after open surgery. No missed abdominal organs injuries were revealed after laparoscopic examination of abdominal cavity.

Po-Chu Lee *et al.*<sup>[12]</sup> conducted a study with 47 patients in group A and 57 patients in group B. There were no significant differences in demographic characteristics, injury severity score, and injuries requiring surgical intervention between the groups (all,  $P > .05$ ). Patients in group B had a shorter hospital stay (11 days vs 21 days,  $P < .001$ ) and shorter ICU stay (0 [0, 1] days vs 0 [0, 9] days,  $P = .029$ ). In group A, 6 of 47 patients (12.8%) underwent a nontherapeutic laparotomy.

In contrast, 9 of 57 patients (15.8%) in group B avoided a nontherapeutic laparotomy because no significant intraabdominal findings warranting an intervention were disclosed by laparoscopy. The incidence of laparotomy for patients with significant injuries in group B was lower than in group A (4.2% vs 100.0%;  $P < .001$ ). There was no difference in the complication rate between the groups. He concluded that Laparoscopy is feasible and safe for the diagnosis and treatment of hemodynamically stable patients with blunt abdominal trauma and can reduce the laparotomy rate.

Heng-Fu Lin *et al.*<sup>[13]</sup> studied with 139 patients in group A and 126 patients in group B. Group A patients were more severely injured (mean injury severity score of 23.3 vs. 18.9,  $P < .001$ ) and had a higher frequency of traumatic brain injuries (25.2% vs. 14.3%,  $P = .039$ ). The sensitivity and specificity of diagnostic laparoscopy for patients in group B was 99.1% and 100.0%, respectively. No non-therapeutic laparotomies were performed in group B, and the success rate of therapeutic laparoscopy was 92.0% (103/112) for patients with significant intra-abdominal injuries. Patients in the 2 groups had similar

perioperative and postoperative outcomes in terms of operation times, blood loss, blood transfusion requirements, mortality, and complications (all,  $P > .05$ ). Laparoscopy is a feasible and safe tool for the diagnosis and treatment of hemodynamically stable patients with blunt abdominal trauma who require surgery.

M. Mathonnet *et al.*<sup>[14]</sup> studies about role of laparoscopy in blunt perforations of the small bowel and he conclude that in hemodynamically stable patients with blunt abdominal trauma, laparoscopy safely and effectively identifies small bowel injuries. Early recognition of these injuries and timely surgical treatment offer the best prognosis.

## Conclusion

Laparoscopy can play an important role in diagnosis and treatment of blunt and penetrating trauma in hemodynamically stable patients. Low missed injury rates, reduced duration of hospital stay, faster recovery and reduced cost make it an attractive and safe alternative to classical trauma laparotomy.

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