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ORIGINAL RESEARCH

A comparative study of diagnostic laparoscopy and exploratory laparotomy in management of blunt abdominal trauma

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ABSTRACT

Introduction: Trauma is the primary cause of death for patients under 35 in the globe and is a significant obstacle for medical professionals. It ranks as the sixth leading cause of death worldwide. Globally, blunt trauma accounts for between 78.9 and 95.6% of injuries, despite regional differences. The abdomen is involved in between 9 and 14.9% of all trauma cases. **Material and Methods:**The Present Randomized comparative studyconducted in Department of General Surgery, National Institute of Medical Science and Research, Jaipur for the duration of 18 months (1 July 2022- 31 December 2023).After the sample estimation, a total of 76 patients with blunt abdominal trauma were included which were randomly and equally distributed into two groups i.e. Diagnostic Laparoscopy and Exploratory Laparotomy. Data was collected and subjected to statistical analysis. **Results**: Males were comparatively more as compared to females among both the study groups. RTA was the most common mode of trauma among the study subjects followed by fall from height.The mean operative time (in min) required during surgery was 117.43±8.09 and 148.58±16.14 in Diagnostic Laparoscopy and Exploratory Laparotomy group respectively. **Conclusion:**The use of minimally invasive surgery is expanding across various surgical specialties. Compared to laparotomy, laparoscopy has been linked to decreased rates of morbidity and death as well as shorter hospital stays, blood loss and transfusions, wound infections, and operating time.

Keywords: Diagnostic Laparoscopy, Exploratory Laparoscopy&Minimally invasive surgery Trauma.

INTRODUCTION

Trauma is the primary cause of death for patients under 35 in the globe and is a significant obstacle for medical professionals.[1]. It ranks as the sixth leading cause of death worldwide. Globally, blunt trauma accounts for between 78.9 and 95.6% of injuries, despite regional differences.[2–5]. The abdomen is involved in between 9 and 14.9% of all trauma cases.[4] Whole-body trauma, multiple organ injuries, which are more prevalent, or single organ traumas like falling on one hand can all occur. One abdominal injuries from a fist punch may be observed. In order to comprehend the characteristics of trauma, it is crucial to take a thorough history from trauma patients. Our diagnosis is based on the location of the abdominal damaged area and the type of trauma—blank or penetrating. Determining whether or not there is an intra-abdominal organ injury and whether or not surgery is required in the event that one exists is crucial. A misdiagnosis could result in needless surgery. Every needless surgical procedure has a higher risk of morbidity and fatality[6,7].

There are radiological methods available to determine whether or whether there is an intra-abdominal organ injury. However, not all hospitals may have these modalities available at that particular time, or they may require a preparatory phase while we are pressed for time and require a prompt diagnosis. The surgeon needs to decide quickly in these situations. Once more, a surgeon must still make a decision and make a precise diagnosis even in the absence of radiological imaging. An other technique in these circumstances is diagnostic laparoscopy (DL).[8–10] Laparoscopy's function in traumatic abdominal trauma (BAT) remains unclear, nevertheless.[9]. Compared to patients with PAT (penetrating abdominal trauma), patients with BAT have greater trauma score values, as well as higher rates of morbidity and fatality.

Due of distracting concomitant injuries, BAT is typically coupled with other injuries, and clinical

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assessment is not always trustworthy.[10] The gold standard, a computed tomography (CT) scan examination, is not always reliable in identifying lesions to the hollow viscus. Many investigators view exploratory laparotomy as a harmless operation in circumstances of diagnostic ambiguity.[11] Nonetheless, there is a 41% chance of morbidity after laparotomy. Additionally, 27% of needless negative laparotomies are performed.[12]

The first account of the use of laparoscopy to help diagnose abdominal injuries was published in 1977 by Simon et al. When Cuschieri compared laparoscopy and diagnostic peritoneal lavage in patients with traumatic abdominal trauma in 1988, he found that the latter had a lower positive predictive value while laparoscopy had a better one. Laparoscopy may help trauma patients avoid needless (non-therapeutic) laparotomies, enhance diaphragm vision during surgery, and enable laparoscopic injury repair[13].

However, the number of surgeons performing laparoscopy on patients with abdominal trauma has increased, and the number of cases converting to laparotomy has reduced, as laparoscopic surveillance has been demonstrated to lower the negative laparotomy rate.[14-15] Consequently, the current writing team became focused on establishing whether laparoscopy is appropriate for use in abdominal trauma patients as a diagnostic and therapeutic tool[16]. Hence the present study was conducted to compare outcome of diagnostic laparoscopy and exploratory laparotomy in management of blunt abdominal trauma.

MATERIAL AND METHODS

The Present Randomized comparative studyconducted in Department of General Surgery, National Institute of Medical Science and Research, Jaipur for the duration of 18 months (1 July 2022- 31 December 2023). The study was performed after the approval taken from Institutional ethical committee & written informed consent taken from the patients.

Inclusion Criteria for the studyPatients with blunt abdominal trauma of class 1 and class 2 according to Advanced Trauma Life Support (ATLS) guidelines for hemorrhagic shock, With Age more than 12 years and of either sex and Willing to participate in the study.Exclusion Criteria was Patients with class 3 and class 4 according to ATLS guidelines for hemorrhagic shock in patients with trauma and penetrating abdominal injury.

After the sample estimation, a total of 76 patients with blunt abdominal trauma were included which were randomly and equally distributed into two groups i.e. Diagnostic Laparoscopy and Exploratory Laparotomy.

METHODS

- Arrival of the patient
- Primary assessment of the patient
- Doing all the laboratory investigations and USG FAST
- whether the patient falls under the inclusion criteria or not
- After the patient fits in the inclusion criteria random sampling was done with the help of computer.
- The procedure was done
- Operative time, surgical findings, conversion from diagnostic laparoscopy to laparotomy and the reason was noted.
- Post operatively the patient was monitored in terms of vitals, post operative complications like wound infection, respiratory tract infections, and deep venous thrombosis (DVT), duration of postoperative ICU stay, total hospital stay, and mortality was also be recorded.

Data was collected and subjected to statistical analysis.

STATISTICAL ANALYSIS

Data so collected was tabulated in an excel sheet, under the guidance of statistician. The means and standard deviations of the measurements per group were used for statistical analysis (SPSS 24.00 for windows; SPSS inc, Chicago, USA). Difference between two groups was determined using t test as well as chi square test and the level of significance was set at $p<0.05$.

RESULTS

The present randomized comparative studywas conducted in Department of General Surgery, National Institute of Medical Science and Research, Jaipur for a period of 18 months (1 July 2022- 31 December 2023) among 76 patients with blunt abdominal trauma of class 1 and class 2 according to Advanced Trauma Life Support (ATLS)guidelines for hemorrhagic shock having age more than 12 years and of either sex. The patients were randomly and equally distributed into two groups i.e. Diagnostic Laparoscopy and Exploratory Laparotomy. The aim of the study was to compare the outcome of diagnostic laparoscopy and exploratory laparotomy in management of blunt abdominal trauma.

Table 1,shows the gender distribution among the study groups. Males were comparatively more as compared to females among both the study groups. There was no statistically significant difference between the Diagnostic Laparoscopy and Exploratory Laparotomy groups w.r.t. gender distribution. In this study; maximum subjects were from the age group of 51-60 years followed by 31-40 years while minimum subjects were from the age group of >60 years as well as 18-30 years

Table 2 showed RTA was the most common mode of trauma among the study subjects followed by fall from height. The distribution of injured organ among the study groups. Spleen was the most common injured organ followed by liver. Bleeding with no organ injury was revealed in 21.05% of the subjects.

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The mean operative time (in min) required during surgery was 117.43±8.09 and 148.58±16.14 in Diagnostic Laparoscopy and Exploratory Laparotomy group respectively. Hence mean operative time (in min) was needed more in Exploratory Laparotomy group as compared to Diagnostic Laparoscopy group respectively. When mean operative time (in min) was compared between the Diagnostic Laparoscopy and Exploratory Laparotomy group using t test, statistically significant difference was found as $p<0.05$ (table 3).

The mean postoperative days in ICU was 2.18±0.55 and 3.76±0.67 in Diagnostic Laparoscopy and Exploratory Laparotomy group respectively. Hence mean postoperative days in ICU was needed more in Exploratory Laparotomy group as compared to Diagnostic Laparoscopy group respectively. When mean postoperative days in ICU was compared between the Diagnostic Laparoscopy and Exploratory Laparotomy group using t test, statistically significant difference was found as $p<0.05$ (table 4).

Postoperative complications viz. respiratory tract infection, surgical site infection and deep vein thrombosis were found more in Exploratory Laparotomy group as compared to Diagnostic Laparoscopy group with statistically significant difference as $p<0.05$. Mortality was reported in one subject which was managed with Exploratory Laparotomy group. Conversion into laparotomy was required in 10.53% of the subjects in Diagnostic Laparoscopy group (table 5).

Table 1: Distribution among the study groups according to Gender and Age Group

Gender	Diagnostic Laparoscopy		Exploratory Laparotomy		Chi Square Test	p value
	N	%	N	%		
Gender						
Male	23	60.53	26	68.42	0.93	0.62
Female	15	39.47	12	31.58		
Age Group						
18-30	2	5.26	1	2.63	0.58	0.71
31-40	14	36.84	12	31.58		
41-50	7	18.42	10	26.32		
51-60	13	34.21	14	36.84		
>60	2	5.26	1	2.63		

Table 2: Mode of trauma among the study groups

Mode of Trauma	Diagnostic Laparoscopy		Exploratory Laparotomy		Chi Square Test	p value
	N	%	N	%		
Mode of Trauma						
RTA	26	68.42	24	63.16	0.67	0.65
Fall from Height	7	18.42	9	23.68		
Assault	4	10.53	4	10.53		
Hit by Animal	1	2.63	1	2.63		
Injured Organ						
Spleen	17	44.74	13	34.21	1.39	0.46
Mesentery	2	5.26	4	10.53		
Bleeding with no organ injured	9	23.68	7	18.42		
Liver	8	21.05	9	23.68		
Small Bowel	1	2.63	3	7.89		
Duodenum	1	2.63	1	2.63		
Colon	0	0.00	1	2.63		

Table 3: Comparison of operative time (in min) among the study groups

	Diagnostic Laparoscopy		Exploratory Laparotomy		T Test	p value
	Mean	SD	Mean	SD		
Operative Time (in min)	117.43	18.09	148.58	16.14	4.81	0.007*

*: statistically significant

Table 4: Comparison of postoperative days in ICU among the study groups

	Diagnostic Laparoscopy		Exploratory Laparotomy		T Test	p value
	Mean	SD	Mean	SD		
Postoperative Days In ICU	2.18	0.55	3.76	0.67	5.41	0.004*

*: statistically significant

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Table 5: Postoperative complications among the study groups

Complications	Diagnostic Laparoscopy		Exploratory Laparotomy		Chi Square Test	p value
	N	%	N	%		
Respiratory Tract Infection	2	5.26	7	18.42	5.91	0.017*
Surgical Site Infection	0	0	5	13.16		
Deep Vein Thrombosis	0	0	1	2.63		
Mortality	0	0	1	2.63		
Conversion into laparotomy	4	10.53	0	0		

*: statistically significant

DISCUSSION

In trauma situations, non-operative therapy has been applied extensively, particularly in cases of abdominal blunt trauma. Nonetheless, a lot of situations necessitate invasive and surgical methods of diagnosis and treatment. The majority of trauma patients were thought to require laparotomy as the usual treatment. Laparoscopy has been explored as a substitute procedure in situations of abdominal forceful trauma in order to prevent needless laparotomies in recent years.

The current randomized comparative study involved 76 patients with blunt abdominal trauma of class 1 and class 2 according to Advanced Trauma Life Support (ATLS) guidelines for hemorrhagic shock, aged over 12 and of either sex. It was carried out over the course of 18 months, from July 1, 2022, to December 31, 2023, in the Department of General Surgery, National Institute of Medical Science and Research, Jaipur. The patients were divided into two groups, one for exploratory laparotomy and the other for diagnostic laparoscopy, at random and equally. The study compared the results of exploratory laparotomy with diagnostic laparoscopy in the treatment of blunt abdominal trauma.

GENDER

In comparison to girls, there were significantly more males in both research groups. Regarding the gender distribution, there was no statistically significant difference between the groups that underwent exploratory laparotomy and diagnostic laparoscopy.

In their study, Ahmed A. Abdelshafy et al.[17]noted a similar gender distribution, or male dominance.

Males are more likely to experience trauma because they work outside the home, travel frequently, engage in more social activities, and occasionally drink alcohol.

This is consistent with research by Panchal, Ramanuj[19,] and Kumawat et al[18].

In a related study, Pranav K. Sharma et al.[67] discovered a similar male dominance.

AGE

The age range of 51–60 years was the largest number of individuals in this study, followed by 31–40 years, while the age range of >60 years and 18–30 years was the least number of subjects.

In their studies, Ahmed A. Abdelshafy et al [17]and Pranav K. Sharma et al[20]reported a similar age distribution.

MODE OF TRAUMA

Falling from a height was the second most prevalent cause of trauma among the research participants, after RTA.

According to a study by Ahmed A. Abdelshafy et al[17], assaults and falls from heights are the next most common causes of blunt abdominal trauma. These results are in line with the current investigation.

In a similar vein, Pranav K. Sharma et al[20] discovered in their research that road traffic accidents were the most frequent cause of abdominal trauma injuries. Of these, 32 patients (or 60%) had blunt abdominal trauma after being injured as drivers, passengers, or pedestrians.

Conversely, according to Al-Ayoubi et al., falling from a height is the most frequent mechanism[21].

INJURED ORGAN

The most often affected organ was the liver, then the sickle. In 21.05% of the individuals, bleeding without organ damage was found.

In a study of 55 patients, Cathey KL reached the same conclusion: the spleen was the most frequently affected organ following blunt trauma, occurring in 25 individuals (45%).[22]

In another study, Brady RR et al. found that among 672 patients with abdominal trauma in Scotland, splenic injury was the most frequent injury attributable to blunt trauma after traffic accidents, occurring in 579 cases (86.2%).[23]

The study conducted by Pranav K. Sharma et al[20] included the following patient numbers: 24 patients (45.28%) had mesenteric injury; 20 patients (37.74%) had splenic injury; 22 patients (41.51%) had bowel injury; 11 patients (20.75%) had retroperitoneal injury; and 4 patients (7.55%) had hepatic injury.

OPERATIVE PARAMETERS

The current study measured the amount of time spent doing surgery in minutes, starting from the initial skin incision and ending with the final sutured closure. With regard to Diagnostic Laparoscopy, the mean operative time (in minutes) was 117.43±8.09, and for the Exploratory Laparotomy group, it was 148.58±16.14. As a result, the exploratory laparotomy group required a longer mean operation time (in

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minutes) than the diagnostic laparoscopy group did. A statistically significant difference of $p<0.05$ was established when the mean operative time (in minutes) was compared between the groups that had exploratory laparotomy and diagnostic laparoscopy using the t test. The groups that underwent exploratory laparotomy and diagnostic laparoscopy had mean postoperative days of 3.76±0.67 and 2.18±0.55, respectively, in the ICU. As a result, the exploratory laparotomy group required longer mean postoperative days in the ICU than the diagnostic laparoscopy group did. A statistically significant difference of $p<0.05$ was established when the mean postoperative days in the ICU were compared between the groups that underwent exploratory laparotomy and diagnostic laparoscopy using the t test. The groups that underwent exploratory laparotomy and diagnostic laparoscopy had a mean hospital stay of 14.51±2.63 days and 10.94±3.12 days, respectively. As a result, the exploratory laparotomy group required a longer mean hospital stay (measured in days) than the diagnostic laparoscopy group. A statistically significant difference of $p<0.05$ was established when the mean hospital stay (in days) was compared between the groups that underwent exploratory laparotomy and diagnostic laparoscopy using the t test.

Since Lamy first used laparoscopy in 1956 to treat trauma patients, Gazzaniga et al. and Carnevale et al. have suggested that laparoscopy can be helpful in determining whether a laparotomy is necessary. As a result, laparoscopy has been used to treat hemoperitoneum in 25% fewer cases than it was in the past.[24,25] We observed that laparoscopy was a useful diagnostic and therapeutic technique when handling patients with traumatic abdominal trauma. The findings of Prasad and Agarwal, who verified that laparoscopy performed by skilled practitioners lowers the number of unsuccessful laparotomies, were in line with this. Furthermore, it has been demonstrated to contribute significantly to the diagnosis and treatment of visceral and diaphragmatic injuries[26].

This was also in line with the findings of Choi and Lim, who discovered that, when performed carefully on patients who had suffered blunt abdominal injuries, laparoscopy was both safe and technically possible, resulting in a shorter length of hospital stay and postoperative ICU stay. With a decrease in unfavorable and nontherapeutic laparotomies, it also provided significant therapeutic potential and cost-effectiveness[27].

Similarly According to a study by Ahmed A. Abdelshafy et al. [17], laparoscopy took less time during surgery than laparotomy. Patients who had laparoscopies had an average operating time of 123.28 minutes, while those who had laparotomies had an average operating time of 150.48 minutes. Compared to laparotomy, which requires a 2.5–5 day stay in the intensive care unit after surgery, laparoscopy is linked to a 1-3 day stay.

Similarly, Pranav K. Sharma et al[20]found that 48 patients—including the three who underwent open surgery after switching from laparoscopy—took an average of 133 minutes (133±32.66) for an exploratory laparotomy. The mean length of the laparoscopic procedure in the remaining 5 patients was 76 minutes (76±22.16). There was a statistically significant difference ($p<0.001$). Patients who had an exploratory laparotomy stayed for an average of 14.26 days (14.26±8.75), whereas patients who had a laparoscopy stayed for an average of 7.65 days (7.65±1.6). It was statistically significant that patients who had a laparoscopy had a shorter length of stay.

Taner AS found similar outcomes in a study of 99 patients who reported a lower length of stay (5.2±1.42 days) for laparoscopic patients compared to 7.4±1.42 days for those in the open category ($p<0.001$)[28].

CONVERSION RATE TO OPEN LAPAROTOMY

In the Diagnostic Laparoscopy group, 10.53% of the participants required a conversion to a laparotomy.

The research revealed that, depending on the selection criteria, the rate of conversion could range from 8.5 to 37%. Bleeding, multiple injuries upon presentation, visual and postural issues, and equipment failure70 were the reasons for the conversion.

The main causes of the 12% conversion rate to open laparotomy, according to Ahmed A. Abdelshafy et al[17], were adhesions from previous procedures and uncontrollable bleeding. These results are in line with the current investigation.

POSTOPERATIVE COMPLICATIONS

There was a statistically significant difference ($p<0.05$) in the number of postoperative complications, including respiratory tract infection, surgical site infection, and deep vein thrombosis, between the groups that underwent exploratory laparotomy and diagnostic laparoscopy. One patient who received treatment with the Exploratory Laparotomy group was reported to have died.

This is in line with the findings of Mohamed et al., who showed that laparoscopy has lower rates of mortality and postoperative complications than laparotomy[29].

Patients who had laparoscopy had a significantly lower rate of postoperative problems, according to Ahmed A. Abdelshafy et al[17].

In their investigation, Sitnikov et al. came to the conclusion that video-assisted laparoscopy, both therapeutic and diagnostic, can be safely employed to treat small bowel injuries. It demonstrated noteworthy precision, sensitivity, and specificity in the identification and treatment of patients with small bowel injuries. When paired with therapeutic laparoscopy as opposed to open laparotomy, it was found to shorten the time for definitive repair by allowing for the early detection of intestinal injury

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and to lower rates of morbidity, mortality, hospital expenses, and duration of hospital stay[30].

Laparoscopy has drawbacks such as limited visibility in all organ dimensions and poor efficacy in treating a variety of trauma types in patients. As previously said, the type of surgery chosen for trauma patients ultimately depends on the hospital, surgeon, and patient's circumstances, as well as the facilities and equipment available.

CONCLUSION

The use of minimally invasive surgery is expanding across various surgical specialties. Compared to laparotomy, laparoscopy has been linked to decreased rates of morbidity and death as well as shorter hospital stays, blood loss and transfusions, wound infections, and operating time. Laparoscopy is found to be a good substitute for laparotomy because it can be used to lower the rate of laparotomies, is associated with lower morbidity and mortality, and is thought to be safe and reliable as a diagnostic and treatment method in hemodynamically stable patients with blunt abdominal trauma.

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