



Original Research Article

COMPARATIVE ANALYSIS OF LAPAROSCOPY AND LAPAROTOMY FOR MANAGEMENT OF ABDOMINAL TRAUMA: A RETROSPECTIVE STUDY

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ABSTRACT

Introduction: The utilization of laparoscopy in managing abdominal trauma, either diagnostically or therapeutically, has been on the rise. However, its comparative outcomes with conventional laparotomy, especially concerning therapeutic management, remain unclear.

Methods: This retrospective cohort study involved patients from trauma center of an Indian medical college. 78 patients who underwent laparoscopic interventions for abdominal trauma were included in the laparoscopy group (LP group). Another 78 patients who underwent laparotomy (LT group) were matched based on baseline characteristics, causes of injury, and hemodynamic parameters. Perioperative clinical parameters and short-term survival were compared between these two groups.

Results: Baseline characteristics were similar between the LP and LT groups. The most common cause of trauma was traffic accidents, and the predominant surgical intervention was bowel repair/resection. Operation time did not significantly differ between the two groups, while the post-operative complication rate was slightly lower in the LP group without statistical significance. Opioid use was lower in the LP group compared to the LT group. Additionally, hospital stay was significantly shorter in the LP group. One patient in the LT group died due to an intra-abdominal abscess and multiple organ dysfunction syndrome 20 days postoperatively, whereas all patients in the LP group recovered and were discharged.

Conclusion: Laparoscopy is deemed feasible and safe for treating hemodynamically stable abdominal trauma patients when performed by experienced surgeons. Laparoscopy appears to offer advantages such as reduced pain and quicker recovery while maintaining similarly favorable clinical outcomes compared to conventional laparotomy.

Keywords: Abdominal trauma, hemodynamically stable, laparoscopy, laparotomy

INTRODUCTION

Managing abdominal trauma effectively presents a significant challenge for surgeons [1, 2]. Prompt diagnosis of abdominal trauma and the application of appropriate surgical interventions are crucial for ensuring positive patient outcomes. Over the past few decades, laparotomy has emerged as a potent tool for both diagnosing and treating abdominal trauma. With the standardization of laparotomy

procedures [3] and the advancement of various diagnostic techniques such as local wound exploration, diagnostic peritoneal lavage (DPL), focused assessment sonography in trauma (FAST), and computed tomography (CT) scans, the morbidity and mortality rates associated with abdominal trauma surgery have considerably decreased [4-8].

Laparoscopic techniques have gained increasing popularity across various surgical fields, including the evaluation and management of abdominal trauma [9, 10]. Due to the similarity in surgical procedures and predictable outcomes observed in other abdominal conditions, laparoscopy is deemed safe for hemodynamically stable trauma patients. However, despite more than two decades of exploration and experience in this area [11, 12], therapeutic laparoscopy has not yet become the standard treatment, and there is no consensus on its value in treating abdominal trauma [13]. This uncertainty may stem from concerns about potentially overlooking injuries and the prolonged duration of laparoscopic procedures [4].

There is a lack of studies comparing the safety and efficacy of therapeutic laparoscopy versus laparotomy. Furthermore, differences in surgical techniques among various surgeons and institutions have contributed to the heterogeneity of available results [14, 15]. Therefore, our study aimed to evaluate whether therapeutic laparoscopy can serve as a safe and effective alternative for hemodynamically stable patients with abdominal trauma and to identify any potential clinical disparities between patients undergoing therapeutic laparoscopy and those undergoing conventional laparotomy.

MATERIAL AND METHODS

This retrospective study was done at a trauma center of an Indian medical college. The study's inclusion criteria encompassed individuals aged 18 to 70 years old, specifically targeting patients with either penetrating or blunt abdominal trauma devoid of severe concurrent injuries like cerebral, thoracic, or pelvic traumas. Additionally, the criteria included patients who had undergone both diagnostic and therapeutic surgical procedures, those with surgical indications based on imaging findings or diagnostic abdominal paracentesis, and individuals who were hemodynamically stable before surgery.

The exclusion criteria were delineated to exclude hemodynamically unstable patients or those with severe peritonitis necessitating emergency surgery. Patients who solely underwent diagnostic or explorative interventions, individuals with negative findings from imaging examinations or abdominal

paracentesis, and cases lacking adequate data for analysis were also excluded.

Surgeons in the laparoscopy (LP) group had at least 3 years of experience in performing minimally invasive surgery for other conditions, such as laparoscopic cholecystectomy, laparoscopic gastrectomy, or colectomy. Positive findings from focused assessment sonography in trauma (FAST) and/or CT imaging were considered important indications for surgical interventions before surgery. Diagnostic/exploratory laparoscopy or laparotomy was initially performed in all enrolled patients to identify intra-abdominal injuries. The subsequent management was decided by the operating surgeon based on the findings and the patient's condition.

Demographic and baseline characteristics, including age, sex, heart rate, blood pressure at admission, injury severity score (ISS), and trauma causes, were collected. Surgical parameters such as explorative findings, detailed operation procedures, injured organs, and operation time were extracted from operation and anesthesia records. Post-operative data, including analgesic use, complications, re-operation cases, time to flatus, and hospital stays, were extracted from the post-operative medical history.

Statistical analyses were conducted using SPSS 21. Continuous variables were presented as mean \pm SD, while categorical variables were presented as ratios or cases. The normality of distribution for continuous variables was assessed using the one-sample Kolmogorov–Smirnov test. Depending on the distribution, either the Student's t-test or the Mann–Whitney U test was applied. Categorical variables were compared using Pearson's χ^2 test. A p-value less than 0.05 was considered statistically significant.

RESULTS

Seventy-eight patients who underwent laparoscopy (LP group) were matched using propensity score-matching analysis with 78 patients who underwent conventional laparotomy (LT group). The demographic characteristics and baseline features of the included patients are presented in. The fundamental demographic parameters were similar between these two cohorts [Table 1].

Table 1: Baseline characteristics on admission

Parameters	Laparoscopy	Laparotomy	p Value
Age (years, mean \pm SD)	39.95 \pm 14.67	41.72 \pm 14.89	0.208
Gender (Male/Female)	62/16	58/20	0.69
Hospital arrival time (in hours)	23.4 \pm 14.92	24.08 \pm 33.29	0.729
Injury Severity Score	5.75 \pm 2.38	4.98 \pm 2.14	0.237
Heart rate (bpm)	97.55 \pm 21.38	99.80 \pm 22.71	0.187
Systolic BP (mmHg)	123.6 \pm 16.21	119.92 \pm 19.95	0.39
Diastolic BP (mmHg)	75.04 \pm 9.67	75.32 \pm 13.84	0.511

Table 2: Mechanism and type of trauma injury

Mode of Trauma	Laparoscopy	Laparotomy	p Value
Cause			

Fall from Height	10	4	0.81
Gunshot injury	6	4	
Others	6	6	
Stab injury	14	16	
Strike injury	16	17	
Road Traffic accident	26	31	
Peritoneal penetration			
Blunt	12	19	0.23
Penetrating	66	59	

Table 2 illustrates the mechanisms of injury, with the most frequent cause being traffic accidents. There was no significant difference in the distribution of trauma causes between the LP and LT groups. Penetrating trauma was more common than blunt trauma, with a similar

distribution of blunt or penetrating trauma observed in both groups.

The most commonly affected anatomical regions were hollow viscera, such as small bowel and colon injuries, followed by spleen injuries, as indicated in **Table 3**.

Table 3: Organ injury

Organ Injured	Laparoscopy	Laparotomy
Bowl Repair/Resection		
Abdominal Wounds	3	0
Bladder Wall Laceration	7	0
Colon & Rectum	15	1
Diaphragmatic injury	1	4
Kidney injury	3	1
Liver injury	10	7
Mesenteric injury	4	3
Omental injury	1	3
Pancreatic injury	6	7
Small Bowel injury	13	17
Spleen injury	12	29
Stomach injury	3	6
Injury Sites		
Single	64	59
Multiple	14	19

Table 4: Surgical variables and post-operative outcome

Parameters	Laparoscopy	Laparotomy	p value
Operation Time (in mins)	207.40 ± 75.40	189.80 ± 84.20	0.271
Opiates use (MEQ, mg)	12.30 ± 4.60	24.60 ± 14.20	<0.05
Flurbiprofen used (mg)	580.50 ± 320.90	525.60 ± 340.10	0.735
Major Complications	9/78 (11.53%)	13/78 (16.66%)	0.34
Reoperation	0/78	1/78	0.475
Time to first Flatus (in days)	3.10 ± 1.90	3.00 ± 1.50	0.169
Hospital Stays (in days)	14.20 ± 11.10	18.20 ± 15.20	<0.05

The predominant surgical procedure performed was bowel repair or resection. Operation duration did not vary significantly between the LP and LT groups, as shown in Table 4. However, opioid use was significantly lower in the LP group compared to the LT group. The utilization of flurbiprofen, another analgesic,

was comparable between the two cohorts. The time to first flatus was also similar. The duration of hospitalization was notably shorter in the LP group than in the LT group. The occurrence of postoperative major morbidities was lower in the LP group, although this difference was not statistically significant. In the LT group, one patient succumbed to severe intra-abdominal abscess and multiple organ dysfunction syndrome 20 days post-surgery, while all other patients recovered. Conversely, all patients in the LP group recuperated and were successfully discharged following treatment.

DISCUSSION

This retrospective matched cohort study demonstrated that laparoscopy could be considered a safe and efficient option for treating hemodynamically stable patients with abdominal trauma. It offers benefits such as reduced pain and quicker recovery times. While urgent laparotomy has been established as a standard procedure for diagnosing and treating trauma patients with positive imaging findings or hemodynamic instability, the therapeutic role of laparoscopy remains uncertain and debated.

Previous studies have indicated the safety and precision of laparoscopy in identifying injuries in hemodynamically stable patients with either penetrating [10,16] or blunt abdominal trauma [17,18]. However, these studies often focused solely on laparoscopy's diagnostic capabilities or included specific trauma types [19,20], limiting their

generalizability due to single-center designs and small sample sizes, leading to variable results across institutions and study methodologies [21,22].

Contrary to findings by Hajibandeh *et al.* [7], our study did not observe a reduction in operation time in the laparoscopy group. Nevertheless, we did not encounter any missed injuries in our cohort, supporting the diagnostic value of laparoscopy following standard exploratory procedures [3,5]. Compared to Saurav *et al.*'s investigation [23], we did notice an extended hospital stay in our laparoscopy group, likely due to post-operative complications. However, our study's strengths lie in its inclusion of patients from various trauma centers, the matched study design, and a reasonably large sample size, providing robust evidence regarding laparoscopy's therapeutic utility in diverse trauma scenarios.

The comparable success rates and minimal missed injuries between laparoscopy and laparotomy groups support the use of therapeutic laparoscopy as a safe alternative for managing hemodynamically stable trauma patients. Our findings also indicated reduced analgesic usage and shorter hospital stays post-laparoscopy, attributed to its minimally invasive nature and improved postoperative recovery. These results suggest that experienced surgeons may opt for laparoscopy over laparotomy in minor trauma cases with hemodynamic stability, offering short-term recovery benefits to patients.

However, our study has limitations, including its retrospective design and moderate sample size, potentially introducing study biases. Additionally, the selection of patients for the laparoscopy group based on surgeon evaluations may have led to selection bias and limited generalizability. Lastly, the expertise of surgeons in the laparoscopy group might have influenced the success rates and underestimated misdiagnoses, emphasizing the need for cautious interpretation of our findings.

CONCLUSION

In conclusion, our study indicates that therapeutic laparoscopy can be safely and effectively conducted in patients with stable hemodynamic conditions following abdominal trauma, potentially offering advantages in the postoperative recovery phase. However, further large-scale multicenter randomized clinical trials are necessary to validate and confirm our findings.

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