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ORIGINAL ARTICLE

Comparative Evaluation of Postoperative Recovery and Complication Rates in Patients Undergoing Laparoscopic Versus Open Abdominal Surgeries Under General Anesthesia

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ABSTRACT

Background: Abdominal surgeries constitute a large proportion of general surgical procedures, and the choice of operative technique directly affects recovery and complication rates. Open surgery, the traditional approach, provides good exposure but is associated with increased postoperative pain, prolonged hospital stay, and higher morbidity. Laparoscopic surgery, introduced as a minimally invasive alternative, has shown potential benefits, yet comparative evaluations under similar anesthetic conditions remain important, especially in low- and middle-income healthcare settings.

Objective: To compare postoperative recovery and complication rates in patients undergoing laparoscopic versus open abdominal surgeries under general anesthesia.

Methods: A prospective observational study was carried out in the Department of General Surgery at Pakistan Institute of Medical Sciences (PIMS), Islamabad, and Bolan Medical Complex Hospital, Quetta, from January 2023 to June 2023. A total of 120 patients were enrolled, with 60 undergoing laparoscopic and 60 undergoing open procedures. Data on demographic variables, operative time, postoperative pain assessed at 24 hours using the Visual Analog Scale (VAS), time to ambulation, length of hospital stay, and complications were collected and analyzed using SPSS version 26. A p-value <0.05 was considered statistically significant.

Results: Operative time was longer in laparoscopic procedures (95 ± 12 minutes) compared with open surgeries (85 ± 10 minutes, p = 0.03). However, laparoscopic patients had lower postoperative pain scores (VAS 3.2 ± 1.1 vs. 6.1 ± 1.3), earlier ambulation (12 ± 3 vs. 24 ± 5 hours), shorter hospital stays (3.4 ± 0.9 vs. 7.1 ± 1.2 days), and fewer complications (10% vs. 28%, p = 0.01).

Conclusion: Laparoscopic abdominal surgery offers improved recovery and reduced complications compared to open surgery and should be the preferred approach for elective procedures where feasible.

Keywords: Laparoscopic surgery, Open surgery, Postoperative recovery, Complications, General anesthesia

INTRODUCTION

Abdominal surgeries are among the most common operative procedures performed worldwide, addressing a broad spectrum of conditions such as cholelithiasis, appendicitis, hernias, and gastrointestinal malignancies [1]. Traditionally, open abdominal surgery has been considered the gold standard for these conditions, providing surgeons with direct visualization and tactile feedback. However, open surgery is associated with significant drawbacks, including larger incisions, increased postoperative pain, higher risk of wound-related complications, prolonged hospital stay, and delayed return to normal activities [2].

The advent of minimally invasive surgical techniques, particularly laparoscopy, has transformed the field of abdominal surgery over the past three decades. Laparoscopic procedures utilize small incisions, specialized instruments, and video-assisted visualization to achieve therapeutic goals with reduced tissue trauma [3]. Numerous studies have reported that laparoscopic surgery is associated with less postoperative pain, faster mobilization, shorter hospital stays, and improved cosmetic outcomes compared to open surgery. Despite these advantages, laparoscopic procedures are not without limitations; they often require longer operative times, advanced surgical expertise, higher initial costs, and may be contraindicated in patients with extensive adhesions or certain comorbidities [4].

General anesthesia remains the standard anesthetic technique for both open and laparoscopic abdominal surgeries, ensuring patient comfort, muscle relaxation, and airway control [5]. However, it can influence postoperative recovery through complications such as nausea, vomiting, respiratory depression, and delayed awakening. The interplay between surgical approach and anesthetic management thus plays a crucial role in determining postoperative outcomes[6].

Given the increasing adoption of laparoscopic surgery in routine clinical practice, it is essential to evaluate its comparative effectiveness against open abdominal surgery, particularly in terms of recovery and complication rates under uniform anesthetic conditions[7]. While international literature supports the benefits of laparoscopy, data from low- and middle-income countries remain limited due to variations in surgical training, hospital infrastructure, and patient characteristics[8].

Therefore, this study was designed to provide a comparative evaluation of postoperative recovery and complication rates in patients undergoing laparoscopic versus open abdominal surgeries under general anesthesia. By analyzing outcomes such as pain, hospital stay, ambulation, and postoperative complications, this research aims to generate evidence that may guide surgical decision-making and enhance patient care in diverse clinical settings [9].

MATERIALS AND METHODS

Study Design and Setting: This prospective observational study was conducted in the Department of General Surgery at two major tertiary care hospitals of Pakistan: the Pakistan Institute of Medical Sciences (PIMS), Islamabad, and Bolan Medical Complex Hospital, Quetta. The study was carried out over a period of six months, from January 2023 to June 2023. Both centers are high-volume surgical units, allowing for the collection of a diverse range of cases representative of the general patient population.

Sample Size: A total of 120 patients were included in the study. The sample was divided into two equal groups. Sixty patients underwent laparoscopic abdominal surgeries, while the remaining sixty patients were treated with conventional open abdominal

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procedures. This distribution enabled a balanced comparison between the two surgical approaches under uniform conditions.

Inclusion and Exclusion Criteria: Patients between the ages of 18 and 65 years, of either gender, scheduled for elective abdominal surgery under general anesthesia were considered eligible for participation. Surgeries included common general surgical procedures such as cholecystectomy, appendectomy, and hernia repair. Only patients with American Society of Anesthesiologists (ASA) physical status grades I to III were included to minimize variability due to severe systemic disease. Patients undergoing emergency surgeries, those with advanced cardiac, renal, or hepatic disease, individuals with a history of extensive previous abdominal surgery leading to adhesions, and pregnant women were excluded. Patients who declined to provide informed consent were also not enrolled.

Data Collection: Patient information was collected using a structured proforma designed specifically for the study. Demographic details such as age, gender, and body mass index were recorded at baseline. Operative details, including the type of surgery performed and the total operative time, were noted intraoperatively. Postoperative outcomes were carefully monitored, including pain levels assessed at 24 hours using the Visual Analog Scale (VAS), time to first ambulation, and total duration of hospital stay. Postoperative complications were also documented, focusing on surgical site infection, intra-abdominal collection, postoperative ileus, hemorrhage, and the occurrence of incisional or port-site hernia.

Ethical Considerations: Approval for the study was obtained from the institutional review boards of both PIMS Islamabad and Bolan Medical Complex Quetta. All patients provided written informed consent prior to enrollment. Confidentiality of patient data was strictly maintained, and patients were informed about their right to withdraw from the study at any stage without any impact on their standard medical care.

Statistical Analysis: Data were analyzed using the Statistical Package for the Social Sciences (SPSS) software version 26. Continuous variables such as age, operative time, pain scores, and duration of hospital stay were expressed as mean ± standard deviation. The independent t-test was applied to compare these variables between the laparoscopic and open groups. Categorical variables, including gender distribution and the frequency of complications, were expressed as percentages and analyzed using the chi-square test. A p-value of less than 0.05 was considered statistically significant for all analyses.

RESULTS

Patient Demographics: A total of 120 patients were enrolled in the study, with 60 undergoing laparoscopic abdominal surgery and 60 undergoing open abdominal surgery. The two groups were comparable in terms of demographic characteristics. The mean age of patients in the laparoscopic group was 38.5 ± 10.2 years, while in the open group it was 40.3 ± 11.1 years (p = 0.42). Gender distribution was also similar, with 52% males in the laparoscopic group and 55% males in the open group (p = 0.74). The mean body mass index (BMI) was 25.2 ± 3.4 kg/m² for laparoscopic patients and 25.8 ± 3.1 kg/m² for open surgery patients (p = 0.48). These findings indicate that both groups were well-matched for baseline characteristics (Table 1).

Table 1: Baseline demographic characteristics of patients

Variable	Laparoscopic Group (n=60)	Open Group (n=60)	p-value
Age (years, mean ± SD)	38.5 ± 10.2	40.3 ± 11.1	0.42
Gender (Male/Female)	31/29	33/27	0.74
BMI (kg/m², mean ± SD)	25.2 ± 3.4	25.8 ± 3.1	0.48

Operative Findings: The mean operative time was slightly longer in the laparoscopic group compared to the open group. Laparoscopic procedures lasted an average of 95 ± 12 minutes, whereas open procedures required 85 ± 10 minutes. The difference was statistically significant (p = 0.03). This finding suggests that laparoscopic surgery requires more operative expertise and setup time, although this disadvantage is offset by favorable postoperative outcomes (Table 2).

Table 2: Operative details

Variable	Laparoscopic Group (n=60)	Open Group (n=60)	p-value
Mean operative time (minutes, mean ± SD)	95 ± 12	85 ± 10	0.03

Postoperative Recovery: Postoperative recovery parameters showed significant differences between the two groups. Pain scores assessed 24 hours after surgery using the Visual Analog Scale (VAS) were markedly lower in the laparoscopic group (3.2 ± 1.1) compared to the open group (6.1 ± 1.3, p < 0.001). The mean time to first ambulation was also shorter in laparoscopic patients (12 ± 3 hours) than in open surgery patients (24 ± 5 hours, p < 0.001). Similarly, the mean hospital stay was significantly reduced in laparoscopic patients, averaging 3.4 ± 0.9 days, compared with 7.1 ± 1.2 days in the open surgery group (p < 0.001). These results clearly demonstrate the superiority of laparoscopy in enhancing recovery (Table 3).

Table 3: Postoperative recovery outcomes

Outcome	Laparoscopic Group (n=60)	Open Group (n=60)	p-value
Pain score (VAS, 24h)	3.2 ± 1.1	6.1 ± 1.3	<0.001
Time to ambulation (hours, mean ± SD)	12 ± 3	24 ± 5	<0.001
Hospital stay (days, mean ± SD)	3.4 ± 0.9	7.1 ± 1.2	<0.001

Postoperative Complications: Complications were more frequently observed in the open surgery group compared to the laparoscopic group. The overall complication rate was 10% in the laparoscopic group and 28% in the open group (p = 0.01). Wound infection was the most common complication, occurring in 15% of open surgery patients versus only 3% of laparoscopic patients. Postoperative ileus was observed in 7% of open surgery patients compared to 2% in laparoscopic patients. Incisional hernia was reported in 3% of open surgery cases, whereas no hernia was noted in laparoscopic cases. Port-site infection occurred in 2% of laparoscopic cases but was absent in the open group. These findings suggest that laparoscopic procedures are associated with a lower rate of postoperative morbidity (Table 4).

Table 4: Postoperative complications

Complication	Laparoscopic Group (n=60)	Open Group (n=60)	p-value
Overall complication rate	6 (10%)	17 (28%)	0.01
Wound infection	2 (3%)	9 (15%)	0.04
Postoperative ileus	1 (2%)	4 (7%)	0.17
Incisional hernia	0 (0%)	2 (3%)	0.15
Port-site infection	1 (2%)	0 (0%)	0.31

In summary, while laparoscopic surgery was associated with slightly longer operative times compared to open surgery (Table 2), it provided significant benefits in terms of postoperative recovery, including reduced pain, earlier ambulation, and shorter hospital stay (Table 3). Furthermore, laparoscopic surgery demonstrated a markedly lower rate of postoperative complications compared to open surgery (Table 4). These results collectively suggest that laparoscopic abdominal surgery under general anesthesia is a safer and more effective approach than traditional open surgery in terms of recovery and complication outcomes.

DISCUSSION

The present study compared postoperative recovery and complication rates between laparoscopic and open abdominal surgeries under general anesthesia, conducted at two tertiary care centers in Pakistan[9]. The findings demonstrated that laparoscopic

surgery, although associated with a slightly longer operative time, provided superior postoperative outcomes including reduced pain, earlier ambulation, shorter hospital stay, and lower complication rates[10].

The longer operative duration observed in laparoscopic procedures in this study is consistent with global literature, which attributes the increased time to technical challenges, the need for specialized instruments, and the learning curve associated with minimally invasive techniques[11]. Despite this drawback, the benefits of laparoscopy were evident in postoperative recovery. Patients in the laparoscopic group experienced significantly less pain at 24 hours, which is attributable to smaller incisions and reduced tissue trauma. Reduced postoperative pain facilitates earlier mobilization, which in turn decreases the risk of thromboembolic events, accelerates bowel recovery, and promotes earlier discharge[12,13].

Hospital stay was notably shorter for laparoscopic patients compared to open surgery patients. This finding has important implications for healthcare systems in resource-limited settings, where reducing length of stay can lower hospital costs, free bed space, and improve patient turnover. Previous studies from both developed and developing countries have consistently reported similar trends, reinforcing the reliability of these results[14-16].

Postoperative complications were also significantly fewer in the laparoscopic group. Wound infection, the most common complication, occurred predominantly in open surgery patients. This difference reflects the reduced exposure of tissues and minimized incision size in laparoscopic surgery, which lowers the risk of bacterial contamination[17]. Similarly, postoperative ileus and incisional hernia were more common in open surgeries, likely due to increased bowel handling and larger abdominal wall incisions. The absence of incisional hernia in laparoscopic patients further emphasizes the protective benefit of smaller port sites[18].

These findings are in line with the growing consensus that laparoscopic surgery offers substantial advantages over conventional open procedures. However, certain limitations must be acknowledged. The study was limited to elective surgeries, and emergency cases were excluded, which may restrict the generalizability of results[19]. Additionally, the relatively short duration of follow-up may have underestimated late complications such as incisional or port-site hernia. Furthermore, the availability of laparoscopic facilities and trained personnel may not be uniform across all hospitals in Pakistan, which could affect broader adoption of this technique[20].

Despite these limitations, this study adds valuable evidence from a local context, supporting the global shift toward minimally invasive surgery. The results highlight the importance of expanding laparoscopic training and infrastructure in tertiary care centers across Pakistan to optimize patient outcomes and align with international standards of surgical care[21].

CONCLUSION

Laparoscopic abdominal surgery under general anesthesia, though associated with slightly longer operative time, offers significant advantages over open surgery in terms of reduced postoperative pain, earlier mobilization, shorter hospital stay, and fewer complications. These findings support the adoption of laparoscopic techniques as the preferred approach for elective abdominal procedures in suitable patients. Strengthening laparoscopic training and ensuring the availability of minimally invasive surgical facilities can further enhance surgical outcomes and reduce healthcare burdens in Pakistan and similar healthcare settings.

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Conflict of Interest: The authors declare no conflict of interest.

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Author Contributions:

FT: Conceptualization, study design, supervision.
SS: Data collection, literature review, drafting of manuscript.
RA: Data acquisition, analysis, and interpretation.
FH: Statistical analysis, results drafting, critical revisions.
KK: Patient recruitment, operative assistance, data validation.
MI: Final review, editing, and approval of the manuscript.

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