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Original Research Article

To Compare the Outcome of Open Versus Laparoscopic Peritoneal Lavage in Patients With Primary Peritonitis Presenting in Surgical Emergency of SHZ Hospital, Rahim Yar Khan

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Abstract: *Primary peritonitis is a surgical emergency traditionally managed by open peritoneal lavage, though minimally invasive approaches are increasingly being adopted due to potential postoperative benefits.* ***Objective:*** *To compare the outcomes of open versus laparoscopic peritoneal lavage in patients with primary peritonitis in terms of wound infection, operative time, postoperative pain, and length of hospital stay.* ***Methods****: A randomized controlled trial was conducted in the Department of General Surgery, Sheikh Zayed Hospital, Rahim Yar Khan, from March to May 2025. A total of 160 patients of either gender, aged 18–60 years, diagnosed with primary peritonitis, were randomly assigned to undergo either open or laparoscopic peritoneal lavage. Demographic variables, operative time, postoperative pain, wound infection, and length of hospital stay were recorded. Categorical variables were analyzed using the Chi-square test, while continuous variables were compared using the Mann–Whitney U test. Statistical analysis was performed using SPSS version 26.0, with a P-value < 0.05 considered statistically significant.* ***Results:*** *Both groups were comparable with respect to age, body mass index, gender distribution, and ASA score. Operative time was significantly shorter in the laparoscopic group (P < 0.001), and hospital stay was shorter (P = 0.030). Postoperative pain scores were significantly lower in the laparoscopic group at 0, 4, and 8 hours postoperatively (P < 0.05). Mild wound infection (SWA Grade I) was more frequently observed in the laparoscopic group, whereas moderate to severe wound infections were significantly more common in the open surgery group (P = 0.011).* ***Conclusion:*** *Laparoscopic peritoneal lavage is a safe and effective alternative to open surgery for the management of primary peritonitis, offering shorter operative time, reduced postoperative pain, a shorter hospital stay, and a lower rate of clinically significant wound infections, supporting its role in emergency surgical practice.*

Keywords: Laparoscopy, Length of Stay, Pain, Peritoneal Lavage, Peritonitis, Postoperative, Surgical Wound Infection

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Introduction

Although medicine is a discipline that is continually evolving, some diseases continue to affect its ability to manage morbidity and mortality. One of these conditions is peritonitis. (1) Peritonitis is characterized as inflammation of the visceral and parietal peritoneum. Peritoneal cavity inflammation can result from a variety of pathogens, including bacteria, fungi, viruses, chemical irritants, and foreign objects. (2) Peritonitis continues to be a potentially lethal illness despite improvements in diagnosis, surgery, antimicrobial medication, and critical care support. Peritonitis can be categorized as primary, secondary, or tertiary based on the kind and source of microbial infection. A common monomicrobial infection of the peritoneal fluid that does not involve visceral rupture is called primary peritonitis. The most common type of peritonitis is secondary peritonitis, which occurs when a hollow internal organ ruptures. After secondary peritonitis is treated, tertiary peritonitis occurs when the host's inflammatory response fails or a superinfection occurs. (3, 4) Therefore, a more profound understanding of this illness might contribute to better prognostication.

The fundamentals of operative care for peritonitis have changed little over the past 1900s: remove purulent material, clear dead tissue, and remove the septic focus. (5) However, with the advent of contemporary critical care, a wide variety of antibiotics, minimally invasive procedures, and diagnostic technology, the time and selection of patients in need of surgery have changed significantly. Patients may get more limited drainage or a trial of non-surgical therapy if they have localized peritonitis (peritoneal symptoms limited to one or two abdominal quadrants) and lab and scan findings that support a contained process. Patients with generalized peritonitis (rigidity, rebound pain, or guarding in all four abdominal quadrants) or sepsis require immediate surgical exploration and rapid resuscitation. (6) Regarding the latest publication of clinical studies comparing laparoscopic lavage with open peritoneal lavage, the perfect method remains to be debated. (7, 8) Laparoscopic lavage might lower the incidence of infections, surgical trauma, time to recovery, and the number of reoperations and stomas. Large wounds can also be avoided in laparoscopic surgeries. No studies are available on this topic for our local population. To determine whether the potential advantages of laparoscopy outweigh the risks of immediate and long-term complications, the long-term outcomes of randomized controlled trials are crucial. The juxtaposition of open and laparoscopic peritoneal lavage outcomes will not only provide clinicians with essential insights but also inform future research. Still, it will also serve as a foundational platform for future medical interventions, designed to address the distinct healthcare needs and demographic characteristics of patients in our setting. The study is poised to bridge the existing research lacuna, offering a comprehensive analysis that could refine clinical practices and optimize patient outcomes in the context of peritonitis treatment within our unique demographic.

This study has been designed to compare the outcomes of open versus laparoscopic peritoneal lavage in patients with primary peritonitis in terms of wound infection, post-op pain, and hospital stay, presenting to the surgical emergency department of SHZ hospital, Rahim-Yar Khan. By systematically examining key parameters, including wound infection, postoperative pain, and hospital stay, this study aims to make a substantive contribution to the current body of knowledge.

Methodology

In this Randomized controlled trial, both male and female patients aged 18 to 60 years with primary peritonitis presenting at the Emergency Department of General Surgery, Shaikh Zayed Hospital, Rahim Yar Khan, Pakistan, from March to September 2025 were included. Primary peritonitis was diagnosed on the basis of clinical features, including diffuse abdominal pain, abdominal distension, fever, weight loss, and generalized abdominal tenderness with a tense abdomen, supported by ultrasonographic evidence of free intraperitoneal fluid. By using a WHO calculator, the sample size was calculated to be 160. Patients were selected using a simple randomization method facilitated by computer software. Patients with primary peritonitis were considered, while cases receiving immunosuppressive therapy and high-risk patients (ASA IV-VI) were excluded.

Participants were randomly assigned to one of two groups—open or laparoscopic peritoneal lavage—through a computer-generated allocation system (Figure 1). Each patient was thoroughly informed about the surgical procedure to be undertaken, and written informed consent was obtained. The Study received ethical clearance from the Institutional Review Board (IRB). Power analysis was conducted to compare outcomes, including wound infection, operative time, postoperative pain, and hospital stay, between open and laparoscopic peritoneal lavage. Sample size estimation was performed using the WHO sample size calculator, considering an effect size of 0.5, a significance level (α) of 0.05, and a power of 80%. Based on these parameters, 160 patients were enrolled, with 80 assigned to the open group (A) and 80 to the laparoscopic group (B).

Every patient had baseline tests, including chest x-rays, ultrasounds, serum urea and creatinine levels, complete blood counts, and plain abdominal x-ray with electrocardiogram (ECG). Standard preoperative preparation was ensured by insertion of a nasogastric tube and a Foley's catheter, along with intravenous fluid resuscitation during the initial hours of admission. Both open and laparoscopic peritoneal lavage procedures were standardized by performing them under general anesthesia. Furthermore, all patients in both groups received a prophylactic dose of 1 gram of Cefazolin one hour before surgery.

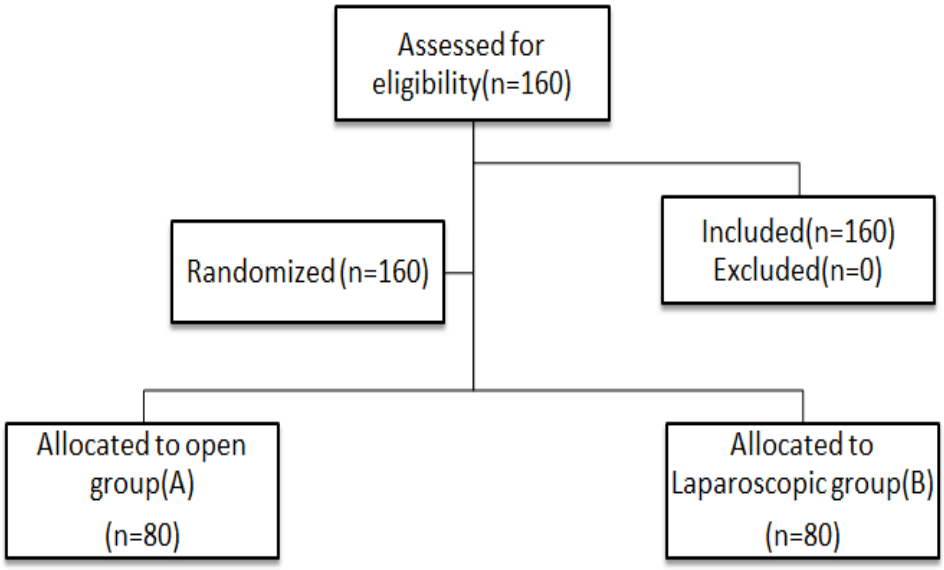

Figure 1: Flowchart of the patient randomization

As initially described by Sangrasi et al., all procedures were performed under general anesthesia in a supine posture. In the laparoscopic group, pneumoperitoneum was established using carbon dioxide via an open (Hasson) technique. (9) A 10-mm umbilical port was introduced for the laparoscope, followed by placement of additional working ports as required. The peritoneal cavity was inspected, and purulent collections were evacuated. Warm isotonic saline was used for thorough irrigation with a suction-irrigation device. Secondary causes were ruled out.

In the open group, a midline laparotomy was performed to access the peritoneal cavity. After aspiration of infected fluid, extensive lavage with warm saline was carried out until the effluent cleared. Secondary causes of peritonitis were ruled out. Drains were inserted as needed, and the abdomen was closed in layers.

All patients received standardized postoperative analgesia. Intravenous paracetamol 1g every 6 hours was administered routinely for the first 24 hours. Additional analgesia, such as intravenous Toradol (50–100 mg) or an opioid, was added as rescue medication based on patient-reported pain using the Visual Analog Scale (VAS).

Data on age, gender, body mass index (BMI), history of diabetes and smoking, and the American Society of Anesthesiologists (ASA) score were documented for all patients. Post-op pain was assessed using the VAS pain scale at 0 hr., 4 hr., 8 hr., 12 hr., and 24 hr. in the recovery room. Patients were followed till discharge, and the hospital stay was documented in days. Wound infection was noted in both groups till discharge. For every patient, data on the procedure length were also collected. All data was entered into an especially designed pro forma.

Baseline characteristics of the study groups were summarized using descriptive statistical methods. Data normality was assessed using the Shapiro-Wilk test. Quantitative data were expressed as medians with interquartile ranges, while qualitative variables were presented as frequencies (n) and percentages (%). The Chi-square test was applied to assess associations between categorical variables, and the comparison between independent groups A and B was performed using the Mann-Whitney U test. A p-value of less than 0.05 was considered statistically significant. All statistical analyses were carried out using IBM SPSS Statistics, version 26 (IBM Corp., Armonk, NY, USA).

Results

A total of 160 patients with primary peritonitis were randomized into two equal groups. Group A: open peritoneal lavage (n=80) and Group B: laparoscopic peritoneal lavage (n=80). Demographic characteristics, including age and BMI, were comparable between the two groups (median age: 38.5 vs. 42 years, p=0.465; BMI: 26.79 vs. 26.12, p=0.486; Table 1). There was no significant difference in gender distribution (p=0.500) or ASA score classification (p=0.064) between the two techniques. (Table 1)

The median duration of hospital stay was 7.00 days in both groups; however, the interquartile range (IQR) was narrower in the open surgery group (p=0.030). The duration of surgery was significantly shorter in the laparoscopic group (56.00 vs. 97.00 minutes, p<0.001). Pain assessment using the Visual Analogue Scale (VAS) revealed significantly lower scores in the laparoscopic group at 0, 4, and 8 hours postoperatively (p<0.05). Differences at 12, 24 hours, and at discharge were statistically insignificant (p>0.05). Regarding the severity of surgical wound infection, assessed by the Southampton Wound Assessment Scale (SWA), mild infection (Grade I) was more frequently observed in the laparoscopic group (92.5% vs. 75.0%, p=0.011). Moderate and severe infections were more common in the open surgery group. (Table 2)

Table 1. Baseline Demographic and Clinical Characteristics of Study Participants by Surgical Technique (n = 160)

Parameter	Group A Open (n = 80)	Group B Laparoscopic (n = 80)	p-value
Age (years)	42 (24)	38.5 (19)	0.465[a]
BMI (kg/m²)	26.12 (6.79)	26.79 (8.68)	0.486[a]
ASA score			0.064[b]
ASA I	10 (12.5%)	21 (26.3%)	
ASA II	52 (65.0%)	40 (50.0%)	
ASA III	18 (22.5%)	19 (23.7%)	
Gender			0.500[b]
Male	58 (72.5%)	57 (71.3%)	
Female	22 (27.5%)	23 (28.7%)	

[a] Data are presented as median (IQR). p-values calculated using the Mann–Whitney U test.
[b] Data are presented as frequency (%). p-values calculated using the Chi-square test.
p-values < 0.05 were considered statistically significant.
ASA = American Society of Anesthesiologists physical status classification.

Table 2Comparison of VAS (Visual Analogue Scale) pain score at different hours, Hospital stay, Duration of Surgery, SWA score between group A and B.

Parameters	Techniques		p-value
	Group A Open (n=80)	Group B Laparoscopic (n=80)	
VAS pain score			
AT 0 hour	8.00(1.0)	6.00(1.8)	<0.001[c]
At 4 hours	5.00(0.0)	5.00(1.00)	0.022 [c]
At 8 hours	4.00(1.0)	4.00(1.0)	0.041 [c]
At 12 hours	3.00(0.8)	3.00(0.8)	0.051 [c]
At 24 hours	2.00(2.0)	2.00(1.8)	0.659 [c]
At discharge	1.00(1.0)	1.00(1.0)	0.821 [c]
Hospital stay(days)	7.00(1.00)	7.00(1.8)	0.030 [c]
Duration of surgery	97.00(13.8)	56.00(10.8)	<0.001[c]
SWA Score			
I (Mild infection)	60(75.0)	74(92.5)	0.011 [d]
III (Moderate infection)	13(16.3)	4(5.0)	
V(Severe Infection)	7(8.8)	2(2.5)	

[c] The data are presented as median (IQR). p: Mann-Whitney U test. p-value is significant at the 0.05 level.
[d] Data are presented as frequency (%). P = Chi-square test. p-value is significant at the 0.05 level. SWA= Southampton wound assessment scale.

Discussion

Regarding wound-related outcomes, the laparoscopic group had a significantly higher rate of Grade I infections, suggesting milder wound complications. Conversely, moderate-to-severe infections were more prevalent in the open group. This aligns with current evidence suggesting a lower risk of wound infection in laparoscopic surgery due to smaller incisions and reduced exposure of intra-abdominal contents to the external environment (10, 11). Several preliminary studies have demonstrated a lower incidence of postoperative infections following laparoscopic procedures compared to open surgery, with reported rates of 5% and 25%, respectively. (12)

Notably, laparoscopic lavage was associated with a significantly shorter operative time, reinforcing the literature's emphasis on its minimally invasive nature and technical efficiency. This is particularly relevant in emergency surgical settings, where time-sensitive interventions can influence outcomes. Sangrasi et al. reported that in selected patients with peritonitis due to various intra-abdominal pathologies, laparoscopic management was a feasible, safe, and effective option. It offered superior diagnostic capability and was associated with faster postoperative recovery. (9, 13, 14) Similarly, Ates et al. emphasized that, in experienced hands, laparoscopy provides both diagnostic and therapeutic benefits in patients presenting with acute abdominal conditions. When conventional methods fail to establish a diagnosis, laparoscopy serves as a valuable

modality to avoid unnecessary laparotomies. With greater expertise and wider availability, laparoscopy may play a broader role in emergency abdominal surgery; however, further studies are needed to define its indications and limitations better. (15, 16)

In the current study, significant differences were observed between the two groups for infections, hospital stay, pain score, and duration of surgery. In the literature, laparoscopy is also unquestionably superior to laparotomy as a diagnostic tool because it imposes less surgical stress on patients and allows a thorough examination of the abdominal cavity. (17, 18)

Postoperative pain, measured using the Visual Analogue Scale (VAS), was significantly lower in the laparoscopic group than in the open group during the early postoperative hours (0, 4, and 8 hours). These findings are consistent with previous studies, which report decreased somatic pain due to smaller incisions and reduced tissue trauma in laparoscopic procedures. (19, 20) Although pain differences leveled out at 12 and 24 hours and at discharge, the early pain relief observed with laparoscopy may contribute to better patient comfort and reduced need for analgesia in the immediate postoperative period.

Existing research on peritoneal lavage is confined mainly to heterogeneous or highly selected cohorts, with little emphasis on primary peritonitis. By directly contrasting laparoscopic and open approaches, this study contributes novel, context-specific evidence that strengthens the limited literature and offers practical guidance for surgical decision-making in emergency care.

Nonetheless, it is essential to acknowledge the limitations of this study. One notable limitation of this study is its single-center design, which may limit the generalizability of the results. Furthermore, long-term outcomes such as recurrence rates were not evaluated and warrant further investigation. Additionally, surgeon experience and selection bias could have influenced the results despite randomization.

Conclusion

Laparoscopic peritoneal lavage demonstrated better outcomes than the open technique in patients with primary peritonitis. This approach was associated with shorter surgical duration, decreased early postoperative pain, and a lower rate of wound infections. While hospital stay duration was similar, the narrower IQR in the open group suggests less variability. Overall, the laparoscopic technique demonstrates potential as a safe and effective alternative for managing primary peritonitis in emergency settings.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC--24)

Consent for publication

Approved

Funding

Not applicable

Conflict of interest

The authors declared no conflict of interest.

Author Contribution

YJ (PGR 4)

Manuscript drafting, Study Design,

MTG (Professor)

Review of Literature, Data entry, Data analysis, and drafting articles.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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