

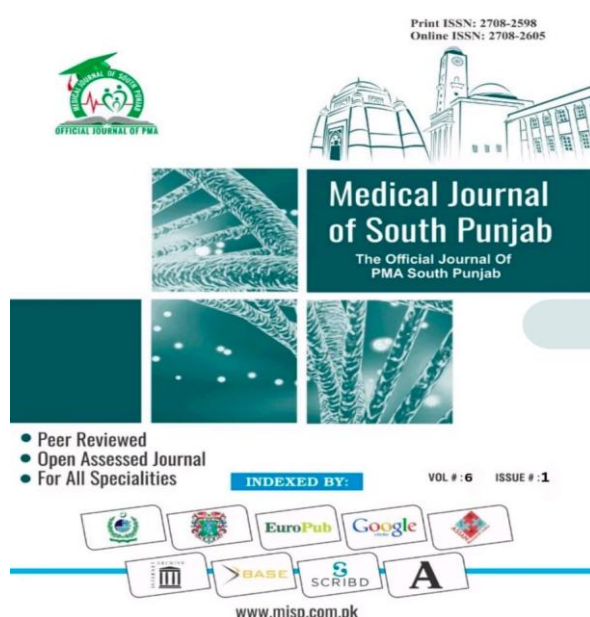
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## Comparison of short-term outcomes of open appendectomy and laparoscopic appendectomy in patients with acute appendicitis

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## Comparison of short-term outcomes of open appendectomy and laparoscopic appendectomy in patients with acute appendicitis

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### ABSTRACT

**Objective:** To compare laparoscopic appendectomy and Open appendectomy in terms of short-term outcomes in patients with acute appendicitis.

**Methods:** Study was commenced at Department of Surgery at Ibn-e-Siena Hospital, Multan, as a randomized controlled trial over six months following the approval of the synopsis. A total of 60 patients, with 30 in each group, were included in the study using non-probability consecutive sampling. Patients were followed up weekly in the outpatient department for 30 days postoperatively. The occurrence of surgical site infection and seroma formation was assessed.

**Results:** Mean duration of surgery of LA was significantly higher than OA,  $63.13 \pm 3.28$  minutes and  $46.90 \pm 2.23$  minutes, respectively ( $p < 0.001$ ). Mean duration of hospital stay of OA was significantly higher than OA,  $3.03 \pm 0.92$  days and  $1.90 \pm 0.61$  days, respectively ( $p < 0.001$ ). Surgical site infection was significantly higher in OA 12 (40.0%) than LA 3 (10.0%). ( $p = 0.007$ ). Whereas, seroma formation was observed in 6.7% OA and 3.3% in LA ( $p = 0.129$ ).

**Conclusion:** Laparoscopic appendectomy offers advantages over open appendectomy in terms of reduced postoperative pain, shorter hospital stays, and lower wound infection rates, making it a preferred approach where feasible. However, the longer operative time and slightly higher risk of intra-abdominal abscess formation should be considered when selecting the surgical technique.

**Keywords:** Appendectomy, Laparoscopy, Open surgery, Seroma formation, Hospital stay.

## 1. INTRODUCTION

Acute appendicitis is one of the most prevalent surgical emergencies globally, with an estimated lifetime risk of 7-8% [1]. It represents a substantial percentage of urgent abdominal surgeries, with an annual incidence of around 100 cases per 100,000 people. Surgery is the gold standard of management, and techniques have progressed over time from open appendectomy (OA) to laparoscopic appendectomy (LA). It involves consideration of patient traits, surgeon skills, hospital resources, and the severity of appendicitis. The interim success of these methods is paramount to informed patient management.

Pathophysiology of acute appendicitis involves obstruction of the appendiceal lumen, commonly caused by lymphoid hyperplasia, fecaliths, and tumors. This blockage causes more bacterial overgrowth, intraluminal pressure, and finally, inflammation of the appendiceal wall. Later in the course of the disease, ischemia, necrosis, and perforation may occur with potential development of peritonitis and sepsis. The amount of inflammation present during surgical intervention plays a vital role in postoperative outcomes, particularly regarding complications (e.g., surgical site infection, intra-abdominal abscess) and time to recovery. Adoption of minimally invasive techniques such as LA has increased, given the potential benefits of reduced surgical trauma and postoperative complications. For more than a century, the open appendectomy has been the surgical standard, providing direct access to the inflamed appendix via a right lower quadrant incision. It is effective but is associated with increased postoperative pain, more extended hospital stays, and higher rates of wound infectious complications.

In comparison, laparoscopic appendectomy developed in the late 1980s with superior visualization of the cavity, decreased postoperative pain, quicker recovery, and reduced wound infection rates. Nonetheless, longer operative times, higher costs, and the risk of intra-abdominal abscess formation are still debated. Such short-term results in OA and LA in adults with acute appendicitis are crucial for better clinical decision-making, especially in resource-limited areas where all the techniques may not be available. This study compares short-term outcomes such as operative time, postoperative pain, complication rate, hospital stay, and recovery in patients undergoing OA and LA. The findings may help refine surgical practice and improve patient care by providing evidence of each technique's relative benefits and limitations.

We have planned this study to compare both surgical approaches regarding short-term outcomes in acute appendicitis patients presenting at our local setting. The study results will help working surgeons opt for a more suitable surgical approach with fewer complications to provide maximum benefit to the patients.

## 2. METHODOLOGY

The study was conducted in the Department of Surgery at Ibn-e-Siena Hospital, Multan, as a randomized controlled trial over six months following the approval of the synopsis. The sample size was extracted from mean difference, considering a hospital stay duration of  $2.7 \pm 2.5$  days for open appendectomy and  $1.4 \pm 0.6$  days for laparoscopic appendectomy, with an 80% power and a 5% significance level. A total of 60 patients, with 30 in each group, were included in the study using non-probability consecutive sampling.

The study included male and female obese patients, aged 25 to 60 years,

who presented with acute appendicitis of three days or less in duration, as per the operational definition. However, patients with a history of abdominal surgery within the past three months, uncontrolled coagulopathy (INR > 1.5), diabetes mellitus (as per history and medical record), carcinoma of the gallbladder (diagnosed on CT scan), or chronic liver disease (based on history and medical records) were excluded.

Following approval from the ethics review committee, eligible patients presenting with acute appendicitis were enrolled in the study after providing informed consent. Demographic data, including age, gender, duration of symptoms, and presence of obesity, were recorded. Patients were randomly assigned to undergo either open appendectomy (Group A) or laparoscopic appendectomy (Group B) using the lottery method. Sealed opaque envelopes marked with Group A or Group B were drawn by the patients to determine their allocation.

All surgical procedures were performed by a consultant surgeon with at least five years of post-fellowship experience, following hospital protocols. The surgery time, defined as the duration from the first incision to skin closure, was recorded by a nurse not involved in the study. Postoperatively, all patients received antibiotics and pain management as per hospital protocol, and the duration of hospital stay was documented. Discharge was determined at the discretion of the treating surgeon.

Patients were followed up weekly in the outpatient department for 30 days postoperatively. The occurrence of surgical site infection and seroma formation was assessed based on the operational definitions. All data were recorded on a structured proforma.

Data were analyzed in SPSS version 27 for analysis. Age, duration of

symptoms, surgery time, and hospital stay were presented as mean and standard deviation, while categorical variables such as gender, obesity, surgical site infection, and seroma formation were reported as frequencies and percentages. The duration of surgery and hospital stay were compared between the two groups using an independent sample t-test, while surgical site infection and seroma formation were compared using the chi-square test. A p-value of less than 0.05 was considered statistically significant.

### 3. RESULTS

A total of 60 patients were included in our study, with 30 patients (50.0%) in each group, Group A and Group B. The mean age of patients in Group A was  $36.83 \pm 6.59$  years, while in Group B, it was  $38.07 \pm 4.13$  years ( $p=0.472$ ). In Group A, there were 10 males (33.3%) and 20 females (66.7%), whereas Group B had 16 males (53.3%) and 14 females (46.7%) ( $p=0.118$ ). The mean duration of symptoms was  $2.73 \pm 0.78$  days in Group A and  $2.87 \pm 1.16$  days in Group B ( $p=0.605$ ). Obesity was present in 4 patients (13.3%) in Group A and 3 patients (10.0%) in Group B ( $p=0.688$ ). The mean duration of surgery was significantly longer in Group B ( $63.13 \pm 3.28$  minutes) compared to Group A ( $46.90 \pm 2.23$  minutes) ( $p<0.001$ ).

However, the mean duration of hospital stay was significantly higher in Group A ( $3.03 \pm 0.92$  days) than in Group B ( $1.90 \pm 0.61$  days) ( $p<0.001$ ). The incidence of surgical site infection was also significantly higher in Group A, with 12 patients (40.0%) affected compared to 3 patients (10.0%) in Group B ( $p=0.007$ ). Seroma formation was observed in 2 patients (6.7%) in Group A and 1 patient (3.3%) in Group B ( $p=0.129$ ).

**Table-1: Demographic and baseline variables of the study groups**

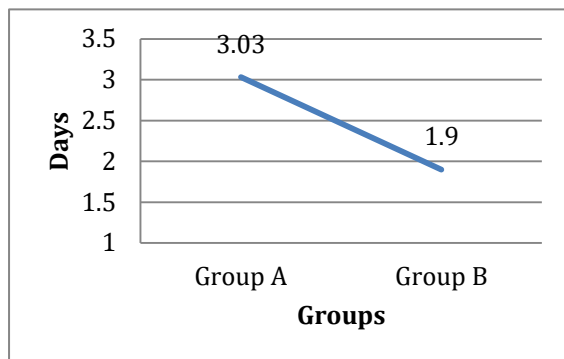
Variable	Group A	Group B	Test of sig.
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Age (years)	36.83±6.59	38.07±4.13	t=0.72, d.f=58, p=0.472
<b>Gender</b>			
Male	10 (33.3)	16 (53.3)	$\chi^2=2.44$ , d.f=1, p=0.118
Female	20 (66.7)	14 (46.7)	
Duration of symptoms (days)	2.73±0.78	2.87±1.16	t=-0.517, d.f=58, p=0.605
Obesity	4 (13.3)	3 (10.0)	$\chi^2=0.16$ , d.f=1, p=0.688
Duration of surgery (minutes)	46.90±2.23	63.13±3.28	t=-22.4, d.f=58, p<0.001
N (%), chi-square. Mean±standard deviation, student t test.			

**Table-2: Outcome variables of the study groups**

Variable	Group A	Group B	Test of sig.
Hospital stays (days)	3.03±0.92	1.90±0.61	t=5.59, d.f=58, p<0.001
Surgical site infection	12 (40.0)	3 (10.0)	$\chi^2=7.20$ , d.f=1, p=0.007
Seroma formation	2 (6.7)	1 (3.3)	$\chi^2=2.31$ , d.f=1, p=0.129
N (%), chi-square. Mean±standard deviation, student t test.			

**Figure-1: Comparison of length of hospital stays between two study groups**



#### 4. DISCUSSION

Acute appendicitis is one of the most common surgical emergencies, requiring prompt intervention to prevent complications. Open appendectomy (OA) has been the traditional approach, but laparoscopic appendectomy (LA) has gained popularity due to advancements in minimally invasive techniques<sup>11</sup>. LA is associated with less postoperative pain, short hospital stay, and

early recovery while OA remains widely used, especially in resource-limited settings<sup>12</sup>.

Findings indicate that while the mean duration of surgery was significantly longer in the LA group (63.13 ± 3.28 minutes) compared to the OA group (46.90 ± 2.23 minutes) (p < 0.001). The results align with several previous studies that have evaluated the efficacy and outcomes of LA versus OA. Basukala et al<sup>13</sup> conducted a retrospective cohort study involving 450 patients and found that the LA group had a longer mean operative time (56.86 ± 11.70 minutes) compared to the OA group (46.08 ± 13.10 minutes) (p = 0.000). However, LA group experienced a shorter length of hospital stay (1.07 ± 0.25 days vs. 1.28 ± 0.80 days, p = 0.000) and required a shorter course of oral analgesics (3.00 days vs. 3.55 ± 0.68 days, p = 0.000).

The group from LA experienced a statistically significantly reduced hospital stay (1.90 ± 0.61 days vs. 3.03 ± 0.92 days, p < 0.001) and a dramatically lower rate of surgical site infections (10.0% vs. 40.0%, p = 0.007). In a similar prospective study by Torun et al<sup>14</sup> postoperative results were compared between LA and mini-incision OA in 226 patients. The rate of wound infection was marginally lower in the LA group. The study concluded that LA and mini-incision OA are feasible and effective procedures for treating acute appendicitis.

Biondi et al<sup>15</sup> conducted a retrospective cohort study to compare outcomes and cost-effectiveness between LA and OA. The study found LA associated with longer operative time but shorter time spent in-hospital and quicker return to routine activities. The authors found that LA had better outcomes than OA regarding less postoperative pain and faster recovery. In a prospective randomized clinical trial, Kocataş et al<sup>16</sup> compared OA and LA in patients with uncomplicated appendicitis. They found no significant differences between the groups in

postoperative infection, hospital stay lengths, or quality of life scores. The authors concluded these complications were not significantly better in LA vs OA.

A systematic review by Valioulis et al<sup>17</sup> examined pediatric patients receiving OA and LA. Compared with OA, LA is associated with decreased postoperative pain, fewer surgical site infections, and a shorter length of stay. The authors concluded LA should be considered a routine surgical approach for pediatric patients with acute appendicitis. Habash et al<sup>18</sup> studied 80 patients with acute appendicitis (40 OA, 40 LA). LA had shorter hospitalization ( $1.4 \pm 0.6$  vs.  $2.7 \pm 2.5$  days,  $P < 0.001$ ) and operative time ( $30 \pm 3.2$  vs.  $35 \pm 5.2$  min,  $P < 0.001$ ). LA patients returned to daily activities faster ( $12.6 \pm 4.2$  vs.  $17.2 \pm 3.4$  days) and had no infections (0% vs. 15%).

In this study, seroma formation was observed in 6.7% of patients undergoing open appendectomy and 3.3% in those undergoing laparoscopic appendectomy, which are higher rates than those reported in some previous studies. For instance, Eledreesi et al<sup>19</sup> reported seroma rates of 1.2% in open appendectomy and 0.4% in laparoscopic appendectomy. Similarly, Shi et al<sup>20</sup> found comparable rates of seroma formation between laparoscopic and open surgeries, although specific percentages were not provided. In the context of hernia repair surgeries, seroma formation has been reported at rates ranging from 8% to 12.5% for open repairs and 5.4% for laparoscopic repairs.

## 5. CONCLUSION

In conclusion, laparoscopic appendectomy offers advantages over open appendectomy in terms of reduced postoperative pain, shorter hospital stays, and lower wound infection rates, making it a preferred approach where feasible. However, the longer operative time and slightly higher

risk of intra-abdominal abscess formation should be considered when selecting the surgical technique.

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