

Original Research Article

Comparative safety and efficacy study of laparoscopic and open appendectomy

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ABSTRACT

Background: Appendicitis is a common surgical emergency and the choice between laparoscopic and open appendectomy can significantly affect patient outcomes. This study aimed to compare the clinical outcomes and resource utilization associated with these two surgical approaches.

Methods: A prospective study was conducted on patients who underwent either laparoscopic or open appendectomy. Demographic and clinical characteristics including age distribution, type of appendicitis, leukocytes and additional surgical findings were evaluated. The two groups were evaluated and compared based on various postoperative outcomes. These included assessments of pain scores, opioid requirements, oral feeding tolerance, time taken to resume normal activities, length of hospital stay and overall expenses.

Results: This study included 100 appendicitis patients. The age distribution showed that young adults were most commonly affected. Laparoscopic appendectomy was linked to lower pain scores (2.77 vs 5.36 on day 0), reduced opioid requirement (6.7% vs 93.3%), faster oral feed tolerance (87% on day 0 vs 3% for open appendectomy) and quicker return to normal activity (2.42 days vs 5.15 days). Complications, such as wound infections and urinary retention, were lower in the laparoscopic group. However, the total cost of laparoscopic appendectomy is high.

Conclusions: Laparoscopic appendectomy yields superior clinical outcomes, including reduced pain, fewer complications and faster recovery, despite being more costly than open appendectomy. These findings suggest that laparoscopic surgery is the preferred approach for managing appendicitis when feasible.

Keywords: Appendicitis, Clinical outcome, Comparison, Laparoscopic appendectomy, Open appendectomy

INTRODUCTION

The comparative efficacy and safety of open appendectomy versus laparoscopic have garnered significant attention in the literature on surgery, particularly because of the increasing preference for minimally invasive techniques. The debate between these two approaches centers on their respective advantages and outcomes, with each method having its own set of benefits and drawbacks. Laparoscopic appendectomy, characterized by its minimally invasive nature, has gained significant popularity due to its association with lesser postoperative pain, quicker recovery times and shorter

hospital stays in comparison to the traditional open approach.¹ This technique utilizes small incisions and a camera, resulting in less tissue trauma and, consequently, fewer complications. In contrary, open appendectomy, which involves a larger incision and has been the standard for over a century, remains widely practiced, particularly in settings where laparoscopic facilities are unavailable or limited.² Despite its long history and broad availability, open appendectomy is related to significant postoperative pain and long recovery times. Studies have consistently shown that laparoscopic appendectomy results in a mean hospital stay of approximately 1.77 days, which is significantly shorter than the 7.73 days

observed for open appendectomy.¹ Additionally, laparoscopic procedures report a reduced incidence of postoperative complications, including infections at the site of surgery (3.3% compared to 26.7% in traditional open surgery) and enhanced patient contentment with cosmetic outcomes (86.7%).¹ However, it is important to note that open appendectomy can still yield equivalent outcomes in specific contexts, such as military settings where resources may be limited.³ This suggests that while laparoscopic procedures are generally preferred owing to their superior clinical outcomes, open appendectomy remains a viable option under certain circumstances.

This study aimed to compare the clinical outcomes and resource utilization associated with these two surgical approaches.

METHODS

Study place

This prospective investigation was carried out in the Department of General Surgery at the Holy Family Hospital and Research Centre, Mumbai.

Study duration

The study duration was from October 2010 to September 2012.

This study involved an analysis of 100 patients who underwent appendectomy. The study sample included 100 patients who were clinically diagnosed with appendicitis and radiologically confirmed. Patients aged 6-65 years with lower abdominal pain were involved and those under 6 or above sixty-five years with other intra-abdominal pathology, previous abdominal surgery or significant comorbid conditions were excluded. Patient details were recorded in a preformed proforma after obtaining informed consent. A thorough preoperative assessment was performed and the subjects were followed-up from admission to discharge. Patients underwent either open or laparoscopic appendectomy and were managed with intravenous fluids, antibiotics, NBM status and injectable analgesics.

Postoperative pain scores, recovery mobilization and postoperative complications were evaluated. The requirement for pain and analgesia was assessed 24 and 48 hours postoperatively. Data were tabulated in Microsoft Excel and analyzed using SPSS version 15.

Patient details were recorded in a preformed proforma and analyzed statistically. The differences in WBC counts, number of days of stay in hospital, pain scores after 24 and 48 hours, intraoperative findings other than appendicitis, postoperative complications of appendectomy, postoperative requirement of pain killers, day of oral feeding tolerance, day of normal activity after operation and total cost during hospital stay were

recorded. Patients were observed for postoperative pain using a pain chart, with a facial expression grading system ranging from no pain to excruciating pain. Patients with mild and bearable pain who did not require analgesics fell into categories 1–3 range on the scale. Those with bearable pain who required analgesics for pain management were classified into grades 4 to 6. Patients who could not bear the pain and almost always required two different types of analgesics fell into the grade 7 to 10 range.

RESULTS

Eighteen patients were less than ten years old, 48 patients (the largest group) were between 10 and 25 years old and 34 patients were more than 25 years old. This distribution indicated that appendicitis is most commonly diagnosed in young adults.

The subjects were categorised based on the type of appendicitis and surgical approach used. The most common condition was acute appendicitis, affecting 80 patients. Among these, 48 (60%) underwent laparoscopic appendectomy, while 32 (40%) had open appendectomy. Eight patients had multiple episodes of sub-acute appendicitis, 2 (25%) were treated with laparoscopic appendectomy and 6 (75%) underwent open appendectomy. Chronic appendicitis included 12 patients, with 10 (83%) treated by laparoscopic appendectomy and 2 (17%) treated by open appendectomy. The high percentage of laparoscopic procedures for chronic appendicitis suggests a preference for this method in managing chronic cases.

The presence of leucocytosis was analyzed on the basis of the surgical methodology. Among patients with white blood cell counts less than 10,000 cells/ μ L, 18.2% were in the open appendectomy group and 81.8% were in the laparoscopic appendectomy group. For counts between 10,000-15,000 cells/ μ L, 37.0% of patients underwent open appendectomy and 63.0% underwent laparoscopic appendectomy. For counts > 15,000 cells/ μ L, 87.0% of the patients underwent open appendectomy, whereas only 12.5% underwent laparoscopic appendectomy. This suggests that higher levels of leukocytosis may be more commonly associated with open surgical procedures.

Other significant findings during surgery have also been reported. Meckel's Diverticulitis was found in 1 (2.56%) open appendectomy patient and 3 (4.91%) laparoscopic appendectomy patients. Mesenteric Lymphadenitis was observed in 3 (7.69%) subjects who went through open appendectomy procedure and 2 (3.27%) who underwent laparoscopic appendectomy. Ovarian Cyst was observed in 1 patient (2.56%) in the open appendectomy group and 1 patient (1.63%) in the laparoscopic appendectomy group. The mean length of hospital stay varied significantly between the two surgical approaches. The patients who underwent open appendectomy had a mean hospital stay of 6.26 days. In contrast, subjects who went

through laparoscopic appendectomy procedure had a considerable shorter mean hospital stay (3.95 days). This difference highlights the shorter recovery times associated with laparoscopic surgery (Table 1). The pain scores differed significantly between the 2 surgical approaches. On day 0, subjects who went through open appendectomy had a mean pain score of 5.36, whereas those who went through laparoscopic appendectomy procedure reported a mean pain score of 2.77. On day 1, the mean pain scores decreased to 2.74 for open appendectomy and 1.30 for laparoscopic appendectomy. This indicates that subjects who went through laparoscopic appendectomy procedure experienced less postoperative pain.

The requirement for opioids varied substantially between the 2 groups. For open appendectomy, 93.3% of the patients required opioids, whereas only 6.7% of the subjects who underwent laparoscopic appendectomy required opioids. This finding suggests that laparoscopic surgery results in significantly reduced opioid use. The time to oral feed tolerance also differed between the groups. For open appendectomy, only 1 patient (3%) started oral feeding on day 0, 33 patients (84%) on day 1

and 5 patients (13%) on day 2. In contrast, for laparoscopic appendectomy, 53 patients (87%) started oral feeding on day 0 and 8 patients (13%) began on day 1. The time taken to return to normal activity was shorter in the patients who underwent laparoscopic surgery. Patients who underwent open appendectomy required an average of 5.15 days to resume normal activity, whereas those who went through laparoscopic appendectomy procedure required an average of 2.42 days.

The total costs related to each type of surgery were also analyzed. The total cost of open appendectomy was Rs 20,171.79, whereas laparoscopic appendectomy had a higher total cost of Rs 28,450.82.

Postoperative complications linked to open appendectomy included 4 cases (10.25%) of wound infection, 2 cases (5.12 %) of intra-abdominal infection, 3 cases (7.69 %) of urinary retention and 2 cases (5.12 %) of chest infection. In contrast, for laparoscopic appendectomy, there was only 1 case (2.56%) of wound infection and 1 case (2.56%) of pulmonary infection. Intra-abdominal infections or urinary retention were not found in the laparoscopy group (Table 2).

Table 1: Demographic and clinical characteristics of appendicitis patients.

Demographic and clinical characteristics		Number of patients (%)	
Age (in years)			
Less than 10		18	
10 to 25		48	
More than 25		34	
Type	Laparoscopic appendectomy	Open appendectomy	Number (n)
Acute appendicitis	48 (60 %)	32 (40 %)	80
Multiple episodes of sub-acute appendicitis	2 (25 %)	6 (75 %)	8
Chronic appendicitis	10 (83 %)	2 (17 %)	12
Leukocytosis	Open appendectomy	Laparoscopic appendectomy	
Less than 10000	18.2	81.8	
10000-15000	37.0	63.0	
More than 15000	87.0	12.5	
	Open appendectomy	Laparoscopic appendectomy	
Meckel’s diverticulitis	1 (2.56%)	3 (4.91%)	
Mesenteric lymphadenitis	3 (7.69%)	2 (3.27%)	
Ovarian cyst	1 (2.56%)	1 (1.63%)	
Appendectomy	Mean stay at hospital (days)		
Open appendectomy	6.26		
Laparoscopic appendectomy	3.95		

Table 2: Post-appendectomy outcomes and resource utilization.

Appendectomy	Pain score day 0	Pain score day 1
Open appendectomy	5.36	2.74
Laparoscopic appendectomy	2.77	1.30
Opioid required	Open appendectomy (%)	Laparoscopic appendectomy (%)
	93.3	6.7
Day oral feed	Open appendectomy (%)	Laparoscopic appendectomy (%)
0 days	1 (3%)	53 (87%)

Continued.

Appendectomy	Pain score day 0	Pain score day 1
1 day	33 (84%)	8 (13%)
2 days	5 (13%)	-
Appendectomy	Day normal activity	
Open appendectomy	5.15	
Laparoscopic appendectomy	2.42	
Appendectomy	Total cost (Rs)	
Open appendectomy	20171.79	
laparoscopic appendectomy	28450.82	
Complications	Open appendectomy	Laparoscopic appendectomy
Wound infection	4 (10.25 %)	1 (2.56%)
Intra-abdominal infection	2 (5.12 %)	-
Urinary retention	3 (7.69 %)	-
Pulmonary infection	2 (5.12%)	1 (2.56 %)

DISCUSSION

The comparison between laparoscopic and open appendectomies has been a subject of significant interest in the surgical community given the potential differences in patient outcomes, recovery times and overall health benefits. This study aimed to provide a comprehensive analysis of these two surgical approaches by examining various key parameters including postoperative pain management, duration of hospital stay, intraoperative findings, postoperative complications, analgesic requirements, oral feeding tolerance, return to normal activity and total hospital costs.

The distribution of appendicitis cases in the present study showed a significant prevalence among young adults, with 48 patients aged 10–25 years old. Literature studies indicate a median age of 8.76 years for pediatric cases, with a notable prevalence in children below 6 years.⁴ However, some studies suggest that appendicitis is increasingly common in older adults, challenging the traditional view.⁵

Acute appendicitis was the most prevalent type in the present study, with 60% of subjects who went through laparoscopic appendectomy procedure, reflecting a shift towards minimally invasive surgery. Chronic appendicitis cases showed a preference for laparoscopic methods (83%), consistent with findings that laparoscopic surgery is preferred due to its benefits, including shorter recovery times.⁶ Our present study found that higher leukocyte counts were correlated with open appendectomy, indicating a potential association between severity and surgical choice. This aligns with literature suggesting that older patients often experience more complicated cases, leading to longer duration of hospital stays and increased resource utilization.⁷

The comparison of pain scores, opioid use, recovery time and complications between laparoscopic and open appendectomy in this study revealed the significant benefits of the laparoscopic approach. Laparoscopic appendectomy resulted in lower pain scores and reduced

opioid requirements, with mean pain scores of 2.77 on day 0 for laparoscopic versus 5.36 for open appendectomy. Additionally, 87% of laparoscopic patients started oral feeding on day 0 compared with only 3% in the open group. Subjects who underwent Laparoscopic appendectomy reported significantly lower pain scores (2.77 vs. 5.36). Opioid use was drastically reduced, with only 6.7% of laparoscopic patients requiring opioids compared to 93.3% for open appendectomy consistent with the literature.⁸ Subjects who went through laparoscopic surgical procedure returned to normal activities in an average of 2.42 days, while open appendectomy patients took 5.15 days. Faster recovery was also noted in other studies, with laparoscopic patients resuming activities sooner.^{9,10}

Complications were lower in the laparoscopic group, with only 2.56% experiencing wound infections compared to 10.25% in the open group, consistent with findings that SSI (surgical site infections) are prevalent in open procedures.^{8,11} Intra-abdominal Infection was 5.12%, consistent with literature indicating higher risks in open surgeries due to greater tissue trauma.¹² This finding is significant, as intra-abdominal abscesses are a common concern in open appendectomies.¹³ In our study 7.69% urinary retention cases were observed. It is a complication noted in studies emphasizing the impact of surgical approach on postoperative recovery.¹⁴

However, we noted that laparoscopic appendectomy has high overall expense (Rs 28,450.82) in comparison with open appendectomy (Rs 20,171.79). Despite the higher expenses related to laparoscopic appendectomy, the benefits in pain management, lower rates of complication and recovery time make it is preferable option for treating acute appendicitis, aligning with findings from multiple studies.^{15,16}

CONCLUSION

Laparoscopic appendectomy generally offers superior clinical outcomes in comparison to open appendectomy. Subjects who went through laparoscopic surgical

procedure experienced superior clinical results, including reduced pain, fewer complications and quicker recovery, despite being costlier than those who went through open appendectomy procedure. Future investigations should continue to evaluate the long-term outcomes and cost-effectiveness to inform surgical guidelines.

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