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A Comparative Study between Open and Laparascopic Appendicectomy in Perforated Appendicitis in Western Rajasthan

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Abstract: ***Introduction: Laparoscopic appendectomy for non perforated appendicitis is associated with improved outcomes. This study compares laparoscopic appendectomy and open appendectomy in cases of perforated appendix based on evaluation of surgical site infection, mean operative time, and length of hospital stay. Material and methods: This study was a prospective randomized trial conducted at the Surgical Clinic of Dr. S. N. Medical College, Jodhpur from January 2022 to January 2023 by randomly allocating laparoscopic or open appendectomy to 130 patients by lottery method. Patients with a perforated appendix were included after providing informed consent. Data were entered and analyzed using IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, NY, USA). Results: The frequency of wound site infection was significantly higher in open appendectomy (27.69%) than in laparoscopic approach (10.77%; p=0.01). The average length of hospital stay was slightly longer for the laparoscopic approach (4.38 ± 1.09 days) than for the open appendectomy (4.18 ± 0.77 days; p=0.23). The mean operative time for laparoscopic appendectomy and open appendectomy was 46.98 ± 2.99 minutes and 53.02 ± 2.88 minutes, respectively (p<0.000). Conclusion: Laparoscopic appendectomy was associated with fewer surgical site infections and a shorter mean operative time than open appendectomy.***

Keywords: Open Appendectomy, Laparoscopic Appendectomy, Perforated Appendix, Infection, Complication

1. Introduction

Appendicitis is an inflammation of the worm - like appendix [1]. Acute appendicitis is the most common abdominal emergency worldwide and is the most common cause of abdominal surgery in all age groups [2]. Appendicitis has an overall lifetime risk of 8.6% in men and 6.7% in women [2, 3].

Of all patients with acute appendicitis, 13–20% have a perforated appendix [4]. Men have a greater risk of appendiceal perforation (18%) than women (13%) [5]. Although the risk of perforation is eminent 24 hours after the onset of appendicitis symptoms, the time course varies from case to case. Within 24 hours of the onset of symptoms, there is a 20% risk of perforation of the appendix [6].

Open appendectomy has become the method of choice for acute appendicitis since its description by McBurney [7, 8]. The field of surgery has changed dramatically since the advent of laparoscopy [9]. Laparoscopic appendectomy was first introduced by Semm [2]. It has gained great popularity among surgeons due to the use of minimally invasive techniques, but some still question its use instead of open appendectomy [8]. Those who criticize laparoscopic appendectomy cite the increased operating costs of using disposable instruments. Other objections to laparoscopic appendectomy focus on the lengthening of the operating time and the increased incidence of intra - abdominal abscesses, especially in cases of perforated appendix [10, 11]. Proponents of laparoscopic appendectomy claim that this procedure results in better wound healing, reduced postoperative pain, and earlier discharge from the hospital with an earlier return to normal activities [8].

In addition, laparoscopy has the advantages of minimal incision, better view of the peritoneal cavity, and safe exploration [12]. The feasibility and validity of the laparoscopic approach in complicated (i. e., perforated) cases of the appendix remains controversial because it is associated with an increased incidence of intra - abdominal sampling, but several other studies have statistically found that the laparoscopic approach is associated with fewer postoperative complications [13]. Due to the lack of randomized prospective studies, there is a gap in the literature comparing laparoscopy and laparotomy in the treatment of perforated appendix.

Laparoscopic treatment has now become the preferred method of treatment because it can diagnose and remove the appendix at the same time [14].

The aim of this study is to compare the results of the laparoscopic and open approach in perforated appendicitis. Although there has been a study comparing the two techniques in uncomplicated appendicitis, there has been no study comparing these techniques to remove a perforated appendix [15].

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2. Materials and methods

Our study was a prospective randomized trial conducted at the surgical clinics of Dr. S. N. MEDICAL COLLEGE, JODHPUR from January 2022 to January 2023. A total of 130 patients were included in the study, 65 patients in each group. All patients between the ages of 15 and 50 who had a perforated appendix and ultrasonographic evidence of free fluid in the abdomen were included in the study. Patients with a perforated appendix were defined as patients presenting with right iliac fossa pain for one or two days, with a history and examination suggestive of a perforated appendix, with lower abdominal tenderness, tachycardia, and fever (>99°F). Those who had a total leukocyte count of 10, 000 or more and those who had evidence of free fluid in the lower abdomen or pelvis on ultrasonography were also included in the study. Patients who had simple, uncomplicated appendicitis and who had undergone any previous abdominal surgery were excluded from the study. Patients who were anaesthesiologically unfit for American Society of Anaesthesiologists (ASA) class 3 or higher and patients with any general contraindication to laparoscopic surgery, such as morbid obesity, respiratory insufficiency, or a history of tuberculosis, were also excluded. Patients meeting the inclusion criteria were included after providing informed consent. Cases were prospectively randomized by lottery into open and laparoscopic appendectomy groups. Intraoperative and postoperative effects were assessed by nurses. All information was recorded on a pre - designed proforma.

Outcome variables were port site infection, length of hospital stay, and mean operative time.
Operative time in minutes was measured from the port insertion site to the retrieval of the appendix. The length of hospitalization in days from admission to discharge was also recorded. Port site infection was defined as the presence of signs of inflammation (erythema and discharge) at day 4 post - operative outpatient check - up.

All patients who underwent open or laparoscopic surgery received single doses of intravenous metronidazole 400 mg and ceftriaxone 1 g intraoperatively, and the same doses were continued for five days postoperatively. An open approach was performed through a lower median laparotomy, an appendectomy was performed, and the abdomen was washed with normal saline. The abdomen was closed. However, the skin remained open. Laparoscopic appendectomy was performed by creating a pneumoperitoneum using the three - port technique. An appendectomy was performed and the appendix was collected through a gloved specimen bag to minimize spillage. The abdomen was washed with normal saline. First intravenous injection of pain medication immediately after surgery. The second injection was given eight hours later and the third was given 72 hours after surgery.

The collected data were entered and analyzed using IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, NY, USA). Qualitative variables such as gender and infection were measured as frequencies and percentages. Quantitative variables such as age, length of hospitalization, and operative time were measured as mean ± SD. An independent samples t test was used to compare length of hospitalization and operative time between the two groups. Effect modifiers such as age, sex, and ASA class were controlled for by stratification. Post stratification chi - square tests were used for qualitative variables and independent samples t - test for quantitative variables. A p - value ≤0.05 was considered significant.

3. Result

A total of 130 cases (65 in each group) meeting the inclusion criteria were included in the study. Of the 130 patients, 65 (50%) were men and 65 (50%) were women. The mean age was 32 ± 7 years in the laparoscopic appendectomy group and 34 ± 7 years in the open appendectomy group. There were 29 patients aged 15 to 30 years (44.62%) in the laparoscopic surgery group and 27 patients aged 15 to 30 years (41.54%) in the open surgery group. The laparoscopic surgery group had 36 patients aged.31 to 50 years (55.38%), and the open surgery group had 38 patients (58.46%) aged 31 to 50 years. Patients were almost equally distributed according to gender in both groups. The laparoscopic surgery group contained 33 male patients (50.77%) and 32 female patients (49.23%). The open surgery group contained 32 male patients (49.23%) and 33 female patients (50.77%).

In comparing the mean operating time in both groups, the mean operating time for the laparoscopic surgery group was 46.98 ± 2.99 minutes, which was significantly shorter than the 53.02 ± 2.88 minutes from the open surgery group (p<0.000). The mean length of hospitalization was 4.38 ± 1.09 days in laparoscopic surgery and 4.18 ± 0.77 days in the open surgery group (p=0.23). Seven port sites (10.77%) in the laparoscopic group and 18 (27.69%) in the open surgery group were infected (p= 0.01). The comparison of mean operating time, length of hospitalization, and rate of surgical site infections are shown in Table 1.

Table 1: Comparison of operating time and length of hospitalization in laparoscopic and open appendectomy

Outcome Variable	Laparoscopic Appendicectomy	Open Appendicectomy	P - Value
Operating time (mean ± SD)	46.98 ± 2.99 minutes	53.02 ± 2.88 minutes	<0.000
Length of hospitalization (mean ± SD)	4.38 ± 1.09 days	4.18 ± 0.77 days	0.23
Rate of surgical site infections frequency (%)	7 (10.77%)	18 (27.69%)	0.01

4. Discussion

Laparoscopy was considered a relative contraindication in complicated appendicitis, as it is associated with an increased risk of postoperative complications [16, 17, 18]. This theory has been challenged by the findings of several studies that measured the outcomes of laparoscopic appendectomy in complicated cases of appendicitis [19, 20, 21].

Muhammad et al. performed a similar study and reported that the mean age in the laparoscopic appendectomy group

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was 32 ± 14 years; the mean age of patients in the open appendectomy group was 34 ± 13 years [12]. These results are very close to the average age in our study. This age similarity is due to the fact that appendicitis is more common in the younger age group, as shown by Thomas et al. [22]. According to Drinkovic et al. appendicitis most often occurred in the age group of 11 to 20 years, but the increasing incidence in older patients may be due to increasing life expectancy [23, 24].

The significantly shorter mean operative time for laparoscopic surgery compared to open appendectomy noted in our study differs from the findings of Muhammad et al., who reported a mean operative time of 75 ± 23 minutes for laparoscopic appendectomy and 64 ± 15 minutes for open appendectomy [12]. Another study by Lin et al. showed that laparoscopic appendectomy took longer to complete (96.1 ± 43.1 minutes) than open appendectomy (67.8 ± 32.2 minutes) [14]. Other studies suggest that the laparoscopic approach is associated with a longer operative time than open appendectomy [25, 26, 27, 28]. These results were in conflict with ours. However, our findings of shorter mean operative times through the laparoscopic approach are in agreement with the studies of Yau et al. and Tiwari et al., who found that the **TABLE 2: Stratification for operation time, length of hospital stay, and wound infection with regards to age, gender, and ASA class**

Dependent Variables (Outcome Variables	Independent Variables (Explanatory Variables)	Groups	Laparoscopic Appendicectomy	Open Appendicectomy	P - Value
Operation time (minutes, Mean ±SD)	Age	15 - 30 years	47.14 ± 3.10	53.19 ± 2.99	0.001
		31 - 50 years	46.86 ± 2.94	52.89 ± 2.84	0.001
	Gender	Male	47.09 ± 3.16	53.13 ± 2.89	0.001
		Female	46.88 ± 2.88	52.91 ± 2.91	0.001
	ASA	ASA - 1	47.04 ± 3.36	53.25 ± 2.49	0.001
		ASA - II	46.88 ± 2.86	53.02 ± 2.88	0.001
Hospital stay (days, mean±SD)	Age	15 - 30 years	4.45 ± 1.12	4.22 ± 0.75	0.38
		31 - 50 years	4.33 ± 1.10	4.16 ± 0.79	0.001
	Gender	Male	4.33 ± 1.14	4.09 ± 0.73	0.31
		Female	4.44 ± 1.08	4.27 ± 0.80	0.48
	ASA	ASA - 1	4.32 ± 1.01	4.25 ± 0.78	0.74
		ASA - II	4.50 ± 1.25	4.08 ± 0.76	0.16
Wound infection (frequency (%))	Age	15 - 30 years	3/29 (10.34)	6/27 (22.22)	0.19
		31 - 50 years	4/36 (11.11)	12/38 (31.58)	0.03
	Gender	Male	4/33 (12.12)	8/32 (25)	0.18
		Female	3/32 (9.37)	10/33 (30.30	0.03
	ASA	ASA - 1	5/41 (12.19)	9/40 (22.5)	0.22
		ASA - II	2/24 (8.33)	9/25 (36)	0.02

mean operative time for laparoscopic appendectomy was 47.8 ± 14.5 minutes and 49.10 ± 12.5 for open appendectomy [13, 29]. Differences in mean operative times reported in the literature may be due to differences in skill level and experience with laparoscopic techniques in different centres.

Comparison of the mean length of hospital stay in both groups in our setting showed a non- significant difference between the laparoscopic appendectomy group (4.38 ± 1.09 days) and the open appendectomy group (4.18 ± 0.77 days). However, Muhammad et al. reported that the mean length of hospital stay in the laparoscopic appendectomy group was 5.3 ± 2.1 days, while the mean length of hospital stay in the open appendectomy group was 7.2 ± 3.2 days [12].

Tiwari et al. reported a significant difference in the length of hospitalization between groups (4.34 ± 4.84 days in the laparoscopic appendectomy group, 7.31 ± 9.34 days in the open appendectomy group) [13]. Lin et al. also reported that the length of hospital stay was significantly shorter for laparoscopic appendectomy (6.3 ± 2.9 days) than for open appendectomy (9.3 ± 8.6 days) [14].

Our comparison of port site infections yielded similar results to Muhammad et al., who reported that the rate of infection in the laparoscopic appendectomy group was 8.3%, while it was 24.4% in the open appendectomy group [12]. Lin et al. also showed that the rate of infection was significantly lower in laparoscopic appendectomy (15.2%) than in open appendectomy (30.7%) [14]. This can be attributed to the fact that laparoscopic appendectomy requires less bowel manipulation by the surgeon's hands and instruments compared to open appendectomy. In addition, the bowel does not come into contact with the incision in the layers of the anterior abdominal wall during laparoscopic appendectomy when the appendix is examined in situ.

The results of post stratification chi - square tests showed that the operative time of laparoscopic and open appendectomy was significantly different in the 15 - to 30 - year age group than in the 31 - to 50 - year - old group. Operative time was also significantly different for both techniques in both male and female patients and ASA class one and two. The difference in length of hospitalization was also statistically significant between the two techniques for the age group 31 to 50 years. This may be due to post - operative complications associated with the older age group. Wound infections were significantly more frequent in open appendectomy and in the older age group. Infections were also significantly more frequent in female patients and in ASA class 2 for open appendectomy. These factors may contribute to reduced immunity and increased risk of infection in these groups.

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5. Conclusions

Laparoscopic appendectomy is superior to open appendectomy in terms of wound site infections and operative time. The operative time depends on the surgical skills of the operating surgeon and the severity of the condition. In terms of length of hospital stay, there is no difference between the two techniques. Thus, laparoscopic appendectomy can be safely used to remove a perforated appendix.

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