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Comparison of Clinical outcome of Open Appendectomy and Laparoscopic Appendectomy in Acute Appendicitis

Dr. Owais-Ul-Umer Zargar [(1)], Dr. Nashrah Ashraf [(2)], Dr. Ayat Albina [(3)], Dr. N C Dhingra [(4)].
[1]Senior Resident, [2]Post-Graduate, [3]Post-Graduate, [4]Professor,
Department of Surgery, Govt. Medical College & Hospital, Jammu

***Corresponding Author:**
Dr. Owais-Ul-Umer Zargar
Senior Resident, Department of Surgery, Govt. Medical College & Hospital, Jammu.

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Abstract

Background: Laparoscopic appendectomy for acute appendicitis is associated with improved clinical outcomes. This study compares laparoscopic appendectomy and open appendectomy in cases of acute appendicitis by assessing surgical site infection, mean operating time, and length of hospital stay.

Objective: To study the comparison of clinical outcome of open appendectomy and laparoscopic appendectomy in acute appendicitis.

Materials and methods: This study was a prospective randomized study conducted at the Department of Surgery, Govt. Medical College and hospital, Jammu, India, from January 2018 to January 2019, by randomly allotting the laparoscopic or the open appendectomy technique to 130 patients. An informed written consent was taken from all the patients before surgery.

Results: The frequency of surgical site infection was significantly higher in open appendectomy (29.54%) than in the laparoscopic appendectomy (12.13%; p=0.01). Mean hospital stay was slightly longer in the laparoscopic approach (5.62 ± 1.04 days) than in open appendectomy (3.92 ± 0.13 days; p=0.23). Mean operating time for laparoscopic appendectomy was 47.92 ± 2.36 minutes whereas in open appendectomy it was 55.02 ± 2.67 minutes($p<0.000$).

Conclusion: Laparoscopic appendectomy was associated with lesser incidence of surgical site infections and shorter mean operating time than in open appendectomy.

Keywords: Open appendectomy, Laparoscopic appendectomy, Acute appendicitis, Surgical site infection.

Introduction

Appendicitis is a condition in which there is inflammation of the appendix [1]. Acute appendicitis is the most common abdominal emergency worldwide, and it is the most common cause of abdominal surgeries in all the age groups [2]. Laparoscopic appendectomy (LA) was first described by Semm in early 1990s and has now advanced in becoming the treatment of choice for acute appendicitis with increasing numbers of procedures being performed [3]. The incidence of appendicular perforation in patients of acute appendicitis is 13-20% [4]. The risk of perforation of the appendix is greater in men (18%) than in women (13%) [5]. The risk of perforation of appendix is 20% within 24 hours of the appearance of symptoms [6].

Open appendectomy was first described by McBurney and has now become the procedure of choice for acute appendicitis [7]. The field of surgery has undergone a dramatic change since the advent of laparoscopy [8]. It has gained much popularity among surgeons because of the use of minimally invasive techniques [9]. Those who criticize laparoscopic appendectomy cite the increased operative costs of using disposable instruments, increased operating time and increased incidence of

intra-abdominal abscesses, particularly in cases of a perforated appendix [10,11]. Those in favour of laparoscopic appendectomy claim the operation yields improved wound healing, lesser incidence of surgical site infection, lesser postoperative pain, and earlier discharge from the hospital and earlier return to normal activities [8]. Also, laparoscopy has the advantage over open surgery in terms of minimal incision, a better visualisation of the peritoneal cavity, and safe exploration [12]. The feasibility and advantages of the laparoscopic approach in complicated (i.e., perforated) appendicitis cases remain controversial, as it is associated with an increased incidence of intra-abdominal collection, but at the same time laparoscopic approach is associated with fewer postoperative complications [13]. Advantages of laparoscopic approach in contrast to open approach are reduced postoperative pain, better cosmetic appearance, and early discharge from hospital. In the present days laparoscopic approach has now become the preferred mode of surgery because it can diagnose as well as remove the appendix at the same time [14,15].

The aim of this study is to compare the clinical outcome of laparoscopic and open approaches in patients of acute appendicitis.

Material and Methods

This study was conducted in the Department of Surgery, Govt. Medical College and Hospital, Jammu, India, from January 2018 to January 2019. A total of 130 patients were included in our study. All patients aged 15 to 50 years who presented with acute appendicitis were included in the study. Patients with acute appendicitis were defined as those presenting with pain in the right iliac fossa with a history and examination suggestive of acute appendicitis, having right lower abdominal tenderness, rebound tenderness, nausea, tachycardia, and fever (>99°F), elevated total leucocyte count. Patients who had complicated appendicitis (perforated appendix) and who had undergone any previous abdominal surgery were excluded from the study. Patients who were unfit from anaesthesia point of view with American Society of Anaesthesiologists (ASA) class three or above and those having contraindication to laparoscopic procedure like morbid obesity, respiratory insufficiency, or history of tuberculosis were also excluded from the study. Those patients who fulfilled the inclusion criteria were included in the study after taking informed consent from them. Cases were randomized prospectively into two groups namely open and laparoscopic appendectomy groups. All the information was recorded on a predesigned proforma. The outcome variables that were taken into consideration were port site infection, mean operative time and length of hospitalization.

The operating time in minutes was calculated from the point of port insertion until the retrieval of appendix. The length of hospitalization in days was calculated from the time of admission to the time of discharge. Port site infection was defined as the presence of signs of inflammation (erythema and discharge) on follow-up evaluation in the outpatient department after the surgery. All the patients either undergoing open or laparoscopic surgery were given single doses of intravenous injections of metronidazole 500 mg and ceftriaxone 1 g perioperatively, and the injectables were continued on 1st postoperative day. The open appendectomy was done by grid-iron incision at Mc Burney's point. Laparoscopic appendectomy was done by creating a pneumoperitoneum via the three-port technique. Intravenous analgesics were given as a painkiller immediately after the surgery. The second injection was given eight hours later, and the third was administered 72 hours after surgery.

Qualitative variables including gender and infection were measured as frequencies and percentages. The quantitative variables which included age, length of hospitalization, and operative time were calculated as mean ± SD. Independent samples t-test was used to compare the length of hospital stay and operating time between two groups. The effect modifiers which included age, gender, and ASA class were controlled by stratification. Post-stratification chi-square tests were applied for qualitative variables and the independent samples t-test for quantitative variables. A p-value of ≤ 0.05 was considered significant.

Results

A total of 130 patients (65 in each group) were included in the study. Of 130 patients, 65 (50%) were male and 65 (50%) were female patients. The mean age was 31 ± 4 years in the laparoscopic appendectomy group and in the open appendectomy group it was 35 ± 6 years. Twenty-five patients were in the 15 to 30 years age group (38.4%) in the

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laparoscopic surgery group, and 28 patients were aged 15 to 30 years in the open surgery group (43.07%). The laparoscopic surgery group had 35 patients aged 31 to 50 years (53.84%), and the open surgery group had 37patients (56.92%) aged 31 to 50 years.

The laparoscopic surgery group contained 34 male (52.30%) and 31 female patients (47.69%). The open surgery group contained 33 male (50.76%) and 32 female patients (49.24%). In comparing the mean operating time in the two groups, the mean operating time in the laparoscopic surgery was 45.94 ± 3.56 minutes, which was shorter than the open appendectomy group in which the mean operating time was 54.31 ± 2.74 minutes (p<0.000). The mean duration of hospitalization was 4.47 ± 1.05 days in laparoscopic surgery and 4.16 ± 0.84 days in the open surgery group (p=0.23). In the laparoscopic group 7 port sites (10.77%) were infected and in the open appendectomy group 18 port sites (27.69%) were infected (p= 0.01). The comparison of mean operating time, length of hospitalization, and rate of surgical site infections are shown in Table1.

Table 1: showing Comparison of operating time, length of hospitalization and rate of surgical site infections in laparoscopic and open appendectomy.

Outcome Variable	Laparoscopic Appendectomy	Open Appendectomy	p-value
Operating time (mean ± SD)	45.94 ± 3.56 minutes	54.31 ± 2.74 minutes	<0.000
Length of hospitalization (mean ± SD)	4.47 ± 1.05 days	4.16 ± 0.84 days	0.23
Rate of surgical site infections (frequency (%))	7 (10.76%)	18 (27.70%)	0.01

The effect modifiers which included age, gender, and ASA grades were controlled by stratification. The results of post-stratification chi-square tests (for qualitative variables) and independent samples t-tests (for quantitative variables) are shown in Table 2.

Table 2: showing Stratification for operation time, duration of hospital stay and surgical site infection with respect to age, gender, and ASA class.ASA: American Society of Anaesthesiologists.

Dependent Variables (Outcome Variables)	Independent Variables	Groups	Laparoscopic Appendectomy	Open Appendectomy	p-value
Operation time (minutes, mean±SD)	Age	15-30 years	46.23 ± 3.14	54.17 ± 2.96	0.0001
		31-50 years	47.76 ± 2.87	53.91 ± 2.83	0.0001
	Gender	Male	46.79 ± 3.12	54.15 ± 2.83	0.0001
		Female	47.17 ± 2.56	53.68 ± 2.85	0.0001
	ASA	ASA-I	48.04 ± 3.64	54.65 ± 2.64	0.0001
		ASA-II	45.89 ± 2.73	53.08± 2.73	0.0001
Duration of Hospital stay	Age	15-30 years	4.56 ± 1.62	4.83 ± 0.82	0.38

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(days, mean±SD)		31-50 years	4.43 ± 1.34	4.34 ± 0.67	0.0001
	Gender	Male	4.67 ± 1.30	4.10 ± 0.78	0.32
		Female	4.54 ± 1.09	4.31 ± 0.78	0.49
	ASA	ASA-I	4.64 ± 1.67	4.31 ± 0.82	0.76
		ASA-II	4.65 ± 1.64	4.17 ± 0.87	0.16
Surgical site infection (frequency (%))	Age	15-30 years	4/29 (13.79)	7/27 (25.92)	0.18
		31-50 years	5/36 (13.88)	11/38 (28.94)	0.03
	Gender	Male	5/33 (15.15)	9/32 (28.12)	0.19
		Female	4/32 (12.5)	11/33 (33.33)	0.04
	ASA	ASA-I	6/41 (14.63)	10/40 (25)	0.24
		ASA-II	3/24 (12.5)	10/25 (40)	0.04

Discussion

Laparoscopic surgery as a minimally invasive technique has advantages in several surgical areas of daily practice and has been found to be superior to the conventional open approach. Lesser postoperative pain, early recovery, and better cosmetic outcomes are accepted as the main advantages of laparoscopic surgery over open surgery. Longer operative time and massive blood loss during Laparoscopic appendectomy are another issue in the comparison of Laparoscopic appendectomy and Open appendectomy. Generally, these two factors are dependent on surgeon's experience. The operating time is long when performed by inexperienced surgeons, and is shortened by accumulating experience [10, 14]. Laparoscopy has been considered a relative contraindication in complicated appendicitis, since it is associated with a higher risk of postoperative complications. This theory has been opposed by the findings of several studies that measured the outcomes of laparoscopic appendectomy in complicated appendicitis cases [16,17].

Muhammad et al. in his study reported that the mean age in the laparoscopic appendectomy group was 32 ± 14 years and the mean age of patients in the open appendectomy group was 34 ± 13 years [15,18]. These results are similar to the mean ages in our study. This similarity in age is because appendicitis is more common in the younger age group, as shown by Thomas et al. [19-22]. In a study conducted by Drinkovic et al., he found that appendicitis was more common in the 11to20 year age group, but the increasing incidence in older patients may be due to increase in life expectancy in the present times [23,24]

In our study there was a significantly shorter mean operating time for laparoscopic appendectomy as compared to open appendectomy which differs from the study conducted by Muhammad et al. who reported the mean operating time as 75 ± 23 minutes for a laparoscopic appendectomy and 64 ± 15 minutes for an open appendectomy [12]. Another study was conducted by Lin et al. which found that laparoscopic appendectomy took a longer time to complete (96.1 ± 43.1 minutes) than open appendectomy (67.8 ± 32.2 minutes) [14]. There are some other studies which found that the mean operating time in laparoscopic approach is more than an open approach [25-28]. These results were in

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contradiction to ours. However, our findings of shorter mean operating time in laparoscopic appendectomy as compared to open appendectomy are consistent with studies done by Yau et al. and Tiwari et al., who found that the mean operating time for laparoscopic appendectomy was 47.8 ± 14.5 minutes and for appendectomy it was 49.10 ± 12.5 minutes [13,28]. The variation in the mean operating time reported in the literature may be attributed to variations in skill levels of the operating surgeons and experience with laparoscopic techniques in different centres.

Comparison of mean hospital stay in the two groups in our study did not show much significant difference between the laparoscopic appendectomy group (4.47 ± 1.05 days) and the open appendectomy group (4.16 ± 0.84 days). However, in the study conducted by Muhammad et al. it was found that the mean length of hospitalization for the laparoscopic appendectomy group was 5.3 ± 2.1 days while the mean length of hospitalisation in open appendectomy group was 7.2 ± 3.2 days [12]. In the study conducted by Tiwari et al. a significant difference in the length of hospital stay was found between the two groups (4.34 ± 4.84 days in the laparoscopic group, 7.31 ± 9.34 days in the open appendectomy group) [13]. A similar study was conducted by Lin et al. who reported that the length of hospital stay was significantly shorter for laparoscopic appendectomy group (6.3 ± 2.9 days) than that for open appendectomy group (9.3 ± 8.6 days) [14].

The rate of port site infection in our study was similar to the study conducted by Muhammad et al., who reported that the rate of infections in the laparoscopic appendectomy group was 8.3% whereas in the open appendectomy group the rate of port site infection was 24.4% [12]. In the study conducted by Lin et al. it was found that the rate of infections was significantly lower in laparoscopic appendectomy group (15.2%) than in open appendectomy group (30.7%) [14]. This may be attributed to the fact that in laparoscopic appendectomy there is less manipulation of the gut by the instruments and the surgeon's hands as compared to open appendectomy. Furthermore, during laparoscopic appendectomy bowel does not come into contact with the incision in the layers of the anterior abdominal wall as the appendix is explored in situ.

The results of post-stratification chi-square tests revealed that the operating time for the laparoscopic appendectomy and open appendectomy was significantly different in the 15 to 30-year age group as compared to 31 to 50-year age group. If we compare the operating time, it was also significantly different for the two techniques in both ASA class one and class two groups and in male and female patients. The difference in the duration of hospital stay was also statistically significant between the two techniques for the 31- 50-year age group. This difference can be attributed to the age factor as the risk of postoperative complications are more in the older age group. The incidence of surgical site infections was more in open appendectomy done in the older age group patients. These results might be attributed to various comorbidities and decreased immunity associated with older age groups leading to increased incidence of infections in these patients.

Conclusion.

Laparoscopic appendectomy has got advantages over open appendectomy in terms of operating time and incidence of surgical site infections. The operating time depends on the surgical skills of the operating surgeon and the intensity of the condition. If we compare the duration of hospital stay, it is almost same in the two groups. It can be concluded that laparoscopic appendectomy can be safely done in patients presenting with acute appendicitis with certain advantages over open appendectomy in terms of operating time and risk of surgical site infections.

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