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A comparative Clinical Trial of Laparoscopic Appendectomy versus Open Appendectomy in uncomplicated Cases

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ABSTRACT

Background: Appendicitis is one of the most frequent causes of acute abdominal pain and usually leads to the surgery called appendectomy. Various advantages can be associated with laparoscopic appendectomy but possible disadvantages include longer operative time and complications.

Objectives: The purpose of this research was to find out the differences between laparoscopic appendectomy (LA) and open appendectomy (OP) in patients with uncomplicated acute appendicitis focusing on operative time, length of hospital stay, postoperative pain, postoperative complication rates, and patient satisfaction.

Methods: The present study was a Comparative randomized clinical trial performed in Farooq Teaching Hospital and Hameed Latif Teaching Hospital from January 2022 to January 2023. Two hundred patients with uncomplicated appendicitis were randomly chosen and divided into the laparoscopic appendectomy(n=100) and the open appendectomy(n=100). Primary outcomes were operative time, length of hospital stay, postoperative pain as assessed by the Visual Analog Scale, and complications. Secondary measures were time to resume normal activities, and patients' satisfaction, measured on a Likert scale. Descriptive statistics, Student's t-test and chi-square test were used for analysis and $p \leq 0.05$ was considered significant.

Results: Laparoscopic appendectomy took a relatively longer mean operative time (54. 9 ± 14. 2 min) in comparison with open appendectomy (31. 4 ± 11. 1 min) with $p<0.001$ but overall, the patients who underwent laparoscopic appendectomy had lesser hospital stay (1. 4 ± 0. 6 days) than those who underwent open appendectomy (2.7 ± 2.5 days, $p<0.01$). Patients were able to get back to their normal activities sooner (11. 5 ± 3. 1 days; 16. 1 ± 3. 3 days; t = -3. 80; $p<0.01$) and expressed higher level of satisfaction (4.7 ± 0.6 vs. 3.9 ± 0.7, $p<0.01$).

Conclusion: Compared to open appendectomy, laparoscopic appendectomy has a longer operative time, but the advantages include less postoperative recovery time, less postoperative pain and higher postoperative patient satisfaction.

Keywords: Laparoscopic appendectomy, open appendectomy, acute appendicitis, postoperative pain, patient satisfaction.

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INTRODUCTION

The acute appendicitis is one of the most significant reasons of acute abdomen pain that requires surgical treatment. It is a disorder that occurs in all age groups with a lifetime prevalence of about 7-8% [1]. The standard therapy for acute appendicitis has been the open appendectomy (OA), a method that was described by McBurney in 1894 [2]. However, the development of laparoscopic procedures has brought in Laparoscopic appendectomy (LA), first done by Semm in 1983. The advantages of performing LA have been highlighted of which they include; lesser postoperative pain, shorter

hospital stay, faster recovery and better aesthetic results[3]. However, these advantages are outweighed by common perceptions of increased operative time as well as potential intra-abdominal abscess formation[3]. This is the reason why the choice between LA and OA is most crucial in cases of simple appendicitis when the disease has not affected the organ beyond the point of perforation, abscess formation or general peritonitis[4, 5]. In such scenarios, the choice between the two surgical procedures depends on factors such as operative time, healing time, and the risk of developing complications.

Longer operating durations, higher hospital expenses, and most importantly a higher risk of postoperative abscess formation are the reasons why LA is not recommended. But with more experience, operative times have dropped significantly. Additionally, the use of reusable laparoscopic equipment utilization has resulted in a notable decrease in healthcare expenses Nevertheless, despite numerous research revealing conflicting findings, the rising incidence of postoperative abscess formation remains a serious concern. There is no single surgical approach has been definitively proven superior treating a subgroup of people with simple appendicitis. Therefore, we compared OA and LA in the treatment of simple appendicitis in a prospective randomized clinical trial. The purpose of this research was to compare the results of LA and OA in regards to the patients with uncomplicated appendicitis in terms of operative time, the length of hospital stay, postoperative pain, rate of complications, and the level of the patients' satisfaction[6]. The most common surgical procedure worldwide, accounting for 6% of all surgeries, is the appendectomy, which is always done as an emergency unless an appendicular tumor or abscess forms. Interval appendectomy is carried out as an elective procedure in these circumstances. Less operating time, less discomfort after surgery, less need for analgesics, fewer surgical problems, a shorter hospital stay, quicker recovery, less wound infections, and less scarring are all benefits of the laparoscopic technique.

MATERIALS AND METHODS

Study Design: This study was a comparative randomized clinical trial (RCT) and was conducted in Farooq Teaching Hospital and Hameed Latif Teaching Hospital between January 2022 and January 2023. This research received a clearance from the institutional review board of Rashid Latif khan university medical and dental college (RLKU) ethical approval certificate ref. no: IRB-RLKU-17/09/24/5-A and informed consent was sought from all the participants before they were recruited in the study. In total, the study recruited 200 patients with uncomplicated acute appendicitis. Uncomplicated cases of appendicitis were diagnosed clinically, laboratory investigations, ultrasound or CT scans.

Inclusive and exclusive criteria: The criteria for patients selection were patients aged between 18 and 65 years with definite diagnosis of uncomplicated appendicitis. Consequently, patients with complicated appendicitis, pregnant women, patients with severe comorbid conditions including uncontrolled diabetes, severe cardiovascular disease, or previous history of abdominal surgery were excluded.

Uncomplicated appendicitis was defined as appendicitis without perforation, abscess formation, or generalized peritonitis. By using the computer-generated random numbers, the patients were divided into two groups; LA group with 100 patients and OA group with 100 patients. Randomization made it possible to achieve an equal distribution of demographic and clinical variables between the two groups. The LA procedure was done using a standard three port approach. Pneumoperitoneum was created with Veress needle and a 10 mm camera port was placed at the umbilicus. Two more ports of 5mm were then inserted in the lower abdomen. The appendix was then palpated and the mesentery was divided using a vessel-sealing device and the base was ligated using an end loop or a stapler. The appendix was then taken out endoscopically by using the retrieval bag in order to avoid cross infection. The abdominal cavity was explored for haemorrhage or rupture which in case were controlled before suturing the wounds. However, the OA procedure required McBurney or Rockey-Davis incision to use in accessing the appendix. The mesoappendix was then tied and then divided at the base of the appendix before the latter was removed using absorbable sutures. In each case, the peritoneum was washed when required, and the incision sutured in layers. Postoperative drains were not employed in most cases unless there were intraoperative findings that suggested that they were needed. The first efficacy endpoints assessed in this study included the operating time and the hospital stay period, postoperative pain, and the occurrence of postoperative complications.

Data Collection and Analysis: Surgical time was measured as the time period starting from first cut made on the skin till the time the skin was sutured and closed. Time to surgery was defined as the time from the first surgery to the day of the final surgery Time to hospital discharge was defined as the time from the day of the first surgery to the day of discharge from the hospital. The severity of the pain after surgery was measured through the Patient's Self-Reported VAS Pain Scale after 24hours from the operation. Morbidities such as wound infection, intra-abdominal abscess and reoperation were noted during the hospitalisation and follow up period. Other measures were time to normalcy, which was the duration of time patients required to get back to their normal daily activities or work and patient satisfaction which was assessed using a Likert scale during a post-treatment visit.

Statistical analysis: All data were analysed using the software Statistical Package for the Social Sciences (SPSS) version 26. Quantitative data of continuous nature were summarized using mean and standard deviation and

compared with the help of Student t-test. In categorical data chi-square test was used to analyse the data. In order to determine the postoperative complication risk factors, a multivariate logistic regression analysis was conducted with the p≤0.05 was considered statistically significant.

RESULTS

The sample size comprised of two hundred patients; one hundred patients were assigned to the LA group while the other one hundred to the OA group. There were no significant differences in the demographic and clinical characteristics of both groups as seen in the age, sex or BMI. The mean age in the LA group was 32.8 ± 9.8 years. Eight years for the control group whereas for the OA group, it was 33.1 ± 10.2 years (p=0. 65). The distribution of gender was 60% male in LA and 62% in OA (p = 0. 78). They also found no significant differences in the mean BMI between the two groups as it was found to be 24.5 ± 3.2 kg/m²in the LA group and 24.8 ± 3.5 kg/m² Of the total body weight, the OA group had 5 kg/m² on average (p=0. 58). The results are presented in the (Table-1) below.

The mean operative time was significantly different; the LA group had a mean operative time of 54.9 ± 14.2 minutes compared to 31.4 ± 11.1 minutes. The use of such technology in a classroom is a great idea: 36 ± 11. 13 min more in the OA group with a p value of (2.7 ± 2.5 days, p≤0.01) thus showing operative signific-ance This is however insignificant given the postoperative benefits that were observed in the LA group (1.4 ± 0.6 days). The duration of hospital stay was also significantly shorter among patients in the LA group; 1. The VAS pain score at 24 h after surgery was also significantly lower in the LA group (3.2 ± 1.1) compared to the OA group (5.1 ± 1.5, p≤0.01). Thus, in the OA group there is less pain, 5 (p<0. 01). Further, the incidence of early post- operative complications was significantly less in the LA group 4% as compared to OA group 11% (p<0.05). The complications observed were in form of wound infections and intra-abdominal abscesses. There was a statistically significant difference in the wound infection rate, which was significantly lower in the LA group than in the OA group (1.4% compared with 10.6%, p=0.02), yet intra-abdominal abscesses occurred infrequently and the two groups were comparable (2.0% in the LA group and 2.5% in the OA group, p=0. These are highlighted in (Table-2) below.

Secondary outcomes also favored the laparoscopic approach. Patients who underwent LA returned to normal daily activities significantly sooner, with an average of 11.5 ± 3.1 days, compared to 16.1 ± 3.3 days for those who underwent OA (p<0.01). Patient satisfaction was higher in the LA group, as reflected by a Likert scale score of 4.7 ± 0.6, compared to 3.9 ± 0.7 in the OA group (p<0.01). These results indicate a clear preference for LA among patients in terms of both recovery time and overall satisfaction with the surgical outcome. The detailed results for these secondary outcomes are presented in (Table- 3).

The results from this study demonstrate that although laparoscopic appendectomy takes longer to perform, it offers significant advantages in terms of shorter hospital stays, reduced postoperative pain, quicker return to normal activities, and higher patient satisfaction. Additionally, the lower incidence of wound infections in the LA group further supports the use of the laparoscopic approach as a preferred method for treating uncomplicated appendicitis.

Table 1: Baseline Characteristics of Patients

Characteristic	Laparoscopic Appendectomy (n=100)	Open Appendectomy (n=100)	p-value
Mean Age (years)	32.8 ± 9.8	33.1 ± 10.2	0.65
Male Gender (%)	60%	62%	0.78
BMI (kg/m²)	24.5 ± 3.2	24.8 ± 3.5	0.58

*Student t-test and chi-square test; no significant differences between groups

Table 2: Comparison of Primary Outcomes

Outcome	Laparoscopic Appendectomy (n=100)	Open Appendectomy (n=100)	p-value
Operative Time (minutes)	54.9 ± 14.2	31.36 ± 11.13	<0.001
Hospital Stay (days)	1.4 ± 0.6	2.7 ± 2.5	<0.01
Postoperative Pain (VAS)	3.2 ± 1.1	5.1 ± 1.5	<0.01
Complication Rate (%)	4%	11%	<0.05

*Student t-test and chi-square test; LA had significant benefits in operative time, hospital stay, and postoperative pain (p ≤ 0.05).

Table 3: Comparison of Secondary Outcomes

Outcome	Laparoscopic Appendectomy (n=100)	Open Appendectomy (n=100)	p-value
Return to Normal Activities (days)	11.5 ± 3.1	16.1 ± 3.3	<0.01
Patient Satisfaction (Likert)	4.7 ± 0.6	3.9 ± 0.7	<0.01

*Student t-test; LA showed faster recovery and higher patient satisfaction (p ≤ 0.01).

DISCUSSION

The results presented in this work show that laparoscopic appendectomy (LA) is more advantageous than open appendectomy (OA) in the treatment of simple acute appendicitis[7]. Although LA procedure takes longer operative time in comparison with the conventional method, the laparoscopic surgery offers more benefits as less hospitalization time, less postoperative pain, less

complications, early return to normal activities, and high patient satisfaction[8]. he difference in the duration of stay in the hospital is one of the most prominent results that point towards the effectiveness of the LA group. LA patients were on average discharged, a day and a half earlier than OA patients. This is a very important consideration as shortened hospital stay not only means lower healthcare expenses but also low incidences of hospital borne illnesses as well as increased bed turn over in surgical wards[9, 10]. The fact is that, the reduction in the length of stay that goes hand in hand with LA, has been evidenced by the other similar studies which state that the minimally invasive techniques are helpful in faster recovery[11]. The patients in the LA group also reported lesser pain after the surgery as observed from lower Visual Analog Scale (VAS) scores at 24 hours post-surgery. These include the fact that, unlike OA that requires a large incision that causes more tissue damage, LA employs small incisions that mean lesser pain[12]. This would have made it easier for the LA group to engage in their normal activities as most of them were able to do so about five days before the OA group. The shorter time to recovery is a major advantage of LA especially for those patients who have to resume their work or other activities[13].The complication rates support the benefits of LA even more. While both procedures are relatively safe, a lower incidence of wound infection in the LA group is considered an important result. LA being less invasive than OA in terms of size of the incisions made as well as the use of endoscopic retrieval bags to remove the specimens, minimizes the chances of wound contamination and consequent infection[14]. This finding is particularly relevant bearing in mind that postoperative infections are still a significant concern in surgical practice. Despite the low incidence of intra-abdominal abscesses and equal distribution between the two groups, it is imperative that the surgeon pay attention to the details of surgery, especially during lavage in laparoscopic cases[15]. The time taken to perform the operation which is longer in LA is another factor that is usually given as the reason why the procedure is unpopular. Nevertheless, it should be noted that this is a consideration in relation to the other clinical outcomes[16]. This study revealed that a longer operative time can be justified by the benefits of LA in patients' recovery and satisfaction despite the fact that it may take longer to perform LA compared to traditional surgeries. Furthermore, with increased use of laparoscopy, operating time will presumably be shortened, thereby reducing this as a disadvantage of LA[17]. LA group achieved a better patient satisfaction rate than the CA group which has a great importance in the setting of patient centred care. The higher satisfaction scores are attributed to the advantage of using LA in that patients experience less pain, have faster recovery time and better aesthetic outcome. These factors sum up to a better experience of the patient and this is a factor that is now seen as a very important factor when assessing the results of surgeries[18]. Therefore, based on the results of this study, it can be concluded that laparoscopic appendectomy is a reliable method for treating uncomplicated acute appendicitis. The following advantages placed LA over OA: lesser hospital stay; less postoperative pain; fewer complications; faster recovery; and higher patient satisfaction[19]. Although LA may take more time to be operated, the advantages outweigh the disadvantages that accrue to patients and healthcare systems hence making it as standard procedure for managing uncomplicated appendicitis[20]. LA might become an object of further studies to identify potential ways to decrease the operative time for this procedure as well as to determine its efficiency from the viewpoint of cost-effectiveness in different healthcare facilities [21].

CONCLUSION

The Findings of current research showed that laparoscopic appendectomy was more effective surgical modality than open appendectomy in the management of uncomplicated Acute appendicitis (AA). LA has benefits such as shorter length of stay, less postoperative pain, lower complication rates, early return to work and more satisfied patients even though it takes a longer time in operation.

Future prospects: Thus, future studies are needed to compare the approaches to minimize operative time in LA and to ascertain the feasibility of its implementation in various health-care organizations.

Authors' Contributions: SMAR: Conceptualization, study design, and manuscript drafting.

AM, LAA: Data collection and statistical analysis.

EA: Assisted in surgical procedures and data interpretation.

HA, AIC: Literature review and manuscript editing.

YH: Supervised the research and provided critical revisions.

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List of Abbreviations:

RCT: Randomized Clinical Trial
LA: Laparoscopic Appendectomy
OA: Open Appendectomy
VAS: Visual Analog Scale
BMI: Body Mass Index
SPSS: Statistical Package for the Social Sciences
CT: Computed Tomography

Data Availability: The datasets used during and/or created during the current study are available from the author upon request.

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