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**Ministry of Higher Education**  
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**Laparoscopic appendectomy versus open appendectomy in**  
**Baquba teaching hospital**

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بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

وَعَلَّمَ آدَمَ الْأَسْمَاءَ كُلَّهَا ثُمَّ عَرَضَهُمْ عَلَى الْمَلَائِكَةِ فَقَالَ أَنْبِئُونِي بِأَسْمَاءِ هَؤُلَاءِ إِنْ كُنْتُمْ صَادِقِينَ (٣١) قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ (٣٢)

صدق الله العظيم

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**all thanks to ALLAH HIS MAJESTY for helping me to complete this work and enabling me to accomplish this stage of my life.**

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## **DEDICATION**

**I dedicate this humble work to my father, who gave me everything**

**And to my mother who gave me affection and love**

**And to my hapiness "Shaimaa, Tuqa, Mohammed"**

**And then to everyone who taught me a character who has become a lightning rod that lights the road in front of me.**

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## Abstract

**Background:** Appendectomy is the most common surgical procedure performed in emergency surgery. Because of lack of consensus about the most appropriate technique, appendectomy is still being performed by both open (OA) and laparoscopic (LA) methods. In this retrospective analysis, we aimed to compare the laparoscopic approach and the conventional technique in the treatment of acute appendicitis.

**Material and Method:** We collected data of 40 appendectomies done in Baquba teaching hospital between September 2020 and May 2021. These comprised 20 patients who underwent conventional appendectomy and 20 patients treated laparoscopically. The two groups were compared for operative time, length of hospital stay, postoperative complication .

**Results:** We found Laparoscopic appendectomy was associated with a shorter hospital stay ( $1.4 \pm 0.6$  day in LA and  $2.7 \pm 2.5$  days in OA. Operative time was significantly shorter in the Laparoscopic group ( $30 \pm 3.2$  in LA and  $35 \pm 5.2$  min in OA ). Total number of complications was less in the LA group with a significantly lower incidence of wound infection (00.00% vs 15 %,  $P=1.00$ ).

**Conclusion:** The laparoscopic approach is a safe and efficient operative procedure in appendectomy and it provides clinically beneficial advantages over open method (including shorter hospital stay , earlier return to work, lower rate of wound infection)

**Keywords:** Open appendectomy, Laparoscopic appendectomy, Appendicitis.

## **Introduction**

### **Anatomy**

The vermiform appendix is a blind muscular tube with mucosal, submucosal, muscular and serosal layers. Morphologically, it is the undeveloped distal end of the large caecum found in many lower animals. In approximately one-quarter of cases, rotation of the appendix does not occur, resulting in a pelvic, subcaecal or paracaecal position. Especially in childhood, the mesoappendix is so transparent that the contained blood vessels. In many adults, it becomes laden with fat, which obscures these vessels. The appendicular artery, a branch of the lower division of the ileocolic artery, passes behind the terminal ileum to enter the mesoappendix a short distance from the base of the appendix. It then comes to lie in the free border of the mesoappendix. An accessory appendicular artery may be present but, in most people, the appendicular artery is an 'end-artery', thrombosis of which results in necrosis of the appendix (synonym: gangrenous appendicitis). Four, six or more lymphatic channels traverse the mesoappendix to empty into the ileocaecal lymph nodes<sup>(1)</sup>.

### **Microscopicaly**

The appendix varies considerably in length and circumference. The average length is between 7.5 and 10 cm. The lumen is irregular, being encroached upon by multiple longitudinal folds of mucous membrane lined by columnar cell intestinal mucosa of colonic type<sup>(1)</sup>.

Acute appendicitis is the most common intra-abdominal condition requiring emergency surgery.

## **Appendicitis**

Appendicitis is the inflammation of the vermiform appendix. It typically presents acutely, within 24 hours of onset, but can also present as a more chronic condition. Classically, appendicitis presents with initial generalized or periumbilical abdominal pain that later localizes to the right lower quadrant. This activity reviews the presentation, evaluation, and treatment of appendicitis and stresses the role of the interprofessional team in evaluating and treating patients with this condition.

### **Symptoms of appendicitis<sup>(1)</sup>**

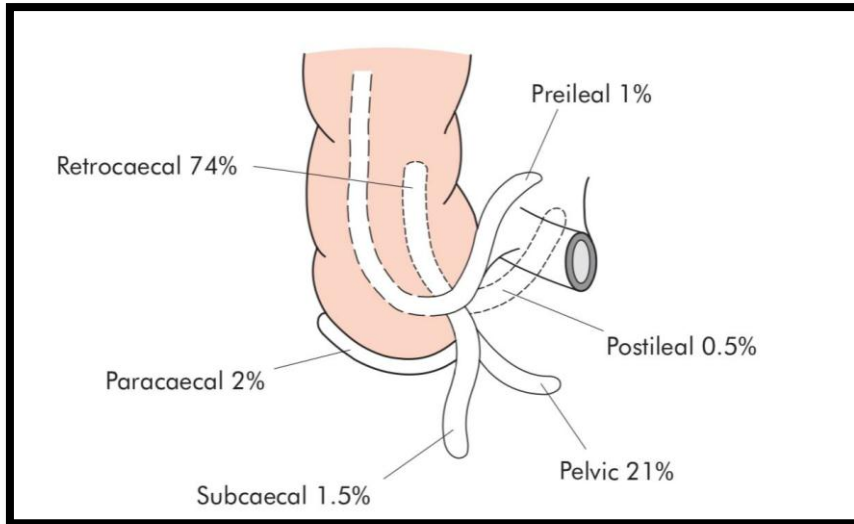
- Peri-umbilical colic
- Pain shifts to the right iliac fossa
- Anorexia
- Nausea

### **Clinical signs in appendicitis**

- Pyrexia
- Localised tenderness in the right iliac fossa ■ Muscle guarding
- Rebound tenderness

### **Signs to elicit in appendicitis<sup>(1)</sup>**

- Pointing sign
- Rovsing's sign
- Psoas sign
- Obturator sign



**Figure (1): The various positions of the appendix (after Sir C. Wakeley, London, formerly PRCS).**

Open appendectomy has been a safe and effective operation for acute appendicitis for more than a century. According to the literature, approximately 7% of the population develop appendicitis in their lifetime, with peak incidence between the ages of 10 and 30 years, thus making appendectomy the most frequently performed abdominal operation<sup>(2)</sup>. Recently, several authors proposed that the new technique of laparoscopic appendectomy should be the preferred treatment for acute appendicitis. However, unlike laparoscopic cholecystectomy, laparoscopic appendectomy (LA) has not yet gained popularity<sup>(3)</sup>. Laparoscopic cholecystectomy is now considered a standard method of performing cholecystectomy and has mostly replaced the old method throughout the world, while appendectomy has yet to achieve such popularity<sup>3</sup>. Since its introduction by McBurney in 1884, appendectomy has been a treatment of choice for acute appendicitis<sup>(4)</sup>. For more than a century, open appendectomy remained the gold standard of treatment of acute appendicitis and for interval appendectomy. In 1981, Semm, a German gynecologist performed the first laparoscopic appendectomy<sup>(5,6)</sup>.



Open appendectomy (OA) is standardized among surgeons and, unlike cholecystectomy, OA is typically completed using a small right lower quadrant incision and postoperative recovery is usually uneventful<sup>(8,7)</sup>. It is the second most common general surgical procedure performed after laparoscopic cholecystectomy, and the most common intra- abdominal surgical emergency, with a lifetime risk of 6%. The overall mortality of OA is around 0.3%; and morbidity, about 11%.<sup>4</sup> The introduction of laparoscopic appendectomy (LA) was therefore greeted with initial reluctance, skepticism, or outright rejection by many surgeons<sup>(9,10)</sup>. Surgeons were discouraged by the disadvantages of the laparoscopic approach, including longer duration of operation, increased cost to the patient, and reports of complications<sup>(11)</sup>. Nearly 3 decades later, large series of randomized controlled trials have shown significant evidence in favor of LA in many centers across the world. Despite published studies showing several advantages, the validity of this procedure in developing countries has not been confirmed<sup>(12)</sup>. Hence the present study was planned to compare the clinical outcomes between laparoscopic and open appendectomy.

There are studies showing that laparoscopic appendectomy does not offer any advantages <sup>(13, 14)</sup>. With improved visualization of the entire abdomen, laparoscopic appendectomy improves the diagnostic accuracy and can identify the definitive pathology causing lower abdominal pain in young females than the open approach. It was concluded that laparoscopy reduces unnecessary appendectomies and improves diagnosis in fertile women.

Many advantages of Laparoscopic surgery have been documented over to open appendectomy.

It requires small incisions and its gives good visualization, it also gives better access to reach the organs in abdomen, as well as fast recovery in the postoperative period. Even Meta- analyses of randomized, controlled trials proved that this approach in better as compared to open appendectomy. It also showed that the incidence of intra-abdominal abscess is thrice more in LA than OA<sup>(15)</sup>.

The incidence of intra-abdominal abscess is found to be more common especially in complicated cases of appendicitis<sup>(16)</sup>. Hence laparoscopic appendectomy is considered a suitable surgical technique for uncomplicated appendicitis. As mentioned above, it has several advantages. But it has certain and some disadvantages also. Hence it is the choice of surgeons to decide whether to go for laparoscopic appendectomy or open appendectomy<sup>(17)</sup>.

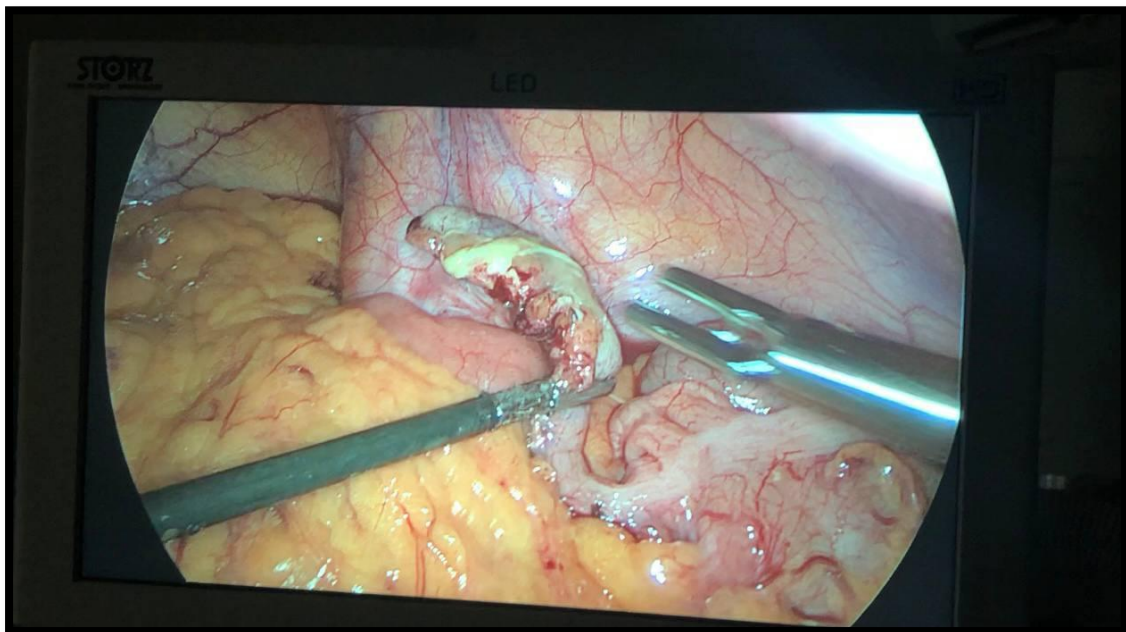
Use of Laparoscopic appendectomy technique in cases of complicated appendicitis remains doubtful<sup>(18)</sup>. Considering pros and cons discussed above, laparoscopic appendectomy is suggested as the method of choice for surgical treatment for acute appendicitis<sup>(19)</sup>. Considering these issues, we have undertaken to study the efficacy of laparoscopic appendectomy its advantages, disadvantages and reasons for conversion of laparoscopic to open appendectomy.

## **Patients and Methods**

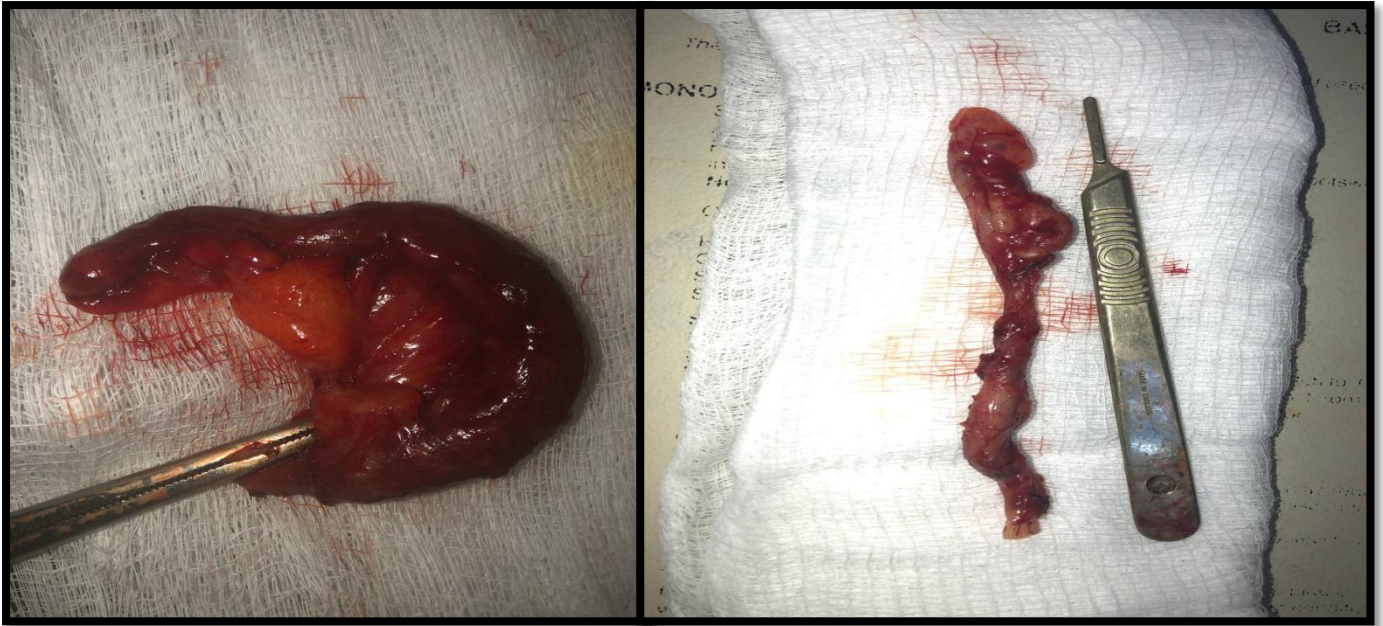
We conducted retrospective review study of patients with appendectomy in Baquba teaching hospital between September 2020 and May 2021. Pregnant women and patients with severe medical disease (hemodynamic instability, chronic medical or psychiatric illness, cirrhosis, coagulation disorders) requiring intensive care were excluded. The decision about the type of the operation was made according to the

preference and experience of the surgical team on duty. We analyzed 40 patient that met the inclusion criteria and their clinical data .. The patients were divided into two groups: open appendectomy (OA) group 20 patients and laparoscopic appendectomy (LA) group 20 patients. The collected clinical data included demographic data, comorbidities, initial laboratory findings, operation time, intraoperative findings , time to soft diet, postoperative hospital stay, amount of analgesics and postoperative complications. The diagnosis was made clinically with history (right iliac fossa or periumbilical pain, nausea/vomiting), physical examination (tenderness or guarding in right iliac fossa). In patients where a clinical diagnosis could not be established, imaging studies such as abdominal ultrasound or CT were performed. Both groups of patients were given a prophylactic dose of third-generation cephalosporin and metronidazole at induction of the general anesthesia as part of the protocol. OA was performed through standard McBurney incision. After the incision, peritoneum was accessed and opened to deliver the appendix, which was removed in the classical appendectomy. A standard 3-port technique was used for laparoscopic group. Pneumoperitoneum was produced by a continuous pressure of 12–14 mmHg of carbon dioxide via a Verres canula, positioned in supraumbilical site. The patient was placed in a Trendelenburg position, with a slight rotation to the left. The abdominal cavity was inspected in order to exclude other intrabdominal or pelvic pathology. After the mesoappendix was divided with bipolar harmonic, the base of the appendix was secured with two legating loops, followed by dissection distal to the second loop. Then, the distal appendicular stump was closed to avoid the risk of enteric or purulent spillage. The specimen was placed in an endobag and was retrieved through a 10-mm supraumbilical port. All specimens were sent for histopathology. The patients were not given oral feed until they were fully recovered from

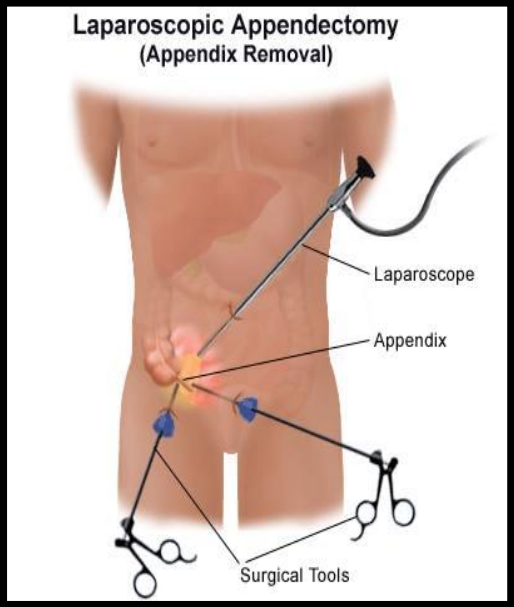
anesthesia and had their bowel sounds returned when clear fluids were started. Soft diet was introduced when the patients tolerated the liquid diet and had passed flatus. Patients were discharged once they were able to take regular diet, afebrile, and had good pain control. The operative time (minutes) for both the procedures was counted from the skin incision to the last skin stitch applied. The length of hospital stay was determined as the number of nights spent at the hospital postoperatively. Wound infection was defined as redness or purulent or seropurulent discharge from the incision site. Seroma was defined as localized swelling without redness with ooze of clear fluid. Paralytic ileus was defined as failure of bowel sounds to return within 12 h postoperatively. Waiver of informed consent from patients was approved because of the observational nature of the study .



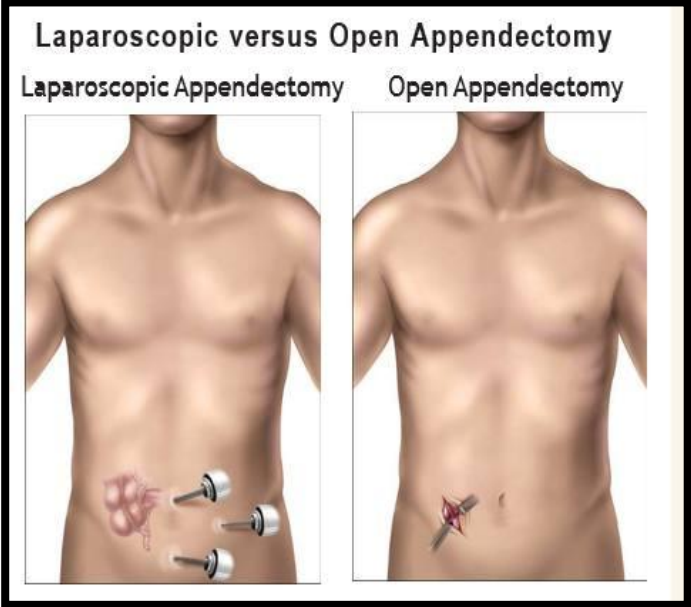
**Figure (2): Laparoscopic appendectomy**



**Figure (3):Inflamed appendix during laparoscopic appendectomy**

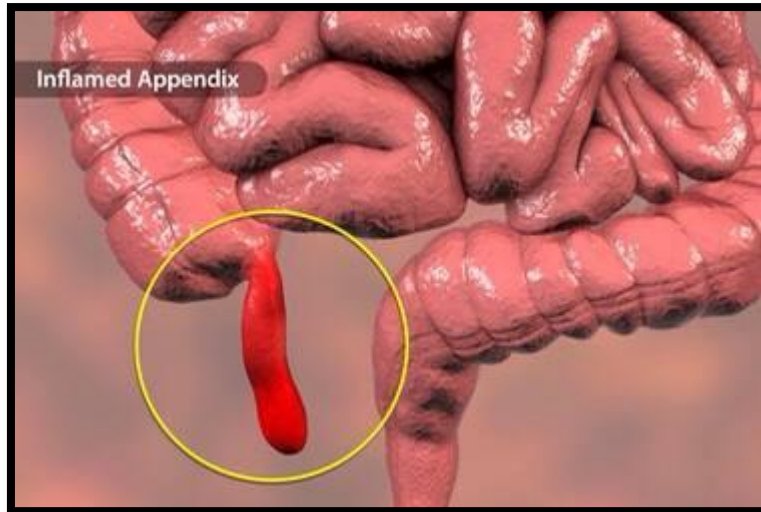


**A**



**B**

**Figure (4): A. Laparoscopic appendectomy,B. Laparoscopic versus open appendectomy**



**Figure (5): Inflamed appendix**

### **Statistical analysis**

Data of current study were analyzed by using Chi-square (X<sup>2</sup>) test to compared between percentages. Numeric data were described by (Mean  $\pm$  SD). T test used to compare between two numeric variables. A level of significance of  $\alpha=0.05$  was applied to test. (Excel 2013) programs used to analyze current data.

### **Results**

Out of 40 patients with acute appendicitis, 20 patients underwent open appendectomy and 20 patients underwent laparoscopic appendectomy. Demographic and preoperative clinical data between OA group and LA group are showed in Table 1. There were no significant differences with respect to age and associated comorbidities. On the contrary, the difference in gender at presentation was statistically significant. Out of the total 20 open procedures, 13 (65%) males and 7(35%) females. In the laparoscopic group, 20 procedures, 9(45%) males and 11(55%) females.

operative and postoperative complication showed in table 2 In our study, the mean  $\pm$  standard deviation (SD) operative time of  $30\pm 3.2$  min for the LA group was shorter than the mean operative time of  $35\pm 5.2$  min for open appendectomy ( $p=0.049^*$  ).

Hospital stay was significantly shorter in the laparoscopic group with a mean  $\pm$  SD of  $1.4 \pm 0.6$  days compared with  $2.7 \pm 2.5$  of the open appendectomy group ( $P = 0.019^*$ ).

A highly significant difference existed between the 2 groups in time taken to return to routine daily activities, which was less in the laparoscopic group with a mean  $11.5 \pm 3.1$  days compared with mean  $16.1 \pm 3.3$  days in the open appendectomy group (Table 2).

We observed a greater overall incidence of complications in open surgery than in laparoscopic surgery. the Wound infection was reported by only 03(15.00%) individuals from open appendectomy group .

**Table 1: Demographic and preoperative clinical data**

|                 | <b>laparoscopic<br/>appendectomy<br/>n=20</b> | <b>Open appendectomy<br/>n=20</b> | <b>P value</b> |
|-----------------|---|-----------------------------------|----------------|
| <b>Gender</b>   |   |                                   |                |
| <b>Male</b>     | 9(45)   | 13(65)                            | 0.394          |
| <b>Female</b>   | 11(55)  | 7(35)                             | 0.346          |
| <b>Mean age</b> | 27.75 $\pm$ 14.24                             | 29.66 $\pm$ 15.13                 | 0.761          |

**Table 2: operative and postoperative complication clinical data**

|   | <b>Laparoscopic<br/>appendectomy</b> | <b>Open<br/>Appendectomy</b> | <b>P value</b> |
|---|--------------------------------------|------------------------------|----------------|
| <b>Operative time<br/>(min)</b>                           | 30±3.2                               | 35±5.2                       | 0.049*         |
| <b>Hospital stay(day)</b>                                 | 1.4±0.6                              | 2.7±2.5                      | 0.019*         |
| <b>Postoperative<br/>complication<br/>Wound infection</b> | 0(0.0)                               | 3(15)                        | 1.00           |
| <b>Return to normal<br/>activity(day)</b>                 | 11.5±3.1                             | 16.1±3.3                     | 0.053          |

## **Discussion**

Acute appendicitis is the most common intra-abdominal condition requiring emergency surgery <sup>(5)</sup> . The possibility of appendicitis must be considered in any patient presenting with an acute abdomen, and a certain preoperative diagnosis is still a challenge <sup>(20,21)</sup> .

Muhammad et al. conducted a similar study and reported that the mean age in the laparoscopic appendectomy group was  $32 \pm 14$  years; the mean age of patients in the open appendectomy group was  $34 \pm 13$  years<sup>(22)</sup> . These results are quite close 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.<sup>(23)</sup> .According to Drinkovic et al., appendicitis was most common in the 11 to 20 year age group, but the increasing incidence in older patients may be due to increased life expectancies <sup>(24,25)</sup> .



The significantly shorter mean operating time for laparoscopic as compared to open appendectomy noted in our study differs from Muhammad et al.'s findings, who reported the mean operating time as  $75 \pm 23$  minutes for a laparoscopic appendectomy and  $64 \pm 15$  minutes for an open appendectomy<sup>(22)</sup>. While in our study operative time as  $30 \pm 3.2$  minutes for a laparoscopic appendectomy and  $35 \pm 5.2$  minutes for an open appendectomy. Another study conducted by Lin et al. showed that laparoscopic appendectomy took a longer time to complete ( $96.1 \pm 43.1$  minutes) than open appendectomy ( $67.8 \pm 32.2$  minutes)<sup>(26)</sup>. These results were in contradiction to ours. However, our findings of shorter mean operating times via the laparoscopic approach align with studies by Tiwari et al., who found a mean operating time for laparoscopic appendectomy were  $47.8 \pm 14.5$  minutes and  $49.10 \pm 12.5$  for open appendectomy<sup>(27)</sup>. The variation reported in the literature in mean operating times may be due to variations in skill levels and experience with laparoscopic techniques in different centers.

Comparison of mean hospital stay in both groups in our setup showed an insignificant difference between the laparoscopic appendectomy group ( $1.4 \pm 0.6$  days) and the open appendectomy group ( $2.7 \pm 2.5$  days). Result of our study align with study done by, Muhammad et al. reported the mean length of hospitalization for the laparoscopic appendectomy group was  $5.3 \pm 2.1$  days while open appendectomy group had a mean length of hospitalization of  $7.2 \pm 3.2$  days<sup>(22)</sup>. In our study postoperative wound infection similar Muhammad et al., who reported that the rate of infections in the laparoscopic appendectomy group was 8.3% while that in the open appendectomy group was 24.4%<sup>(22)</sup>. Lin et al. also showed that the rate of infections was significantly lower in laparoscopic appendectomy (15.2%) than in open appendectomy (30.7%)<sup>(26)</sup>. This

may be attributed to the fact that laparoscopic appendectomy requires less manipulation of the gut by the surgeon's hands and instruments as compared to open appendectomy. Furthermore, the gut does not come into contact with the incision in the layers of the anterior abdominal wall during laparoscopic appendectomy as the appendix is explored in situ.

Result of return to normal activity in our study similar to study done by Antonio et al.who reported  $11.5 \pm 3.1$  days in laparoscopic appendectomy and  $16.1 \pm 3.3^{(28)}$ .

## **Conclusions**

Our results showed the advantages of laparoscopic superior better than open appendectomy including shorter hospital stay,earlier return to work and lower rate of wound infection.

## **Recommendations**

We recommend use Laparoscopic surgery for acute appendicitis because give a better results and less complications.

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