

# Laparoscopic Versus Open Appendectomy

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**Abstract:** *Background: Appendicitis is the most common cause for acute abdominal pain. Laparoscopic appendectomy is an effective alternative to open appendectomy. Both surgical methods are safe but there has been a controversy about which surgical procedure is the most appropriate. Objective: To compare the outcomes of laparoscopic versus open appendectomy. Patients and Methods: In this prospective study, 200 cases of acute appendicitis were included. Patients were distributed into 2 groups namely, open appendectomy group or laparoscopic group. The groups were compared in terms of operative time, postoperative pain, postoperative wound infection, other morbidities and length of hospital stay. Result: Out of 200 patients, 93 underwent open and 107 underwent laparoscopic appendectomy. The mean operating time in laparoscopic appendectomy group was 39.5(5.2) min and in open appendectomy group, was 23.3(3.8) min. The hospital stay was 1.17(0.3) days in laparoscopic appendectomy group and 2(0.8) days in open appendectomy group. In laparoscopic appendectomy group, there is lower incidence of wound infection, lesser postoperative analgesic requirement and shorter hospital stay in comparison to open appendectomy. Though, the operative time is more with laparoscopic appendectomy, Conclusion: Laparoscopic approach for appendectomy can be effective as the gold standard for surgical treatment of acute appendicitis and superior to open approach regarding post operative pain, hospital stay days and return to usual activities .*

**Keywords:** Appendicitis, Abdominal surgery, Open appendectomy, Labroscopy.

## INTRODUCTION:

One of the commonest etiology of acute abdominal condition is acute appendicitis [1]. It is treated by appendectomy which is the most daily performed operation in the abdomen. Open appendectomy has been considered as a golden standard procedure for more than hundred years. Till the last few decades when the laparoscopic approach admitted to the field and it is subsequent development in terms of equipments and experience leading to performing of many kind of operations by this approach. Semm (German gynecologist) was performed first appendectomy by laparoscopy in 1983[2]. Since that time it is a subject of debate to choose open or laparoscopic technique to perform this operation[3,4]. However it is known that laparoscopic surgery has many advantages for example, short hospital stay and less pain post operatively. However, it is reported that in many previous studies (comparing two different approach) that the result are conflicting[3-8]. For instance, some of them reveal no or some clinical advantage associated with high cost[6,9-12]. But other studies reveal that laparoscopic technique has many advantages over the open one[5-12]. Currently, there is a wish to utilize laparoscopic approach in many surgeries including appendectomy[8,13]. Although there is no guaranty in previous literatures about the superiority of laparoscopic approach over open one. Therefore, the aim of the study is to compare the outcome of treatment of acute appendicitis by two different techniques (open Vs laparoscopic).

## PATIENTS AND METHODS :

It is randomized study including 93 patients underwent for open appendectomy and 107 patients for laparoscopic appendectomy due to acute appendicitis.. They were admitted to Emergency Department of Al-Basra General Hospital from January 2015 to December 2017. The diagnosis of appendicitis was made on following criteria; history of pain at right iliac fossa (RIF) or peri-umbilical pain migrating to the RIF (tenderness, rebound tenderness at RIF and guarding on examination), Nausea and /or vomiting, leukocytosis above 11,000 cell/ml. All patients included were 15years age or older.

Patients were excluded if they have had a history of pain for more than 5 days and/or a palpable mass in RIF, suggesting an appendiceal abscess. Also, patients with the following conditions are also excluded: coagulation disorder, generalized peritonitis, shock on admission, Absolute contraindication to laparoscopic surgery (Large ventral hernia), history of laparotomy for small bowel obstruction, ascites with abdominal distension, contraindication to general anesthesia (severe pulmonary or cardiac disease) and pregnancy. The patients were informed about risk and benefits of each operation and asked to sign a detailed informed consent.

Three ports, umbilical (10 ml) for camera, RIF (5mm) and suprapubic (5mm) were performed for laparoscopic appendectomy. Then dissection and division of appendicular artery with aid of harmonic scalpel (Ethicon Endosurgery). The base of Appendix was ligated with secured loop ligature and divided between the two distal ligatures and extract through 10mm umbilical port.

*Post operative Course:*

The patient start sips of water following Regain of Bowel activity (positive bowel sound).

*Outcome parameters:*

The following parameters were recorded:

- Operation time.
- Post operative complication (intra peritoneal abscess , wound / port infection , fecal fistula, hematoma etc.)
- Frequency of analgesia requirement.
- The period of resumption of regular diet.
- Period of Hospital stay (in days).
- The duration of return to normal work

**Results :**

A total of 200 patients underwent appendectomy during the study period. Of these surgeries, 107 were performed laparoscopically and 93 by open surgery based on the operating surgeon preference.

In current study, male to female ratio in laparoscopic surgery patients was 71:36, while male to female ratio in open surgery was 51:42. No statistical difference was found regarding gender with chi square p value equal to 0.096.

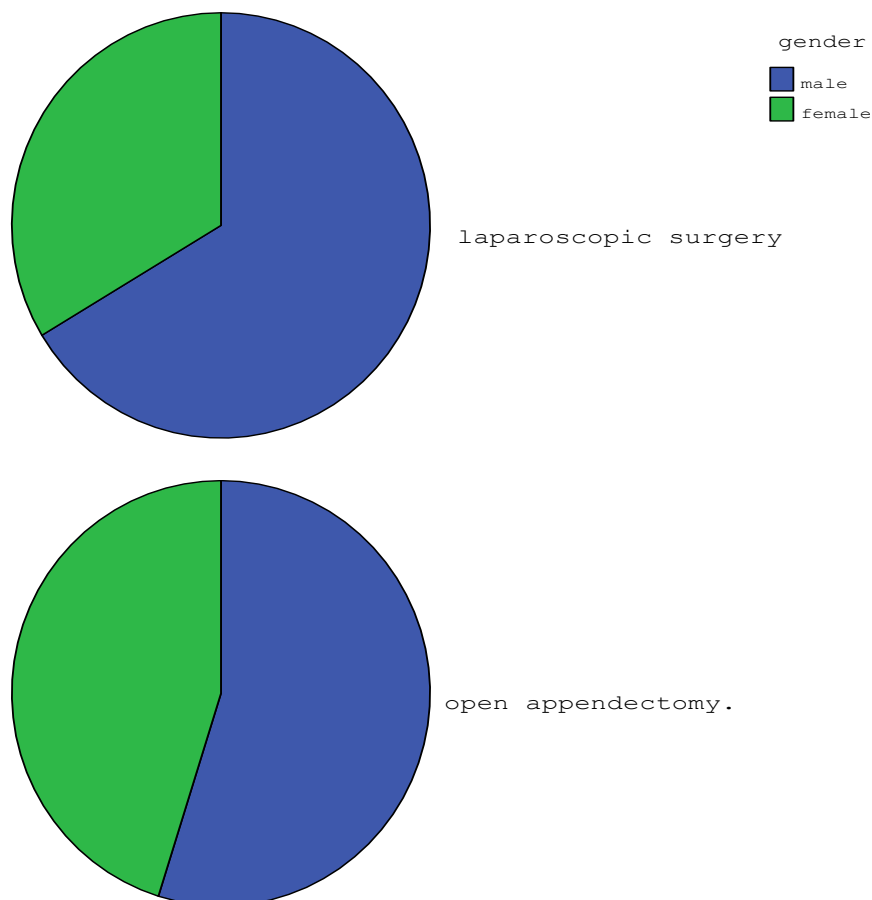


Figure 1: Gender distribution in the study patients

As shown in Table (1), demographic profile of the study patients, the mean age of the patients in Laparoscopic appendectomy group was  $23.3 \pm 5.05$  years and in Open appendectomy group was  $18.3 \pm 3.1$ . The average body mass index (BMI) was higher in the laparoscopic group  $25.8 \pm 1.9$  kg/m<sup>2</sup> while in open appendectomy  $22.07 \pm 0.9$  kg/m<sup>2</sup>.

**Table 1 : demographic profile of the patients**

	Laparoscopic surgery (n=107)	Open surgery (n=93)
Average age (years )	$23.3 \pm 5.05$	$18.3 \pm 3.1$
BMI	$25.8 \pm 1.9$	$22.07 \pm 0.9$

In Table (2), operative finding observed in the study patients, a total of 200 patients, 181 were found to have inflamed appendix, 97 of them underwent laparoscopic appendectomy while 84 underwent open appendectomy, normal appendix only found in 7 cases, 5 in laparoscopic surgery and 2 in open appendectomy. Regarding appendix complication, perforated appendix was found in 3 cases underwent laparoscopic surgery and 5 cases in open surgery, also gangrenous appendix observed in 4 cases, 2 during laparoscopic surgery and 2 in open surgery of appendix.

No statically difference between the two groups regarding operative

Finding.

**Table 2 : Surgical finding of appendix in the patients**

	Laparoscopic appendectomy	Open appendectomy	Total
<u>Normal</u>	<u>5</u>	<u>2</u>	<u>7</u>
<b>Inflamed</b>	97	84	181
<b>Perforated</b>	3	5	8
<b>Gangrenous</b>	2	2	4
<b>MASS</b>	0	0	0
<b>Total</b>	107	93	200

**P value 0.626 using chi-square test**

**Data in numbers**

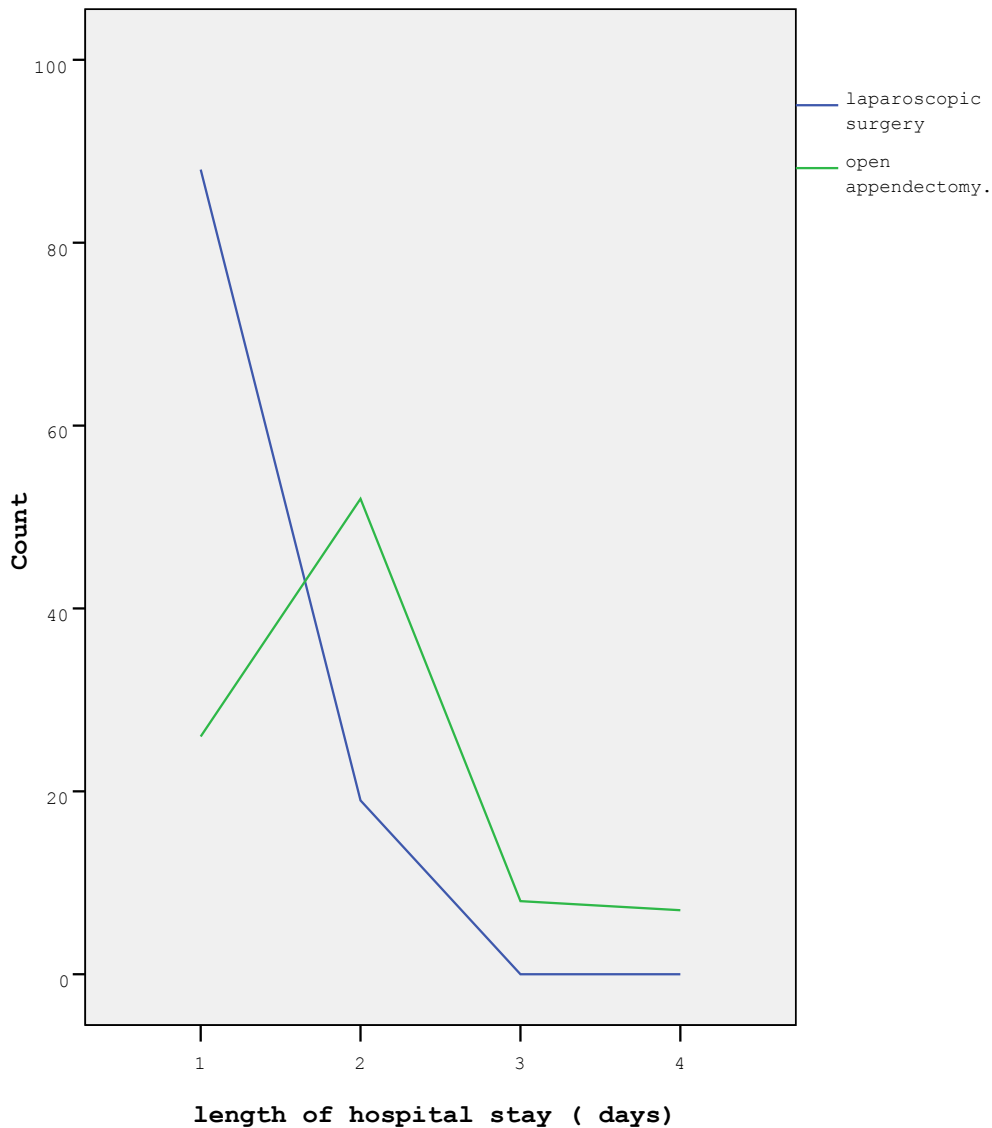
In Table 3, operative and postoperative clinical data between the two groups, statistical correlation was noted in mean operating time ( p value=0.0001 ), clearly it was shorter in open appendectomy  $23.3 \pm 3.8$  min as compared with laparoscopic surgery  $39.5 \pm 5.2$  min, while length of hospitalization was shorter in patients underwent laparoscopic surgery  $1.17 \pm 0.3$  days as compared to open appendectomy  $2 \pm 0.8$  days with p value (0.0001), also a significant statistical correlation was found in time to oral intake p value (0.0001) which was faster in laparoscopic surgery  $3.2 \pm 1.9$  hours as compared to open appendectomy  $19 \pm 5.7$  hours, also return to daily activity was faster in laparoscopic surgery  $2.9 \pm 0.9$  days as compared to open appendectomy  $4.1 \pm 1.4$  days with p value (0.0001), postoperative analgesia use was higher in patients underwent open surgery 64.5% as compared with laparoscopic surgery 57.9% with p value(0.002), postoperative complication rate was higher in open appendectomy 7.6% as compared with laparoscopic surgery 3.7%.

**Table 3 : Comparison of clinical operative and postoperative data between the two study group patients**

	Laparoscopic appendectomy (n=107)	Open appendectomy (n=93)
Mean operating time (min)	$39.5 \pm 5.2$	$23.3 \pm 3.8$
Hospitalization (days)	$1.17 \pm 0.3$	$2 \pm 0.8$
Time to oral intake (hours)	$3.2 \pm 1.9$	$19.2 \pm 5.7$
Return to normal activity(days)	$2.9 \pm 0.9$	$4.1 \pm 1.4$

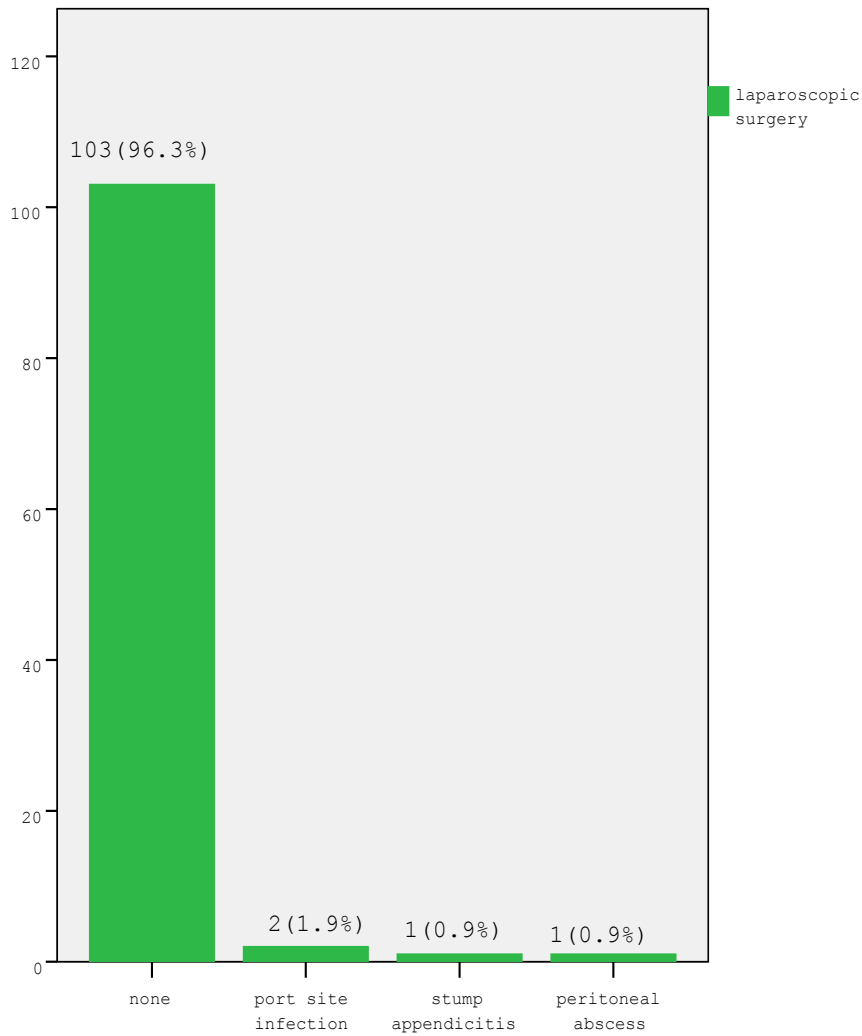
Postoperative analgesia use (%)	57.9%	64.5%
Postoperative complication(%)	3.7%	7.6 %

Length of hospital stay of the study patients, most patients whom underwent laparoscopic surgery had shorter length time between (1-2) days, while those whom had open appendectomy had length time (2-3 ) day as shown in figure (2)



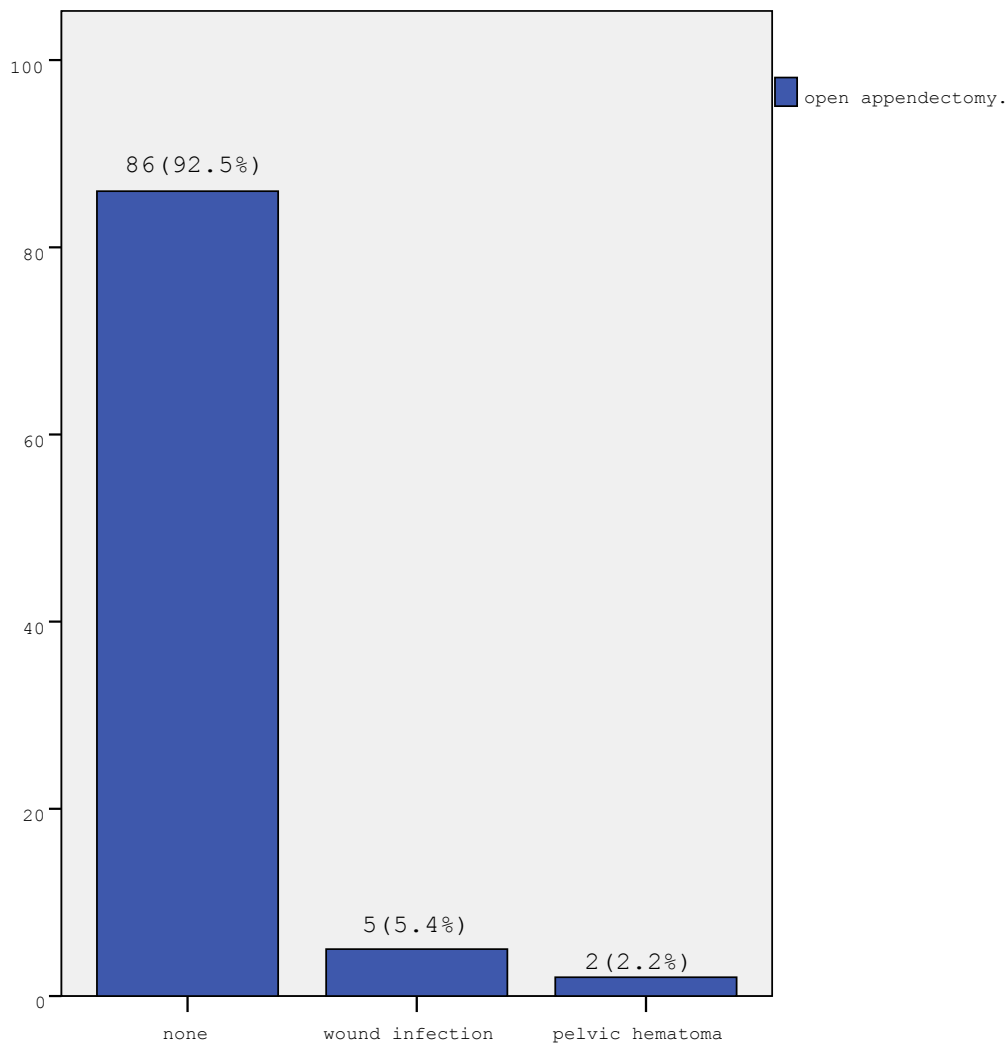
**Figure 2: Length of hospital stay of patients after laparoscopic and open appendectomies.**

Postoperative complication for patients done laparoscopic appendectomy, as it showed four patients developed complication, 2 had port site infection, one had stump appendicitis and one had intraabdominal abscess, as shown in figure (3-A).



**Figure 3-A: Postoperative complication in patients with laparoscopic appendectomy .**

Postoperative complications in patients underwent open surgery were recorded in 7 patients, 5 of them had wound infection, two had pelvic hematoma, as shown in figure (3-B).



**Figure 3-B: Postoperative complication in patients with open appendectomy.**

In Table 4, VAS scores demonstration in the study patients, VAS scores patients with laparoscopic appendectomy as it showed with  $4.4 \pm 1.25$ ,  $3.3 \pm 0.5$ ,  $2.3 \pm 0.89$  respectively, with p value 0.0001 except for 12<sup>th</sup>, they were nearly the same with regards that patients with open appendectomy received more analgesics than with laparoscopic surgery, VAS scores for patients underwent open appendectomy were  $5.6 \pm 1.1$ ,  $3.3 \pm 0.6$ ,  $2.8 \pm 1.05$ , respectively as 6<sup>th</sup>, 12<sup>th</sup>, 24<sup>th</sup> hours after surgery.

**Table4 : VAS score in laparoscopic and open appendectomy of the study patients.**

VAS	Laparoscopic surgery	Open surgery	P value
6 <sup>th</sup> hours	$4.4 \pm 1.25$	$5.6 \pm 1.1$	<b>0.0001</b>
12 <sup>th</sup> hours	$3.3 \pm 0.5$	$3.3 \pm 0.6$	<b>0.741</b>
24 <sup>th</sup> hours	$2.3 \pm 0.89$	$2.8 \pm 1.05$	<b>0.0001</b>

**Discussion:**

Acute appendicitis is one of the most common abdominal surgeries [11]. In the wake of the spectacular success of laparoscopic cholecystectomy, proven benefits of minimal access surgery to other procedures have raised, including appendectomy (which, in the beginning, included athletes, obese and females for conservative reasons). Many surgeons started laparoscopic appendectomy as treatment of choice of uncomplicated appendicitis, but, it still a topic of discussion.

Many studies have been reported the advantage of laparoscopic appendectomy over open surgery as far as less postoperative time, shorter recovery time and fewer complication rates than open surgeries (12-14). Considering the increased instrumentation used during laparoscopic surgery, the setup time involved and the surgeon experience with competence of the team (15).

The present study has showed that operating time in laparoscopic was more than open surgery by 16-20 min. Similarly, the duration of surgery was 7.6-18.3 min (16) and 15-20 min (17) longer in laparoscopic appendectomy.

Early return to normal activity is accepted as an obvious advantage of LA, which was supported by a large scale meta-analysis conducted by the Cochrane Colorectal Cancer Group[18] Number of studies showed no difference between open and laparoscopic appendectomy regarding early return to activity and performance of daily activities. However, this is still in discussion because of the different definitions and classifications of “activity” in such studies[19]. This advantage might be magnified in obese patients, where a larger open incision would be necessary, with its attendant risks of greater infection and postoperative pain[20]. Therefore, surgeons preferred to operate patients with high BMI by laparoscopic surgery as it showed in the current study results. The results of the present study indicates that hospital stay was significantly shorter in laparoscopic group ( $P = 0.0001$ ) with a concomitant earlier bowel movements in patient whom had laparoscopic surgery. leading to earlier feeding and discharge from hospital. Similarly, 2 studies have demonstrated significantly short hospital stay for the laparoscopic approach[21,22]. Pain assessment was studied in 2 ways: subjectively by the administration of a visual analogue scale test and objectively by the analgesics drugs. This study showed decrease pain VAS score in first 6 hours and 24 hours with  $p$  value (0.0001), while no significant difference was found regarding VAS score at 12 hours. This result was in agreement with other studies [23] while a study carried out by Cipe et al. among 241 patients the VAS scores of 1st, 6th and 12th hours were higher in the open appendectomy group[24].

Postoperative complications are considered in an assessment of a procedure's safety. The common complications of appendectomy are wound infection, intra-abdominal abscess, bleeding and others, Infectious complications represented by wound infections and intra abdominal abscesses are 2 variables by which the techniques have been traditionally compared. Wound infections are not a serious complications to be considered (In laparoscopic surgery the inflamed appendix never comes into contact with the wound as it is removed by a bag or a trocar while in open surgery the appendix is delivered directly through the wound) but still represent a major impact to the patient interfere with his convalescence time and quality of life. Intra abdominal abscess formation is a serious complication and can be considered as to be life threatening. We found that 5 cases with wound infection and 2 cases with pelvic hematoma recorded in open appendectomy, while 2 cases of port site infection and 2 patients developed stump appendicitis with one intra abdominal abscess recorded in laparoscopic operated patients, with over all complication rate was higher in open appendectomy as compared to laparoscopic surgery. These results were supported with other studies (25,26). In contrast, a study showed an increased risk of intra-abdominal abscess after laparoscopic appendectomy compared with open surgery[27].

Several hypotheses have been studied the possible explanations: mechanical spread of bacteria in the peritoneal cavity affected by carbon dioxide insufflations, particularly in complicated appendix[28] inadequate learning curve that leads to contamination of the entire abdominal cavity, which is difficult to aspirate latter [29]. Some investigations found significantly higher postoperative wound infections after open appendectomy [30]. Regarding long term complications, laparoscopic appendectomy is superior to open appendectomy as a reduction of adhesion formation and long-term incidence of small-bowel obstructions following appendectomy[31].

The surgeons in the current study had a preference towards laparoscopic surgery as it has many advantages, less hospitalization stay, early return to oral diet and faster recovery time with less postoperative pain and complication. Also laparoscopic surgery has an advantage in localization of the appendix with greater precision due to better visualization of the abdominal wall.

In conclusion, the laparoscopic appendectomy was less morbidity than open appendectomy in form of less post operative pain, wound infection, duration of hospital stay, analgesic requirement, early recovery, advantage of early starting oral diet and early return of normal activity. So the change in surgical approach from open to laparoscopic is safe and effective.

In addition to the advantage of laparoscopic in its improved diagnostic accuracy during operation. Even though the duration of operation is more in laparoscopic appendectomy it can be considered a better alternative to open appendectomy.

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