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Laparoscopic appendectomy for complicated acute appendicitis in Tikrit emergency hospital

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Abstract
Background: With a prevalence of 1.17 cases per 1000 people and an approximate 7 percent risk over the course of a lifetime, acute appendicitis continues to be one of the most common causes of acute abdominal pain
Materials and Methods: During the time period of this observational study, which began on January 1, 2022 and ended on November 30, 2022, 57 patients were admitted to the emergency unit of Tikrit General Hospital with a diagnosis of suspected complicated acute appendicitis. Antibiotics and fluids were given intravenously to the patient before the operation. Pneumo-peritoneum was created using either the Verrus needle or the Hasson open approach while the patient was under general anesthesia and intubated with an endotracheal tube. Additionally, the patient was positioned in the supine position. The appendix could be extracted using either the endo-catch bag or the 10 mm port, depending on which method was used. After performing a peritoneal wash with saline until the wash fluid turned clear, an intra-peritoneal tube drain was left either in an appendicular bed or the pelvis.
Results: The study enrolled 57 participants (38 females, 19 males) with a mean age of 26.73±6.5 years, ranging from 17 to 50 years. All patients underwent diagnostic laparoscopy, and intra-operative findings showed that 26 patients (45.61%) had perforated appendicitis, 13 patients (22.81%) had gangrenous appendicitis, 11 patients (19.30%) had appendicular abscess, and 7 patients (12.28%) had appendicular mass. The mean operation time was 49.5±16.86 minutes, with a range of 39 to 117 minutes. Laparoscopy was the preferred option for 52 patients (91.23%), while 5 patients required open surgery. Hospital stay duration varied, with 13 patients staying for 2 days, 20 patients for 3 days, 17 patients for 4 days, and 4 patients for more than 5 days. During the post-operative follow-up, 43 patients had no complications (75.44%), 2 patients (3.51%) had a fever with a collection on follow-up ultrasound, 5 patients (8.77%) had a fever without a collection, 2 patients (3.51%) had postoperative ileus, and 3 patients (5.26%) had wound seroma or infected seroma.
Conclusions: This study shows that laparoscopic appendectomy may treat severe appendicitis safely and effectively. It reduced hospital stays and conversions. Prevents postoperative infections.

Keywords: Laparoscopic, appendectomy, appendicitis, emergency, Tikrit

Introduction
Laparoscopic appendectomy is a minimally invasive surgical procedure to remove the appendix, a small, tube-like structure attached to the large intestine in the lower right abdomen [1]. This procedure is used to treat appendicitis, an inflammation of the appendix that can cause abdominal pain, fever, and other symptoms [2]. During a laparoscopic appendectomy, the surgeon makes several small incisions in the abdomen and inserts a laparoscope, a thin, flexible tube with a camera and a light, to visualize the inside of the abdomen. The surgeon then uses specialized surgical instruments to remove the appendix through the small incisions. Compared to traditional open appendectomy, laparoscopic appendectomy has several advantages. It typically results in less pain, shorter hospital stays, faster recovery times, and smaller scars. It is also associated with lower rates of complications, such as wound infections and hernias [3]. However, laparoscopic appendectomy may not be suitable for all patients, especially those with advanced appendicitis or other complications, such as abscesses or perforation of the appendix. In these cases, open appendectomy may be necessary [4]. Laparoscopic appendectomy is generally considered a safe and effective procedure for treating appendicitis. However, as with any surgery, there are potential risks involved, including bleeding, infection, and damage to adjacent organs [5, 6].

Patients should have a thorough discussion with their surgeon regarding the risks and benefits of laparoscopic appendectomy to determine if it is the most suitable option for their individual case. A delayed diagnosis of appendicitis can result in serious complications such as abscess formation, gangrene, tumor, perforation, or peritonitis [7, 8]. Compared to traditional open surgery, laparoscopic appendectomy offers several advantages, including shorter hospital stays, faster return to normal activities, reduced pain levels, and improved cosmetic outcomes. Acute appendicitis, which is characterized by acute inflammation of the appendix, is a common surgical emergency with a lifetime incidence of approximately 8% [9, 10, 11]. The goal of this study is to assess the role of laparoscopy in the treatment of difficult appendicitis by analyzing factors such as operating time, intra-operative complications, length of hospital stay, analgesic use, time to return to oral eating, and postoperative risks.

Materials and Methods

Between January 1, 2022, and November 30, 2022, a total of 57 patients with suspected complicated acute appendicitis were admitted to Tikrit Emergency Hospital's emergency unit. Meeting the diagnostic criteria provided conclusive evidence that the acute appendicitis was indeed complicated, characterized by inflammation and infection of the appendix that can lead to severe complications such as abscess formation, perforation, or diffuse peritonitis, which require urgent medical intervention. Surgical removal of the appendix is usually necessary to address any complications, either as an emergency or delayed procedure following initial treatment with antibiotics and other supportive measures, depending on the severity of the condition.

A laparoscopic appendectomy is a minimally invasive surgical operation that involves the use of a laparoscope, a thin, flexible tube with a camera and a light, and specialized equipment to remove the appendix. These are the normal steps in the technique:

1. The patient is put to sleep and kept pain-free by administering general anaesthetic.
2. **Incision:** The surgeon makes several small incisions in the abdomen, typically 3-4 incisions that are less than an inch in length.
3. **Insertion of laparoscope:** A laparoscope is inserted into one of the incisions, allowing the surgeon to view the inside of the abdomen on a video monitor.
4. **Insertion of surgical instruments:** Other specialized instruments are inserted through the other incisions to perform the surgery.
5. **Separation of appendix:** The surgeon uses the instruments to separate the appendix from its attachments to the intestine.
6. **Removal of appendix:** Once the appendix is detached, it is removed through one of the incisions.
7. **Closure of incisions:** The incisions are then closed with sutures or surgical glue.

The procedure typically takes 30 minutes to 1 hour to complete, and most patients are able to go home on the same day or the next day after the surgery. Recovery time is typically shorter compared to open appendectomy, and most patients are able to resume normal activities within 1-2 weeks.

As with any surgery, there are risks associated with laparoscopic appendectomy, such as bleeding, infection, and damage to surrounding organs. Patients should discuss the risks and benefits of the procedure with their surgeon to determine if it is the best option for them.

Results

The study included 57 participants of both genders who were adults. The ages of the patients ranged from 17 to 50, with an average age of 26.73±6.5 years. Out of the total number of patients, 38 (66.67%) were female, and 19 (33.33%) were male. (Table 1).

Table 1: Patients' demographic information from the study

Parameters	Studied cases (n:57)	
	No.	%
Gender		
Males	19	33.33
Females	38	66.67
Total	57	100
Age (years) Mean ± SD	26.73±6.5	

All 57 patients underwent diagnostic laparoscopy at the beginning of the procedure, and the findings during surgery were as follows: 26 patients (45.61 percent) had perforated appendicitis, 13 patients (22.81 percent) had gangrenous appendicitis, 11 patients (19.30 percent) had an appendicular abscess, and 7 patients (12.28 percent) had an appendicular mass (as shown in Table 2).

Table 2: Findings made during the operation for each subject that was evaluated

Findings during the operation	Studied cases (n:57)	
	No.	%
Appendicular abscess	11	19.30
Appendicular mass	7	12.28
Gangrenous appendicitis	13	22.81
Perforated appendicitis	26	45.61
Total	57	100

The duration of surgery ranged from 39 minutes for the shortest case to 117 minutes for the longest case. The average duration of surgery was 49.5 minutes with a standard deviation of 16.86 minutes, as shown in Table 3.

Table 3: Description of operative time in all studied patients

Operative time (minutes)	
Mean	49.5
SE Mean	3.92
Standard deviation	16.86
Minimum	39
Median	65
Maximum	117

Out of the total number of patients, 52 of them (91.23 percent) decided to undergo laparoscopic appendectomy without conversion to open surgery. Only 5 patients chose to switch to the open surgical technique. In one case (1.75 percent) with an appendicular mass, conversion to open surgery was necessary due to the presence of extensive adhesions, and in another case (1.75 percent) with a gangrenous appendix, conversion to open surgery was required due to a gangrenous base with friable cecum that needed trimming of the base and closure by interrupted sutures, followed by the application of an omental patch. These two cases were converted to open surgery due to the presence of extensive adhesions. The details of the conversion to open surgery can be found in Table 4.

Table 4: Conversion to open procedure in all studied patients

Conversion to open procedure	Studied cases (n:57)	
	No.	%
Yes.	5	8.77
No.	52	91.23
Total	57	100

Table 5 displays information about the resumption of oral eating after surgery for all patients. Among the patients, 22 individuals (38.60 percent) were able to restart on the same day of operation, 28 patients (49.12 percent) resumed on the first postoperative day, and 7 patients (12.28 percent) resumed on the second postoperative day.

Table 5: Resumption of oral consumption for each and every patient who was evaluated

Return to oral intake	Studied cases (n:57)	
	No.	%
the exact same day	22	38.60
the first day	28	49.12
the second day	7	12.28
Total	57	100

Out of the total number of patients, 13 individuals (22.81 percent) had a hospital stay of 2 days after the operation, while 20 patients (35.09 percent) had a hospital stay of 3 days, and 17 patients (29.82 percent) had a hospital stay of 4 days. Only 4 patients (7.02 percent) had a hospital stay that exceeded 5 days. Among these cases, three patients (5.26 percent) had to extend their hospital stay because they needed to undergo open surgery.

Table 6: The total number of days that each patient stayed in the hospital

Length of hospitalization (days)	Studied cases (n:57)	
	No.	%
2	13	22.81
3	20	35.09
4	17	29.82
5 and more	4	7.02
prolonged stay (open surgery)	3	5.26
Total	57	100

After the surgical procedures, a total of 43 patients were followed up, and the results showed that a fever above 38 degrees Celsius was observed in 2 patients (3.51 percent) who had a collection during the follow-up ultrasound, while 5 patients (8.77 percent) had a fever above 38 degrees Celsius without any collection on follow-up ultrasound. Two patients (3.51 percent) had postoperative ileus, and 3 patients (5.26 percent) had wound seroma. In addition, 2 patients (3.51 percent) developed a wound infected seroma and infection. On the other hand, no complications were found in 43 patients (75.44 percent).

Table 7: Complications following surgery in each and every patient investigated

Postoperative complications	Studied cases (n:57)	
	No.	%
No complications	43	75.44
Fever >38 with ultrasound collection	2	3.51
Fever >38 without ultrasound collection	5	8.77
Post-op ileus	2	3.51
Seroma wound	3	5.26
Seroma-infected wound	2	3.51
Total	57	100

Discussion

Recent studies have shown that laparoscopic appendectomy has many advantages over the open approach, such as a shorter hospital stay, quicker recovery, and lower incidence of complications. Although some studies suggest that laparoscopic surgery is equally effective as open surgery, there is still debate about its effectiveness. Intra-operative difficulties can result in a conversion to open surgery, as seen in the case of patients with an appendicular mass or gangrenous appendix. The laparoscopic procedure also reduces the risk of wound infection, and factors such as obesity, leukocytosis, and longer operating time are associated with postoperative intra-abdominal abscesses. The use of minimally invasive surgical procedures is becoming more popular for surgical emergencies, but studies suggest that the incidence of intra-abdominal adhesions is higher with laparoscopic surgery. To reduce the risk of developing an intra-abdominal abscess, low-pressure pneumoperitoneum and minimal tissue handling should be used during the procedure. Overall, laparoscopic appendectomy has many advantages and is a viable option for patients with appendicitis [8]. The duration of the operation was unquestionably cut down as a direct result of increased practice on the part of both the surgeons and the nursing staff [1]. We anticipate that intra-operative circumstances will be the primary cause of conversion, in contrast to the widespread belief that conversion is dependent on the routine procedures performed by the surgeon. In the current study, we reported two cases of intra-operative difficulties: one case involved an appendicular mass that required a conversion to an open approach via a midline incision because of extensive adhesions, and the other case involved a gangrenous appendix that required a conversion to an open approach via a lower midline incision because of a gangrenous base with friable cecum. Our findings indicate that the length of time spent in the hospital was much less in the LA, and this finding is consistent with the findings of a number of other research. 10 The patient who required non-steroidal anti-inflammatory intramuscular injection, which is beneficial, was examined for postoperative discomfort. At the outset, the diagnostic laparoscopy was carried out on each and every one of the 57 patients, and the findings that were discovered during the operations were as follows: 26 patients, which accounts for 45.61 percent of the total, had perforated appendicitis, 13 patients, which accounts for 22.81 percent of the total, had gangrenous appendicitis, 11 patients, which accounts for 19.30 percent of the total, had appendicular abscess, and 7 patients, which accounts for 12.28 percent, had appendicular mass. In all of the cases, the CO2 was drawn from the right subphrenic space, and low-pressure pneumo-peritoneum was performed. This was done in addition to minimal tissue handling and trauma, both of which contribute to a reduction in the perception of pain [11, 12, 13]. In addition, the shoulder pain that was caused by the remaining gas irritation was reduced. In the study by Ansari *et al*. [14], out of 103 patients who were successfully operated on laparoscopically, 21 patients developed minor complications. These complications included fever in 11 (10.67 percent) patients, postoperative ileus in 5 (4.85 percent) patients that delayed the beginning of their oral feeding, and port site infection in 5 (4.85 percent) patients. There were no more instances of postoperative intestinal blockage, and there were no fatalities.

LA offers a significant advantage in reducing the risk of wound infection compared to OA. In OA, the infected appendix is removed through the incision, while in LA, it is removed through a port, resulting in a lower incidence of wound infection. Additionally, the port-site wounds in LA are less

severe than the large incision in OA. [15] The aim of our study was to identify predictive factors for the development of intra-abdominal abscess after LA. Our findings revealed that obesity, leukocytosis with a count exceeding 20,000/mm3, ruptured appendicitis, and a longer duration of surgery were all associated with an increased risk of developing intra-abdominal abscess postoperatively.

Although minimally invasive surgical procedures, including LA, have become increasingly prevalent in the treatment of surgical emergencies, a randomized controlled trial conducted in 2002 revealed that the incidence of intra-abdominal adhesions was nearly three times higher with LA than with OA. The possible reasons for this disparity include the spread of infectious substances throughout the abdominal cavity during pneumoperitoneum or the lower incidence of intraperitoneal infection with OA, where the appendix is removed externally and the base is inverted after separation [16, 17]. In a study conducted by Asarias *et al*. [18], it was found that patients with complex appendicitis were five times more likely to develop intra-abdominal abscesses (IAA), with increasing age being a contributing factor. Horvath *et al*. [19] suggested that the use of certain surgical techniques, such as the Roeder knot, severe wash, and Trendelenburg's position, during laparoscopic appendectomy for perforated appendicitis, increased the incidence of IAA. Conversely, Gupta *et al*. [20] attributed the increase in infectious complications to the aggressive handling of the infected appendix and excessive irrigation during surgery. To minimize the risk of developing IAA, several operative considerations were recommended. Firstly, a low-pressure pneumoperitoneum was recommended to limit the spread of bacteria through the bloodstream. Secondly, pus should be drained early in the procedure. Thirdly, extensive adhesiolysis should be performed to prevent the formation of pus pockets. Fourthly, suction irrigation should be used to remove contaminated fluid until it is clean. Finally, adequate drainage should be ensured through multiple drains [21]. In the current study, two cases of IAA were reported, one of which was treated successfully with ultrasound-guided drainage, while the other was a small collection managed conservatively with antibiotics according to culture and sensitivity. As a result of implementing these operative considerations, the frequency of IAA was reduced. A recent report [22] is also relevant to this topic.

Conclusions

This study shows that laparoscopic appendectomy may treat severe appendicitis safely and effectively. It reduced hospital stays and conversions. Prevents postoperative infections.

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