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An Overview on Treatment of Acute Appendicitis

Ehab Shehata Abdallah, Khaled Safwat Fahmi, Osama Ahmed Abdelsattar Mohamed Mohamed, Walid Abdelmawla Elsayed Ali

Department of General Surgery, Faculty of Medicine, Zagazig University, Egypt

***Corresponding author:** Osama Ahmed Abdelsattar Mohamed Mohamed

E-mail: osama_4a@yahoo.com

Abstract:

Background: Acute appendicitis is one of the most common surgical emergencies worldwide, with a lifetime risk of approximately 7–8%. The condition arises from obstruction of the appendiceal lumen, leading to inflammation, bacterial overgrowth, ischemia, and potential perforation. Early recognition and timely management are essential to prevent complications such as abscess formation, peritonitis, and sepsis. While appendectomy has long been considered the standard treatment, non-operative strategies including antibiotics have emerged as viable alternatives in selected patient groups.

Keywords: Acute appendicitis; Appendectomy; Antibiotic therapy; Laparoscopy; Surgical management; Non-operative treatment.

Introduction:

Acute appendicitis remains one of the most frequent surgical emergencies globally, affecting approximately 100 cases per 100,000 adults per year, and its standard treatment typically involves surgical removal via appendectomy **(1).**

Laparoscopic appendectomy has become the preferred surgical approach, offering faster recovery, shorter hospital stays, fewer postoperative complications, and reduced need for analgesics compared to open surgery **(2).**

In recent years, antibiotic-based nonoperative management has emerged as a viable alternative for uncomplicated appendicitis, demonstrating cure rates of 73–88% and a 1-year failure rate below 30%, although its long-term efficacy remains lower than surgery **(3).**

Furthermore, randomized data has shown that antibiotic treatment enables approximately two-thirds of patients to avoid appendectomy within the first year, though the presence of an appendicolith increases the likelihood of treatment failure and subsequent surgery **(4)**.

Treatment of appendicitis is essential in preventing further morbidity and mortality; a margin of error in over diagnosis is acceptable. The rate of negative appendectomies is approximately 20 percent **(5).**

Appendectomy is the standard management of acute non-perforated appendicitis, while appendicular abscess is treated by percutaneous aspiration guided by ultrasound and in appendicular mass; the treatment of choice is non- operative management with antibiotics followed by delayed appendectomy. Ochsner and Sherren first described this conservative treatment **(6).**

Appendicectomy:

Appendicectomy is performed under general or spinal anesthesia with the patient supine on the operating table. When a laparoscopic technique is used, the bladder must be empty. The right iliac fossa should be palpated for a mass before preparing the entire abdomen with an appropriate antiseptic solution. Draping of the abdomen follows the planned operative technique, considering any requirement to extend the incision or convert a laparoscopic technique to an open operation**(7).**

Preoperative Preparation

When deciding to perform an appendectomy for acute appendicitis, the patient should proceed to the operating room without little delay to minimize the chance of progression to perforation. Patients with appendicitis may be dehydrated from fever and poor oral intake, so intravenous fluids should be begun, and pulse, blood pressure, and urine output should be closely monitored**.** Before incision, a single dose of antibiotics should be administered, typically second-generation cephalosporin**.** Markedly dehydrated patients may require a Foley catheter to ensure adequate urine output. Severe electrolyte abnormalities are uncommon with non-perforated appendicitis, as vomiting and fever have typically been present for 24 hours or less but may be significant in cases of perforation. Any electrolyte deficiencies should be corrected prior to the induction of general anesthesia **(8).**

Standard procedure:

1- Position of the Patient and the Surgeon: (Figure 1)

The patient is supine in a 15° Trendelenburg position with both arms and at least the left arm, tucked alongside the body to give the surgeon and the assistant comfortable space. Rotation to the left can be useful. In this position, the ascending colon is slightly suspended from the lateral wall, and the small intestine falls away from the operative field. The surgeon stands on the patient's left side. The assistant stands on the surgeon's right. The monitor is usually placed on the patient's right side **(9).**

A pneumoperitoneum is created in standard fashion, using either the Veress needle technique, the open Hasson technique, or by inserting a non-traumatic bladeless Opti-View port **(10).**

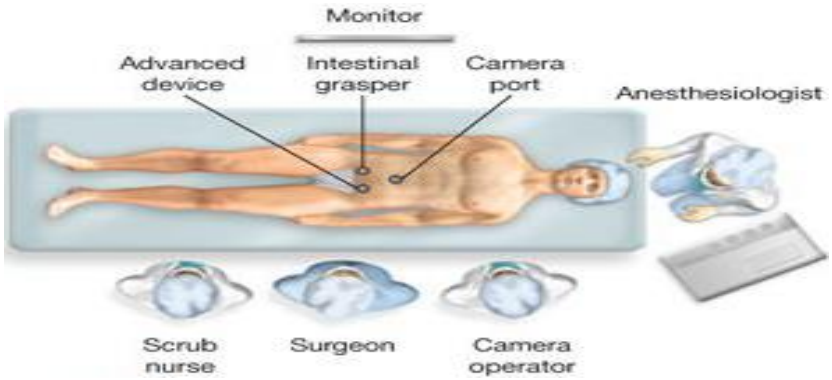

Figure 1*: Standard Laparoscopic Tray for appendectomy (11).*

2- **Trocar Placement:** ***(Figure 2)***

The first trocar is usually 10 mm and is introduced at the lower margin of the umbilicus. Insertion should be in a slightly oblique manner to prevent incisional hernias. The intraperitoneal pressure is set to 12, with a maximum of 14 mmHg in adults. The abdomen is visually explored. A second 5 suprapubic trocar is inserted for the working instruments undervision. A third 10 mm operating trocar is essential and can be introduced either in the right iliac fossa or in the left iliac fossa **(12).**

The third is better to be in the left iliac fossa lateral to the inferior epigastric vessel. The reason for choosing this site is to allow an adequate distance from the first two ports and to allow for so-called triangulation toward the appendix. By this is meant the ability to have the two operating instruments approach each other at a 90-degree angle, which allows for much better tissue manipulation and easy of dissection **(12).**

An additional 5-mm port may be placed in the upper midline or in the right upper quadrant. This may occasionally be necessary to mobilize a retrocecal appendix. It is generally not advisable to have the port placed directly over the area of dissection **(12).**

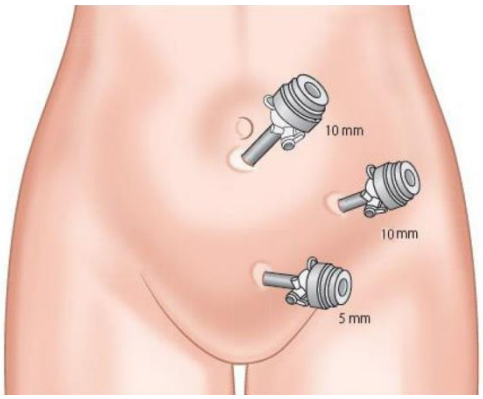

Figure 2: Trocar placement (13).

3- Identification, mobilization of the Appendix:

Before resecting the appendix, exploration of the entire abdominal cavity must be done for evaluation, The appendix is found by following the cecum. The mesoappendix is grasbed near the tip to lift the appendix towards the abdominal wall. If there is appendicular abscess, collection will be opened and aspiration will be done. If there is appendicular mass dissection of the mass from the surrounding omentum and bowel loops will be done cautiously to avoid injury. **(14)**.

A window is made in the mesentry at the base of the appendix with a blunt maryland dissector. Once the window is adequate, an endostapler can be passed through it for stabling of the mesoappendix **(15)**.

Another options for dividing the mesoappendix are using the Ligasure or hook diathermy from the distal end of the artery to its cecal base, but it should be done carefully with a fully retracted appendix, especially when becoming closely to the cecum which may be friable in severe peritonitis. Also harmonic or vessel sealing devices or stapler could be used safely, but they are more costly and usually disposable devices **(Photo 3) (16)**.

Once the mesoappendix is dissected, the appendix is grasped and ligated near its base with 2 proximal and 1 distal endoloop sutures **(Photo 4)**. This step could be done alternatively with absorbable sutures using intracorporeal or extracorporeal knot-tying techniques. Endoclips or endostapler could be also used espicially with complicated appendicitis. **(Photo 5) (16).**

4- Transection of the appendix

Either suture ligation or staplers can be used to divide the appendix and the mesoappendix. Suture ligation, either with free ties or pre-tied endoloops, is inexpensive or only requires a 5-mm port, but it demands more skill and may initially take more time. The stapling technique requires less skill and is initially time-saving, but it is more expensive and requires a 12-mm port **(17).**

The appendix should be visible from tip to base. Harmonic can be used, although it is an additional expense. Care has to be taken not to touch and burn adjacent loops of bowels with cautery devices. Portions of the mesoappendix are cauterized and subsequently cut with the scissors until the base of the appendix is identified and completely freed. **(17).**

1) Clipping technique

In this technique, the appendix is subsequently divided between 1 proximal and 1 distal polymer clip. Two polymer clips inserted at the base, leaving sufficient space to transect the appendix between the two clips **(17).**

2) Endoloop technique

In this technique, the appendix is subsequently divided between 2 proximal and 1 distal endoloop sutures. Two endoloops or free ties are inserted and tied at the base proximally and one endoloop or free tie distally, leaving sufficient space to transect the appendix **(17).**

Transection should be done sharply without cautery to prevent late stump necrosis at the ligated base. After transection, the appendiceal stump mucosa can be carefully cauterized **(17).**

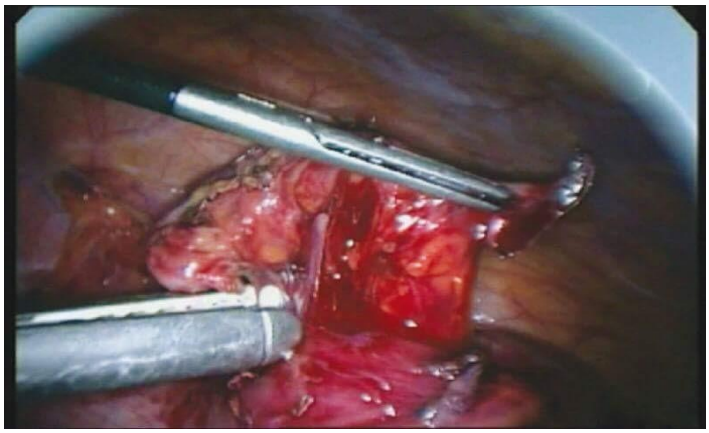

Photo 3: Stapler technique: the transection of the mesoappendix **(18).**

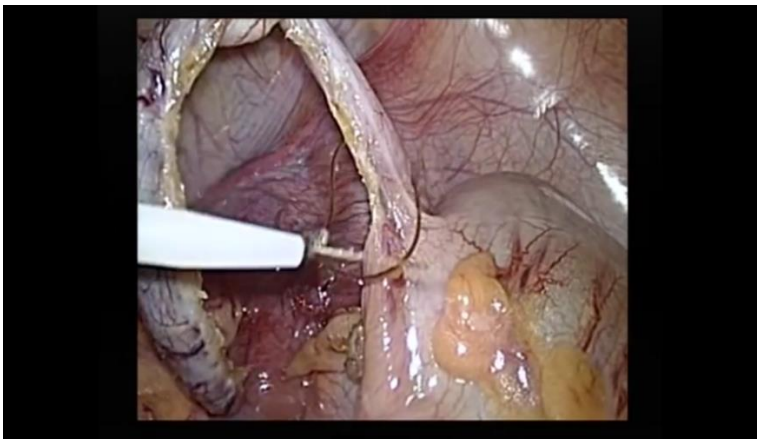

Photo 4: Endloop technique : ligation of the base of the appendix **(18).**

Photo 5: Stapler technique: the transection of the appendix **(18).**

4 - Specimen Retrieval:

The appendix is dividid between the proximal and distal knots or clips using endoscissors with leaving a secure short stump. As care is needed to avoid contamination of the abdomen and port site wounds, the appendix is removed from the abdomen. Alternatively, if the appendix is not too large, it can be pulled into one of the larger ports and withdrawn with the whole port **(19).**

5 - Irrigation and Drainage:

The purpose of irrigation is to remove all debris, purulent fluid collections, and blood from the surgical area. There is no advantage of irrigation in early appendicitis, without any pus, and there may be a risk of spreading contaminated fluid throughout the abdomen **(20).**

In the majority of cases, a drain is not necessary. However, if residual contaminated fluid is to be left in the peritoneal cavity, a mature abscess was drained, or if the appendiceal/cecal stump is of suboptimal quality, placement of a small closed-suction drain may be prudent. It should be brought in through a separate 4 to 5mm incision in the right lower quadrant, not through one of the trocar sites, and laid along the cecum into the pelvis to drain those dependent areas. After a few days, the drain can be removed once the fluid quality is serosanguinous **(18).**

After completing the operation and haemostasis is assured, the abdomen is deflated, ports are removed under direct vision., subcutaneous tissue is approximated with absorbable sutures and skin is closed **(11)**.

Complications of laparoscopic appendectomy:

Laparoscopic surgery is major surgical advance that has enabled surgeons to decrease hospital and total recovery times for patients. Many laparoscopic series report lower infection and complication rate, as compared with the equivalent open procedures but still there are some complications **(21).**

Although laparoscopic appendectomy is considered both feasible and safe, certain serious complication may ensue. It must be emphasized that more than one half of the complications related to laparoscopy are related to the entry technique. **(22).**

Complications of laparoscopic appendectomy are similar to complications of laparoscopy in general with specific complications to laparoscopic appendectomy as intra-abdominal collection **(22).**

A- Trocar site Hernia: A major advantage of laparoscopic surgery is that the incidence of ventral hernia 4.7% is lower than that with a laparotomy incision 18.7% . Hernias that develop at the trocar site usually result from the lack of closure or improper closure of trocar wounds and in most instances, are a preventable complication. It is generally agreed that 5-mm trocar wounds do not need closure, while larger trocar wounds require closure because hernia formation occurs more frequently and the risk of bowel incarceration (Richter hernia) is high **(23).**

B- Intestinal injuries: About one third to one half of bowel injuries are related to entry and the rest are caused during the operative procedure. Thermal injury occurred most frequently. Only in a few instances, bowel injury results from the use of grasping forceps or scissors **(24).**

A compounding factor in the delayed diagnosis is that most patients with a laparoscopic intestinal injury do not present with the typical clinical features of perforated viscus. Pain at the trocar site near the injuried segment of bowel, abdominal distension, and diarrhea with normal bowel sounds were commonly observed. Peritoneal signs are infrequent. It has been postulated that because laparoscopic surgery is associated with less of an inflammatory and immune response than laparotomy, there will be fewer clinical symptoms and signs of injured viscera **(25).**

C- Urinary bladder injuries: The most common type of urinary injury, observed in slightly more than one half of patients is bladder perforation. A mechanical device of any type was responsible for the accident, including unipolar and bipolar cautery, loop suturing, trocars, laser devices, staples, and sharp dissection **(24).**

D- Major vascular injuries: Major vascular injuries that occur after entry are much less frequent than those that occur during the blind entry phase of the operation lymphadenectomies or other procedures performed near large vessels carry a greater risk. Major vascular injuries usually require laparotomy, but laparoscopic repair is possible in certain cases depending on the size and type of the vessel, localization of the injury and visualization of the injury. Laparoscopic repair of a vena cava injury is feasible **(26).**

E- Wound infection: a significant number of trocar site infections was reported in certain cases. With the use of this instrument to remove the infected specimen from the intra-abdominal cavity, the incidence of wound

infection is greatly reduced. As a general rule the incidence of wound infection in laparoscopic appendectomy is very low **(27).**

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