

## Open Appendectomy versus Laparoscopic Appendectomy in Adults

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### ABSTRACT

As of late, the occurrence of appendicitis has notably diminished. However, appendicitis stays one of the more common surgical emergencies, and appendectomy stays the treatment of non-complicated appendicitis. Acute appendicitis (AA), a typical intra-abdominal surgical pathology, obliges a comprehensive understanding of its presentation, assessment, diagnosis, and overall operative administration. There are two types of surgery to remove the appendix. The standard technique is an open appendectomy and laparoscopic appendectomy. As with other laparoscopic surgical procedures, the literature defines decreased pain, earlier resumption of diet, and decreased length of hospital stay for laparoscopic appendectomy versus the equivalent open procedure. Nevertheless, this should be accurately considered in the light of the present condition of the open procedure, which already causes minimal risk and is related with an extremely short hospital stay and a low complication rate. Further disadvantages of laparoscopy incorporate increased cost and longer operating times. We conducted this review using a comprehensive search of MEDLINE, PubMed, EMBASE, Cochrane Database of Systematic Reviews, and Cochrane Central Register of Controlled Trials from January 1, 1988, through July 28, 2017.

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

### INTRODUCTION

Acute appendicitis (AA), a typical intra-abdominal surgical pathology, obliges a comprehensive understanding of its presentation, assessment, diagnosis, and overall operative administration. There are two types of surgery to remove the appendix. The standard technique is an open appendectomy and laparoscopic appendectomy. Concisely, the pathophysiology and progressive timeline of AA are ascribed to luminal obstruction, causing distention, bacterial invasion, ineffective venous and lymphatic drainage, and lastly, perforation with related leakage of contents into the peritoneal cavity.

The presentation, assessment, and diagnosis of AA are extremely inconsistent; many factors attribute to these inconsistencies. The classic history consists of anorexia and periumbilical pain, after that nausea, vomiting, and right-lower-quadrant pain, in addition to leucocytosis<sup>[1]</sup>. Physical examination and history ought to provide sufficient clinical information to diagnose AA, with the utilization of imaging modalities as adjuncts in the valuation.

Treatment comprises of giving aggressive intravenous liquid resuscitation and antibiotics, putting the patient on nil per os (NPO) status, giving pain control, and getting a general surgical counsel for authoritative operative administration.

Expanding evidence proposes that in numerous patients with uncomplicated acute AA, antibiotic treatment might be as effective as surgical treatment<sup>[2, 3]</sup>.

Concisely, the pathophysiology and progressive timeline of AA are ascribed to the following:

#### Bacterial invasion

Luminal obstruction causing distention  
Ineffective venous and lymphatic drainage  
Perforation with associated leakage of contents into the peritoneal cavity. The operative method to deal with AA comprises of appendectomy (surgical expulsion of the vermiform appendix); be that as it may, the decision between an open and a laparoscopic operation keeps on being argued in the medical literature<sup>[4, 5]</sup>. The right-lower-quadrant entry point of open appendectomy has persevered basically unaltered since it was spearheaded by McBurney in the nineteenth century<sup>[6]</sup>. The utilization of laparoscopy in the surgical administration of AA was first portrayed in 1983, and there is progressing pattern toward expanded utilization of this approach<sup>[7]</sup>. Likewise with other laparoscopic surgical techniques, the literature depicts diminished pain, before resumption of eating routine, and diminished length of hospital stay remain for laparoscopic appendectomy versus

the identical open system<sup>[8, 9]</sup>. However, this must be impartially considered in the light of the present condition of the open method, which as of now induces insignificant hazard and is related with an amazingly short healing center stay and a low intricacy rate. Extra disadvantages of laparoscopy incorporate expanded cost and longer operating times.

**INDICATIONS**

From the time when described by McBurney<sup>[6]</sup>, open appendectomy has been a firm and widely

performed operation specified for patients with AA. Whether and when to implement a laparoscopic appendectomy as opposed to an open procedure stays a relevant question. Open appendectomy brings marginal risk and has a tremendously short length of hospital stay<sup>[10, 11]</sup>.

The World Society of Emergency Surgery (WSES) published in 2016 guidelines for acute appendicitis that comprised the following recommendations regarding laparoscopic appendectomy (Table 1)<sup>[12]</sup>:

**Table 1:** Recommendations regarding laparoscopic appendectomy

<b>Laparoscopy is feasible and safe in adolescent male patients, still no clear advantages can be validated in this population (level 2 evidence; grade B recommendation)</b>
<b>No main assistances have also been detected for laparoscopic appendectomy in youngsters, but it decreases hospital stay and general morbidity (level 1 evidence; grade A recommendation)</b>
<b>Laparoscopy should not be considered as a first choice over open appendectomy in pregnant patients (level 1 evidence; grade B recommendation)</b>
<b>Laparoscopy offers clear benefits and ought to be preferred in obese patients, older patients and patients with comorbidities (level 2 evidence; grade B recommendation)</b>
<b>In knowledgeable hands, laparoscopy is more valuable and cost-effective than open surgery for complicated appendicitis (evidence level 3; grade B recommendation)</b>
<b>Laparoscopic appendectomy ought to represent the first selection where laparoscopic equipment and skills are available, in that it offers clear benefits in terms of less pain, lower frequency of surgical-site infection (SSI), decreased length of stay, earlier return to work, and reduced overall costs (level 1 evidence; grade A recommendation)</b>

**CONTRAINDICATIONS**

There are no known contraindications for appendectomy in patients with suspected appendicitis, aside from an account of a patient with a long history of side effects and indications of a vast phlegmon. In the event that a periappendiceal ulcer or phlegmon exists secondary to appendiceal perforation or rupture, a few clinicians can pick a moderate method with wide range antibiotics and percutaneous drainage followed by appendectomy later (interval appendectomy). Certain contraindications occur for laparoscopic appendectomy, comprising extensive adhesions, radiation or immunosuppressive treatment, severe portal hypertension, and coagulopathies. Laparoscopic appendectomy is contraindicated in the first trimester of pregnancy. On the odd occasion, an appendiceal mucocele (i.e., a collection of mucus within the appendiceal lumen) might happen. Infrequently, patients might present with a low-grade carcinoma of the appendix or the cecum. In these cases, the surgeon should prevent perforation throughout dissection, for the reason that it might cause seeding of the peritoneum with viable cells, leading to pseudomyxoma peritonei.

In a study comparing laparoscopic and open appendectomy for complicated appendicitis in adult patients, Taguchi et al<sup>[6]</sup> found that the minimally invasive method was safe and practical in this setting; however, it did not significantly decrease complications. Li et al<sup>[14]</sup> found that laparoscopic appendectomy, as compared with open appendectomy, was practical and effective in paediatric patients giving an appendiceal abscess and that it had useful clinical effects (e.g., in terms of postoperative recovery of gastrointestinal function) and a lesser rate of postoperative complications.

**Equipment & Preparation**

For open appendectomy, all equipment should be present in the surgical arena and checked for appropriate working capacity before the procedure starts. A standard laparotomy set with customary clamps and retractors (Regnel, Roux, and Richardson) are used, accompanied by proper sutures and ties. All methods of laparoscopic appendectomy require the standard laparoscopic equipment and some helpful equipment (Table 2).

**Table 2: Required equipment for laparoscopic appendectomy**

Standard laparoscopic	Helpful equipment
Hook electrocautery	Endoscopic ligatures (Endoloop; Ethicon, Somerville, NJ)
Blunt graspers	Laparoscopic clip applier
Trocars	Endoscopic retrieval bag
Electrosurgical device (eg, electrocautery wand, Harmonic Scalpel [Ethicon, Somerville, NJ], Sonosurg [Olympus, Hamburg, Germany])	Endoscopic gastrointestinal anastomosis (Endo-GIA) 45-mm stapler, white cartridge
Laparoscope, 30°, 10 mm	Laparoscope, 30°, 5 mm
	Suction irrigator

**Table 3: Patient Preparation for open Appendectomy vs. Laparoscopic Appendectomy**

	Open Appendectomy	Laparoscopic Appendectomy
<b>Anesthesia</b>	Open appendectomy can be performed with various anesthetic techniques, including general, regional, and local. Routinely, general anesthesia is the first choice, especially in the pediatric population. Studies show that local anesthesia, with anesthetic infiltrated into the subcutaneous and deep tissue layers (including the peritoneum), and are a safe and cost-effective practice [15, 16]. The operative procedure must always start with the surgical time-out. The importance of reviewing the patient identification, surgical team, procedure to be performed, and completion of all preoperative requirements prior to proceeding cannot be overstated. At this point, the patient is ready to be prepared and draped in a sterile fashion.	Because of the inherent surgical technique and requirements, general anesthesia is the preferred method in performing a laparoscopic appendectomy. Administer preoperative antibiotics to cover gram-negative and anaerobic bacteria.
<b>Positioning</b>	Place the patient supine, and tuck his or her right arm for the duration of the procedure. The surgeon should stand on the patient's right, and the assistant surgeon should stand on the patient's left.	Place the patient supine and tuck the left arm for initial peritoneal access. A single monitor is best positioned to the right of the patient, along the line of the right anterior superior iliac spine (ASIS). Upon abdominal insufflation and laparoscope insertion, steep Trendelenburg positioning allows proper placement of the last two trocars. After all of the trocars have been placed, placing the patient with the left side down aids gravity in relocating the small bowel away from the appendiceal/cecal field of vision.

## **Open Appendectomy vs. Laparoscopic Appendectomy Technique**

### • **Open Appendectomy**

Before incision, the surgeon ought to wisely perform a physical examination of the abdomen to detect any mass and to define the site of the incision. Open appendectomy needs a transverse incision in the right lower quadrant over the McBurney point (i.e., 2/3 of the way between the umbilicus and the anterior superior iliac spine [ASIS]). Vertical incisions (e.g., the Battle pararectal) are hardly performed due to the trend for dehiscence and herniation. The abdominal wall fascia (i.e., Scarpa fascia) and the essential muscular layers are abruptly dissevered or split in the direction of their fibers to take access to the peritoneum. If essential (e.g., on account of concomitant pelvic pathologies), the incision can be stretched medially, with the surgeon dissevering some fibers of the oblique muscle and retracting the lateral part of the rectus abdominis. The peritoneum is opened transversely and entered. The character of any peritoneal fluid ought to be prominent to support confirm the diagnosis, and the fluid ought to be suctioned from the field. If the fluid is purulent, it ought to be collected and refined. Retractors are tenderly set into the peritoneum. The cecum is recognized and medially withdrawn. It is then exteriorized by utilizing a soggy cloth wipe or Babcock clasp, and the taeniae coli are taken after to their joining. The meeting of the taeniae coli is identified at the base of the index, underneath the Bauhin valve (ie, the ileocecal valve), and the reference section is then seen. On the off chance that the supplement is concealed, it can be distinguished medially by withdrawing the cecum and horizontally by broadening the peritoneal entry point.

If the appendix appears normal, other reasons of the patient's condition ought to be sought, for example, ovarian pathology, Meckel diverticulum, and sigmoid disease. After exteriorization of the informative supplement, the mesoappendix is held between clips, separated, and ligated. The reference section is clipped proximally around 5 mm over the cecum to maintain a strategic distance from sullyng of the peritoneal depression, and the cut is made over the clasp by a surgical tool. Fecaliths inside the lumen of the informative supplement might be identified. The supplement must be ligated to keep draining and spillage from the lumen. The residual mucosa of the appendix is softly

cauterized to prevent a future mucocele. The appendix might be inverted into the cecum with the utilization of a purse-string suture or Z-stitch. Appendiceal stump inversion is not compulsory.

The cecum is positioned back into the abdomen, and the abdomen is irrigated. When indication of free perforation occurs, peritoneal lavage with some liters of warm saline is suggested. After the lavage, the irrigation fluid should be totally aspirated to diminish the likelihood of spreading infection to other areas of the peritoneal cavity. The utilization of a drain is not usually necessary in patients with acute appendicitis, but noticeable abscess with gross infection calls for drainage. Wound closure initiates with closing of the peritoneum with a continuous suture. At that point, the fibers of the muscular and fascial layers are re-approximated and closed with a continuous or interrupted absorbable suture. Lastly, the skin is closed with subcutaneous sutures or staples. In cases of perforated appendicitis, some surgeons leave the wound open, letting for secondary closure or a late primary closure until postoperative day 4 or 5. Other surgeons favour immediate closure in these cases <sup>[17, 18]</sup>. According to a 2015 Cochrane review, it is unclear whether routine abdominal drainage is effective in preventing intraperitoneal abscesses after open appendectomy for complicated appendicitis <sup>[19]</sup>.

### • **Laparoscopic Appendectomy**

The surgeon normally positions on the left of the patient, and the assistant stands on the right. The anaesthesiologist and the anaesthesia equipment are placed at the patient's head, and the video monitor and the instrument table are placed at the feet. Albeit a few varieties are conceivable, a standard approach is to put three cannulae amid the system. Two of these have a settled position (ie, umbilical, suprapubic); the position of the third, which is set in the privilege periumbilical district, may fluctuate enormously, contingent upon the patient's life systems. It ought to be noticed that these are recommended port locales and that it is adequate to change port situation as indicated by the attributes of the patient, the sort of ports utilized, and the experience of the specialist. As indicated by the inclinations of the specialist, a short umbilical cut is made to permit position of a Hasson cannula or Veress needle that is secured with two absorbable sutures. Pneumoperitoneum (10-14 mm Hg) is built up and kept up by insufflating carbon dioxide. Through the entrance, a laparoscope is

embedded to see the whole abdomen cavity. A 12-mm trocar is embedded over the pubic symphysis to permit the presentation of instruments (eg, incisors, forceps, or stapler). Another 5-mm trocar is put in the privilege periumbilical area, as a rule between the privilege costal edge and the umbilicus, to permit the addition of an atraumatic grasper to uncover the supplement.

The appendix is grabbed and withdrawn upward to expose the mesoappendix. The mesoappendix is separated with a dissector inserted through the suprapubic trocar. At that point, a linear endostapler, endoclip, or suture ligature is passed through the suprapubic cannula to ligate the mesoappendix. The mesoappendix is transected with scissors or electrocautery; to prevent perforation of the appendix and iatrogenic peritonitis, the tip of the appendix ought to not be grabbed<sup>[20]</sup>.

The appendix can at the moment be transected with a linear endostapler, or consecutively, the base of the appendix might be suture-ligated in a comparable manner to that in an open procedure. The appendix is currently free and might be removed through the umbilical or the suprapubic cannula in a laparoscopic pouch to avoid wound infection. Peritoneal irrigation is performed with antibiotic or saline solution. The irrigant should be totally aspirated. Peritoneal irrigation seems to be a danger factor for intra-abdominal abscess after laparoscopic appendectomy<sup>[21]</sup>.

The cannulas are then detached, and the pneumoperitoneum is decreased. The fascial layers at the cannula sites are closed with absorbable suture. The cutaneous incisions are closed with interrupted subcuticular sutures or sterile adhesive strips.

Single-port appendectomy has been examined as a substitute to conventional laparoscopic appendectomy<sup>[22, 23]</sup>. In matching outcomes from 35 patients who underwent the procedure with those from 37 patients who were treated with the three-port laparoscopic technique, Lee *et al.*<sup>[24]</sup> found no statistically significant changes among the two groups with favour to surgery time, length of hospital stay, or number of times the patients received analgesic injection. In this study, the complication rate was 8.6% for the single-port patients, versus 2.7% for those who underwent three-port surgery; complications incorporated one case in the three-port group and two cases of wound infection in the single-port group, along with one case of intra-abdominal fluid accumulation in a single-

port patient with perforated appendicitis.<sup>[24]</sup> The authors determined that the single-port procedure is a practical technique that, in addition to leaving a nearly inconspicuous scar, has results similar with those of three-port appendectomy.

## CONCLUSION

The benefits of the laparoscopic technique over open appendectomy including shorter hospital stay, decreased need for postoperative analgesia, early food tolerance, earlier return to work, lower rate of wound infection, against only marginally higher hospital costs. Provided that surgical experience and equipment are available, laparoscopy could be considered safe and equally efficient compared to open technique and should be undertaken as the initial procedure of choice for most case of suspected appendicitis. Nevertheless, since there is no agreement to the best technique, both procedures (open and laparoscopic appendectomy) are still being practiced actively deferring the choice to the preference of surgeon and patients.

In the future, laparoscopic appendectomy could represent the standard treatment for patients with appendicitis and undiagnosed abdominal pain.

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