



# Laparoscopic Appendectomy in Complicated Appendicitis: A Narrative Review

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## **Authors' contributions**

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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## **ABSTRACT**

The treatment of complicated appendicitis has moved from conservative treatment to immediate appendectomy and laparoscopic appendectomy has become the treatment of choice for this condition. Laparoscopic appendectomy is safe and associated with reduced morbidity, but it was initially associated with increased intra-abdominal abscess rates. With time there seems to be a reduction in this complication rate and hence we have conducted this review article to look at the use of laparoscopic appendectomy in the management of complicated appendicitis, with regards to complications and morbidity.

**Keywords:** *Laparoscopic appendectomy; open appendectomy; appendicular mass; intra-abdominal abscess; complicated appendicitis.*

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## 1. INTRODUCTION

Complicated appendicitis is defined as defined as appendicitis complicated with intra-abdominal abscess, contained or free perforation. It accounts for about 20%-30% of cases of acute appendicitis [1].

Complicated appendicitis was often treated by open appendectomy with laparoscopic appendectomy being not accepted due to complications like intra-abdominal abscess formation which was encountered most during the early laparoscopic era. [2].

“The initial use of laparoscopic appendectomy for complicated appendicitis was associated with increased wound infection rates and increased operative time. The conversion rate to open appendectomy was also high” [3].

“Laparoscopic appendectomy was compared with open appendectomy in the management of complicated appendicitis, and it was associated with shorter operative time, reduced post operative complications and analgesia usage. It was a safe and reliable procedure in the management of complicated appendicitis. Laparoscopic appendectomy was associated with a comparable and clear benefit over open appendectomy in terms of morbidity and length of hospital stay” [4-9].

“The Society of American Gastrointestinal Endoscopic Surgeons has recommended that laparoscopic appendectomy be performed in patients with complicated appendicitis as the preferred approach” [10].

“The World Society of Emergency Surgeons has also recommended laparoscopic appendectomy as the treatment of choice in complicated appendicitis if the expertise is available” [11].

As there is no current consensus in the management of complicated appendicitis with either open appendectomy or laparoscopic appendectomy, we have conducted this review article looking for the role of laparoscopic appendectomy in the management of complicated appendicitis. We conducted a literature review using PUBMED, the Cochrane database of systemic reviews, Google scholar and semantic scholar looking for randomized control trials, non-randomized trials, observational and cohort studies, clinical reviews, systemic reviews, and meta-analysis

from 1995 to 2023. The following keywords were used, “laparoscopic appendectomy”, “open appendectomy”, “intra-abdominal abscess”, “appendicular mass” and “complicated appendicitis”. All articles were in English, and all articles were assessed by manual cross referencing of the literature. Commentaries, case reports and editorials were excluded from this review. Adult and pediatric patients were included in this study and pregnant patients with acute appendicitis were excluded.

## 2. DISCUSSION

### 2.1 Laparoscopic Appendectomy for Complicated Appendicitis in Adults

“Several randomized control trials and clinical trials were performed comparing the outcomes of laparoscopic appendectomy versus open appendectomy and the results of these trials showed that laparoscopic appendectomy was safe and feasible in the management of complicated appendicitis. It was associated with reduced operative time, comparable intra-abdominal abscess formation and reduced hospital stay” [12-15].

A systemic review and meta-analysis of laparoscopic appendectomy versus open appendectomy in adults by Althanasiou et al showed that laparoscopic appendectomy was associated with reduced operative time, reduced wound infection rates and no significant difference in intra-abdominal abscess rates. This was also confirmed by a systemic review and meta-analysis by Markides et al. [16,17].

“A meta-analysis by Quah et al compared the outcome of both laparoscopic appendectomy and open appendectomy in the treatment of complicated appendicitis and the results showed that laparoscopic appendectomy has reduced morbidity, mortality and reduced hospital stay when compared to open appendectomy. The incidence of intra-abdominal abscess was the same for both procedures. This study concluded that laparoscopic appendectomy should be offered for complicated appendicitis.” [18].

“Initial studies of laparoscopic appendectomy for complicated showed an increased wound infection rate and intra-abdominal abscess formation and hence a high conversion rate” [19,20].

“Intra-abdominal abscess formation is a common post operative complication of laparoscopic

appendectomy for complicated appendicitis. Its incidence has been decreasing over the last decade with most studies showing that the rate of intra-abdominal abscess is the same for both laparoscopic appendectomy and open appendectomy. The rate of intra-abdominal abscess formation was based on the patient's disease. Laparoscopic appendectomy was also associated with a low rate of wound infection rate" [21-24].

"The reduction of the intra-abdominal abscess rate after laparoscopic appendectomy for complicated appendicitis can be due to mastery of the surgical technique and the addition of specific surgical techniques that can be performed by the operating surgeon" [25].

The method of closure of the stump of the appendix with either Endo stapler or Endo loop does not influence the infective complication rates, with Endo loops being preferred due to their reduced cost. The method of closure of the appendicular stump does not influence morbidity and intra-abdominal abscess formation [26-28].

"The use of abdominal drains after laparoscopic appendectomy for complicated appendicitis is not encouraged as it does not prevent post operative complications and it extends the duration of hospital hospital stay" [29,30].

## 2.2 Laparoscopic Appendectomy for Complicated Appendicitis in Children

Laparoscopic appendectomy can be performed safely. It was found to be superior to open appendectomy and is associated with reduced analgesia usage, decreased hospital stay and reduced wound infection rates. The rates of intra-

abdominal abscess formation were initially high, but they have become comparable to open appendectomy [31-37].

Markar et al performed "a literature search comparing laparoscopic appendectomy versus open appendectomy in complicated appendicitis and they concluded that laparoscopic appendectomy was associated with reduced morbidity and hospital stay and an equivalent intra -abdominal abscess formation" [38].

A systemic review and meta-analysis by Neogi et al on "laparoscopic versus open appendectomy for complicated appendicitis in children demonstrated that laparoscopic appendectomy was associated with lower rates of surgical site infection rates and comparable intra-abdominal abscess formation rates. The length of hospital stay and analgesia usage was also reduced" [39].

"A meta-analysis by Low et al comparing laparoscopic appendectomy versus open appendectomy in children with complicated appendicitis also concluded that the intra-abdominal abscess formation rate was comparable in both procedures and laparoscopic appendectomy was safe, feasible and associated with reduced morbidity and wound infection rates" [40].

## 2.3 Irrigation or Suction and use of Drains in Complicated Appendicitis After Laparoscopic Appendectomy

"A meta-analysis by Siotos et al compared the use of irrigation versus suction in laparoscopic appendectomy for complicated appendicitis in

**Table 1. The incidence of intra-abdominal abscess formation for patients with complicated appendicitis who underwent laparoscopic appendectomy and open appendectomy**

Study	Study type	year	Intraabdominal abscess (laparoscopic appendectomy) %	Intraabdominal abscess (open appendectomy) %	Patient characteristics
Katkhoda et al.	Retrospective study	2001	1%	2.4%	adults
Asarias et al.	Retrospective study	2010	1.9%	2.2%	adults
Nataraja et al.	Retrospective study	2011	9.1%	1.6%	pediatric
Zamary et al.	Retrospective study	2023	12.3%	12.3%	adults

both adults and children, and they concluded that irrigation significantly increases the operative time, and it does not seem to reduce the intra-abdominal abscess rate when compared to suction alone. The operating surgeon will have to carefully consider the use of irrigation” [41].

“A meta-analysis of randomized control trials by Oweira et al comparing irrigation with suction during laparoscopic appendectomy for complicated appendicitis. This study also concluded that irrigation increases the operative time and increases the risk of intra-operative abscess and reoperation rate” [42].

“A meta-analysis by Abu et al evaluated drain insertion after appendectomy for complicated appendicitis, and they concluded that drain insertion does not increase the risk of intra-abdominal abscess formation, but it significantly increases the risk of surgical site infection, length of hospital stays and bowel obstruction” [43].

A Cochrane review by Li et al found that the usage of surgical drains during appendectomy does not prevent intra-abdominal abscess formation and does not improve the outcome [44].

### 3. CONCLUSION

As laparoscopic services are available in most countries, this procedure will become more popular in the treatment of complicated appendicitis. Laparoscopic appendectomy should be the treatment of choice if the expertise is available. The risk of intra-abdominal abscess formation and post operative wound infection is low and should be offered to all patients.

### CONSENT

It is not applicable.

### ETHICAL APPROVAL

It is not applicable.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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