

Complicated Appendicitis: An Update on Management: Mini Review

Kumar H.R (MBBS, MS)^{1*}

¹Associate Professor of Surgery, Taylors University School of Medicine and Health Science, 47500 Selangor, Malaysia

*Corresponding Author: Dr Kumar Hari Rajah

Associate Professor of Surgery, Taylors University School of Medicine and Health Science, 47500 Selangor, Malaysia

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Abstract: Complicated appendicitis is a complication of acute appendicitis, which is defined as perforation of the appendix, with abscess or mass formation. The management of complicated appendicitis was initially with conservative treatment with intra-venous antibiotics, with percutaneous drainage of abscess reserved for patients with abscess formation. The recent trend has seen a movement towards immediate appendectomy with laparoscopic appendectomy being the preferred surgical option. As there is no definitive consensus on the management of complicated appendicitis, we have conducted this mini review to look at the treatment option for complicated appendicitis in adults and children.

Keywords: “Complicated Appendicitis”, “Appendicular Mass”, “Conservative Treatment”, “Appendicular Abscess”, “Interval Appendectomy” And “Laparoscopic Appendectomy”.

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INTRODUCTION

Complicated appendicitis is the term that is used to describe a perforation of the appendix, with or without an appendicular mass or an appendicular abscess. It is seen in 2% to 6% of all cases of acute appendicitis. The diagnosis of complicated appendicitis is often made by clinical examination and imaging. The management of complicated appendicitis was initially popularized by Ochsner and Shreen, and this involved conservative treatment with intravenous antibiotics followed by an interval appendectomy in 8 weeks’ time (Garba & Ahmed, 2008). The management of complicated appendicitis can be divided into conservative management with intra-venous antibiotics and analgesics followed by an interval appendectomy, conservative treatment alone and immediate appendectomy. (Ahmed *et al.*, 2005; Kumar H, R. *et al.*, 2023; Tannoury & Abboud, 2013)

The World Society of Emergency Surgeons (WSES) have recommended immediate laparoscopic appendectomy for the management of complicated appendicitis if the service is available, but they have also recommended conservative treatment as an alternative. The European Association of Emergency Surgeons (EAES) however has recommended conservative treatment for complicated appendicitis with the option of an interval appendectomy being performed if it is indicated. Both societies have defined complicated

appendicitis as perforation of the appendix with or without mass or abscess formation. (Di Saverio *et al.*, 2020; Gorter *et al.*, 2016)

As there is no current consensus in the management of complicated appendicitis, we have conducted this review article looking into 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 1990 to 2023. The following keywords were used, “complicated appendicitis”, “appendicular mass”, “conservative treatment”, “appendicular abscess”, “Interval appendectomy” “and” “laparoscopic appendectomy”. 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 with complicated appendicitis were included in this study and pregnant patients with acute appendicitis were excluded.

DISCUSSION

Conservative Treatment of Complicated Appendicitis

Conservative treatment of complicated appendicitis involves the use of intravenous antibiotics and analgesics. It involves the monitoring of the patients’

vital signs and performing an interval appendectomy at eight weeks' time to prevent recurrence. This form of treatment was advocated as performing surgery immediately was associated with a higher risk of complications like bowel injury and abscess formation (Coccolini *et al.*, 2018; Elsaady, 2019; Koirala *et al.*, n.d.; Oliak *et al.*, 2000; Tarar *et al.*, 2023).

Failure of conservative treatment for patients with complicated appendicitis is associated with a higher risk of bowel resection and post operative infective complications like abscess and fistula formations, hence patients should be informed of the pros and cons of this form of therapy (Nimmagadda *et al.*, 2019).

Several systemic reviews and meta-analyses have compared conservative treatment with immediate appendectomy, and these studies have concluded that conservative treatment was associated with reduced morbidity and mortality although the length of hospital stay was increased when compared to open appendectomy. Interval appendectomy was initially recommended but with low recurrence rates, this procedure is not routinely recommended, with surveillance with colonoscopy and computerized tomography being recommended for older patients (Andersson & Petzold, 2007; Med, 2014; Simillis *et al.*, 2010).

Interval Appendectomy after Treatment with Conservative Treatment

Interval appendectomy was often a routine procedure that was performed in eight weeks' time after conservative treatment. It was performed to prevent recurrence and obtain a histological diagnosis. Recent studies have shown that due to the low recurrence rates, interval appendectomy need not be performed as a routine, as it incurs additional cost and patients who are at high risk can be investigated with imaging modalities like computerized tomography (Darwazeh *et al.*, n.d.; Willemsen *et al.*, 2002).

As the recurrence rate after successful treatment with conservative therapy was around 15% this has questioned the need of performing an interval appendectomy. The need for performing an interval appendectomy is also influenced by the practicing surgeon with older surgeons favoring this procedure when compared to surgical registrars (Sajid *et al.*, 2020; Tekin *et al.*, 2008)

Interval appendectomy can be performed as an open or laparoscopic procedure with laparoscopic appendectomy being safer, effective, associated with reduced complications like wound infection and reduced hospital stay (Rashid *et al.*, 2013). Interval appendectomy should be considered for patients with complicated appendicitis who have experienced recurrent attack after completion of conservative

treatment and those that have fecalith on computerized tomography (Perez & Allen, 2018).

Percutaneous Drainage of an Appendicular Abscess

Patients who present with complicated appendicitis with an appendicular abscess will benefit from percutaneous drainage of the abscess with conservative treatment. This is associated with a lower risk of recurrent attacks and hence a lower need for performing an interval appendectomy. Percutaneous drainage of abscess is associated with a higher success rate especially in the pediatric cases of complicated appendicitis (Shinde *et al.*, 2020; Zavras & Vaos, 2020).

Percutaneous drainage can either be performed by an ultrasound or computerized tomography and the success of therapy will depend on the size of the abscess with drainage of abscess of 5cm and above are associated with a better success rate (Ke Lason *et al.*, n.d.; Luo *et al.*, 2016).

Percutaneous drainage of an appendicular abscess is a safe and effective procedure when it is combined with intra-venous antibiotics, and it has a clinical success rate of up to 90%. The main complications of percutaneous drainage include superficial or deep-seated infection, bleeding or rupture of surrounding organs. (Forsyth *et al.*, 2017; Marin *et al.*, 2010).

Immediate Appendectomy for Complicated Appendicitis

Open appendectomy is considered the definitive treatment for complicated appendicitis and the introduction of laparoscopic appendectomy has seen a shift towards immediate surgery. The advantage of immediate surgery includes reduced hospital stay and the avoidance of a second admission to perform an interval appendectomy. The introduction of laparoscopic appendectomy has made it safe, effective with reduced morbidity and mortality (Mekakas *et al.*, 2022)

Several studies have compared conservative treatment versus immediate appendectomy in the treatment of complicated appendicitis and these studies concluded that immediate surgery was associated with reduced hospital stay and infective complications like intra-abdominal abscess formation. Hence, they have recommended immediate laparoscopic appendectomy in the management of complicated appendicitis (Deelder *et al.*, 2014; Gavriilidis *et al.*, 2019)

Laparoscopic appendectomy was compared with open appendectomy in the management of complicated appendicitis, and although it was associated with a longer operative time but the wound infection rates like intra-abdominal abscess formation were reduced. The length of hospital stays, post operative analgesia usage and nausea were reduced. The conversion rate to open appendectomy was about 25%. These studies concluded that laparoscopic

appendectomy should be performed in the management of complicated appendicitis(Athanasidou *et al.*, 2017; Baz *et al.*, 2023; Gomes, 2014; Khiria *et al.*, 2011; Markides *et al.*, 2010; Talha *et al.*, 2020)

A Cochrane review by Zhou *et al.*, compared early versus delayed appendectomy for complicated

appendicitis and they concluded that early appendectomy was associated with reduced abscess rate, reduced hospital stays and reduced morbidity. However, the evidence that was presented was uncertain and further studies need to be done to evaluate its effectiveness (Zhou *et al.*, 2024)

Table I: Showing the wound infection rates and intra-abdominal abscess rate for laparoscopic and open appendectomy for complicated appendicitis

Study	Study type	N=numbers	Wound infection rate (%) Laparoscopic appendectomy	Wound infection rate (%) Open appendectomy	Intra-abdominal abscess rate (%) Laparoscopic appendectomy	Intra -abdominal abscess rate (%) Open appendectomy
So <i>et al.</i> , 2002	Retrospective study	231 Laparoscopic appendectomy-85 Open appendectomy-146	12%	36%	0%	2%
Yau <i>et al.</i> , 2007	Retrospective study	247 Laparoscopic appendectomy-175 Open appendectomy-69	0.6%	10%	5.7%	4.3%
Khiria <i>et al.</i> , 2011	Retrospective study	119 Laparoscopic appendectomy-99 Open appendectomy-20	3%	3%	5%	4%

Management of Complicated Appendicitis in Children

For the pediatric patients who present with complicated appendicitis, conservative treatment with intra-venous antibiotics usually started, with percutaneous drainage of abscess being performed for those with an intra-abdominal abscess. Routine evaluation with an ultrasound or computerized tomography assesses the efficacy of therapy and looks for abscess progression. The presence of fecalith is associated with a higher recurrence rate and the need for an interval appendectomy (López *et al.*, 2017; H. L. Zhang *et al.*, 2013; Y. Zhang *et al.*, 2020)

Immediate appendectomy was compared with conservative treatment in the management of complicated appendicitis in children in a meta-analysis by Fugazzola *et al.*, and this study concluded that conservative treatment was associated with better success rate and readmission rate while the open appendectomy group was associated with reduced hospital stay. This study concluded that complicated appendicitis with abscess formation was better managed with conservative treatment and percutaneous drainage while complicated appendicitis with mass formation was better managed with immediate appendectomy in children (Fugazzola *et al.*, 2019)

Laparoscopic appendectomy was initially not used in the management of complicated appendicitis in children as it was initially associated with a high intra-abdominal abscess rate but a recent meta-analysis by

Low *et al.*, comparing laparoscopic appendectomy versus open appendectomy for complicated appendicitis in children found that the intra-abdominal abscess rate was comparable with open appendectomy (Low *et al.*, 2019)

CONCLUSION

The management of complicated appendicitis has seen a shift in trend from conservative treatment towards immediate appendectomy. The introduction of laparoscopic appendectomy has moved the bar closer towards immediate appendectomy. While laparoscopic appendectomy does have its advantages like reduced morbidity, mortality length of hospital stays and early ambulation, it requires special equipment and expertise. Conservative treatment does have a role to play especially those who present with an intra-abdominal abscess, where percutaneous drainage of abscess can be performed. Interval appendectomy is only performed for patients who present with recurrence and need not be done as a routine.

The treatment of complicated appendicitis in children has seen a slower move towards immediate appendectomy but conservative treatment does have a role to play in children with complicated appendicitis with abscess formation. The combination of conservative treatment and percutaneous drainage is effective in these cases. There is also a trend towards early laparoscopic appendectomy in the management of complicated appendicitis.

The management of complicated appendicitis is still a matter of debate with no proper consensus on which treatment option is the best, hence the management option is often decided by the treating surgeon.

Conflict of Interest: There is no conflict of interest

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