

# Laparoscopic versus open appendectomy for complicated appendicitis

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## Abstract

### Introduction

The treatment of acute appendicitis using laparoscopy reduces the risk of wound infection, hospitalization time and return to normal activity. However, it increases the risk of intra-abdominal abscess, which is one the main complications of complicated appendicitis.

### Methods

We searched in Epistemonikos, the largest database of systematic reviews in health, which is maintained by screening multiple information sources, including MEDLINE, EMBASE, Cochrane, among others. We extracted data from the systematic reviews, reanalyzed data of primary studies, conducted a meta-analysis and generated a summary of findings table using the GRADE approach.

### Results and conclusions

We identified six systematic reviews including 55 studies overall, of which four were randomized trials. We concluded that the used of laparoscopy, compared to open appendectomy, probably reduces the time of hospital stay, and may reduce the risk of wound infection, but there's no clarity regarding the incidence of intra-abdominal abscess due to the very low certainty of the evidence available.

## Problem

Acute appendicitis remains one of the most common surgical diseases in the emergency room. The lifetime risk might be up to 9%<sup>1,2</sup>. The treatment of this condition using laparoscopy was first reported in 1983<sup>3</sup>. The benefits include reduction in the risk of wound infection and the time of hospital stay, and a faster return to normal activity. Because of this, this technique has been well studied and used during the last years. However, one of the disadvantages of this approach is the increased risk of intra-abdominal abscess, particularly in patients presenting with complicated appendicitis. So, there is still controversy about the use of laparoscopy in this setting.

## Key messages

- Laparoscopic appendectomy probably reduces the length of hospital stay and might reduce the risk of wound infection compared to open appendectomy.
- Laparoscopic appendectomy probably increases the duration of surgery, but the relevance of this increase is not clear.
- It is not clear if there are differences in the risk of intra-abdominal abscess between open or laparoscopic appendectomy in complicated appendicitis, because the certainty of the evidence is very low.

## About the body of evidence for this question

<p>What is the evidence. See evidence matrix in Epistemonikos later</p>	<p>We identified six systematic reviews<sup>4,5,6,7,8,9</sup>, including 55 primary studies overall, of which four were randomized trials<sup>10,11,12,13</sup>. This table, and the summary in general, is based on the latter, since the inclusion of the observational studies did not increase the certainty of the evidence or added additional information.</p>
<p>What types of patients were included*</p>	<p>A total of 857 patients were included in the trials, of which 466 presented complicated appendicitis. Their age ranged from 2 to 85 years.</p> <p>Two trials only included adults<sup>12,13</sup>, one only included children between 2 and 20 years<sup>10</sup> and one implicitly included children, but did not analyze them separately<sup>11</sup>.</p> <p>Male:female ratio was 1.3:1.</p> <p>All trials included patients with complicated appendicitis, which was defined as the presence of intestinal perforation. Only one trial included patients with and without perforation, but presented data separately<sup>10</sup>.</p>
<p>What types of interventions were included*</p>	<p>Only one trial used 2-handed, 4-trocar technique<sup>12</sup>, while the rest used conventional 3-trocar technique.</p> <p>All trials compared against open appendectomy, whether by classic incision (McBurney) or infraumbilical.</p> <p>All trials used an antibiotics scheme pre- and post-surgery. There was no information regarding the level of training of surgeons performing the interventions.</p>
<p>What types of outcomes were measured</p>	<p>The outcomes measured can be classified into two groups:</p> <p>1. Technique</p> <ul style="list-style-type: none"> <li>• Duration of surgery</li> <li>• Length of hospital stay.</li> <li>• Post-surgical analgesia.</li> </ul>

## Methods

To answer the question, we used Epistemonikos, the largest database of systematic reviews in health, which is maintained by screening multiple information sources, including MEDLINE, EMBASE, Cochrane, among others, to identify systematic reviews and their included primary studies. We extracted data from the identified reviews and reanalyzed data from primary studies included in those reviews. With this information, we generated a structured summary denominated FRISBEE (Friendly Summary of Body of Evidence using Epistemonikos) using a pre-established format, which includes key messages, a summary of the body of evidence (presented as an evidence matrix in Epistemonikos), meta-analysis of the total of studies when it is possible, a summary of findings table following the GRADE approach and a table of other considerations for decision-making.

	<ul style="list-style-type: none"> <li>• Time to oral intake.</li> </ul> <p>2. Post-surgical complications</p> <ul style="list-style-type: none"> <li>• Mortality.</li> <li>• Total complications.</li> <li>• Wound infection.</li> <li>• Intra-abdominal abscess.</li> <li>• Intestinal obstruction.</li> </ul> <p>Patients were monitored for 14-30 days after surgery.</p>
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\* The information about primary studies is extracted from the systematic reviews identified, unless otherwise specified.

## Summary of Findings

The information is based on four trials<sup>10,11,12,13</sup>, that included 466 patients with complicated appendicitis, of which 197 were treated with laparoscopic appendectomy and 269 with open appendectomy.

All trials reported the length of hospital stay, and three the duration of surgery<sup>11,12,13</sup>. All trials measured the incidence of wound infection and intra-abdominal abscess.

The summary of findings is as follows:

- Laparoscopy might reduce the risk of wound infection in complicated appendicitis, but the certainty of the evidence is low.
- It is not clear whether there is a difference in the incidence of intra-abdominal abscess using laparoscopic or open appendectomy because the certainty of the evidence is very low.
- Laparoscopy probably increases the duration of surgery. The certainty of the evidence is moderate.
- Laparoscopy might reduce the length of hospital stay compared to open appendectomy. The certainty of the evidence is low.

Laparoscopic versus open appendectomy for complicated appendicitis				
<b>Patients</b>	Patients of any age with complicated appendicitis			
<b>Intervention</b>	Laparoscopy			
<b>Comparison</b>	Open surgery			
Outcome	Absolute effect*		Relative effect (95% CI)	Certainty of evidence (GRADE)
	WITH open surgery	WITH laparoscopy		
	Difference: patients per 1000			
Wound infection	156 per 1000	89 per 1000	RR 0.57 (0.2 to 1.6)	⊕⊕○○ <sup>1,3</sup> Low
	Difference: 67 patients less (Margin of error: 125 less to 94 more)			
Intra-abdominal abscess	108 per 1000	127 per 1000	RR 1.18 (0.47 to 2.98)	⊕○○○ <sup>1,2,3</sup> Very low
	Difference: 19 patients less (Margin of error: 57 less to 213 more)			
Duration of surgery	62.1 minutes	74 minutes	--	⊕⊕⊕○ <sup>1</sup> Moderate
	MD: 11.9 minutes more (Margin of error: 3.5 less to 27.3 more)			
Length of hospital stay	6.2 days	4.7 days	--	⊕⊕○○ <sup>1,3</sup> Low
	MD: 1.5 days less (Margin of error: 4.6 less to 1.6 more)			

**Margin of error:** 95% confidence interval (CI).  
**RR:** Risk ratio.  
**MD:** Mean difference.  
**GRADE:** Evidence grades of the GRADE Working Group (see forward).

\*The risk **WITH open surgery** is based on the risk in the control group of the trials. The risk **WITH laparoscopy** (and its margin of error) is calculated from relative effect (and its margin of error).

<sup>1</sup> The certainty of the evidence was downgraded in one level for risk of bias of the trials.  
<sup>2</sup> The certainty of the evidence was downgraded in one level for inconsistency, since there were different conclusions between the studies.  
<sup>3</sup> The certainty of the evidence was downgraded in one level for imprecision, since the edges of the confidence interval entails different decisions.

Follow the link to access the interactive version of this table ([Interactive Summary of Findings – iSoF](#))

## About the certainty of the evidence

### (GRADE)\*

⊕⊕⊕⊕

**High:** This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different† is low.

⊕⊕⊕○

**Moderate:** This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different† is moderate.

⊕⊕○○

**Low:** This research provides some indication of the likely effect. However, the likelihood that it will be substantially different† is high.

⊕○○○

**Very low:** This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different† is very high.

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\* This concept is also called 'quality of the evidence' or 'confidence in effect estimates'.

† Substantially different = a large enough difference that it might affect a decision

## Other considerations for decision-making

### To whom this evidence does and does not apply

The conclusion of this article apply to patients of any age with complicated appendicitis.

It does not apply to pregnant women with complicated appendicitis, given complications and consequences to the mother and fetus are different from those in the general population. Furthermore, the technique may vary substantially keeping into consideration the gravid uterus that protrudes to the abdominal cavity.

This summary considers obese patients as part of the population studied, and not as a subpopulation. However, the conclusions must be applied carefully, since the laparoscopic technique may be more difficult in these cases.

### About the outcomes included in this summary

The outcomes selected are the ones considered critical for decision-making, based on the opinion of the authors of this article. In general, it agrees with those presented in the systematic reviews and main clinical guidelines.

### Balance between benefits and risks, and certainty of the evidence

The intervention shows some benefit, but the relevance is difficult to establish. There is uncertainty regarding the main undesirable effects, in particular the risk of intra-abdominal abscess, which makes it difficult to balance the risk and benefits of laparoscopic appendectomy.

### Resource considerations

The intervention probably saves some resources secondary to the cost of hospitalization. However, the uncertainty about the risk of complications makes it hard to ponder the benefits against the costs.

It would be reasonable to make a formal economic evaluation in the settings where the implementation of this intervention is being considered.

### What would patients and their doctors think about this intervention

There might be variability in the decision-making with the evidence presented. Clinicians who value most the length of hospital stay and the associated costs might choose

laparoscopic appendectomy. On the other hand, those who give more importance to the complications may prefer an open appendectomy.

### Differences between this summary and other sources

The systematic reviews identified differ in their conclusions. Some conclude laparoscopic appendectomy is superior<sup>4,6,7,8</sup>, while the rest agree with this summary, stating there are risks and benefits<sup>5,9</sup>. The main differences between this summary and the systematic reviews is they have a narrower coverage of the literature (none of the systematic reviews included all four randomized trials), give more relevance to non-randomized studies and they do not consider the certainty of the evidence to formulate their conclusions.

### Could this evidence change in the future?

There is a high probability that the evidence will change in the future due to the existing uncertainty.

We did not find ongoing trials evaluating laparoscopy for the treatment of complicated appendicitis in the International Clinical Trials Registry Platform of the World Health Organization.

## How we conducted this summary

Using automated and collaborative means, we compiled all the relevant evidence for the question of interest and we present it as a matrix of evidence.

	Katsuno G 2009	Kirshtein B 2007	So JB 2002	Stoitzing H 2000	Piskun G 2001	Lin HF 2006	Fukami Y 2007	Wullstein C 2001	Yau KK 2007
Athanasiou C 2017	Green	Green	Green	Green	Green	Green	Green	Green	Green
Markar SR 2014	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey
Yu MC 2017	Green	Green	Green	Green	Green	Green	Green	Green	Green
Markar SR 2012	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey
Markides G 2010	Green	Green	Green	Green	Green	Green	Green	Green	Green

An evidence matrix is a table that compares systematic reviews that answer the same question. Rows represent systematic reviews, and columns show primary studies. The boxes in green correspond to studies included in the respective revisions. The system automatically detects new systematic reviews including any of the primary studies in the matrix, which will be added if they actually answer the same question.

Follow the link to access the **interactive version**: [Laparoscopic versus open appendectomy for complicated appendicitis](#).

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## Notes

The upper portion of the matrix of evidence will display a warning of “new evidence” if new systematic reviews are published after the publication of this summary. Even though the project considers the periodical update of these summaries, users are invited to comment in *Medwave* or to contact the authors through email if they find new evidence and the summary should be updated earlier.

After creating an account in Epistemonikos, users will be able to save the matrixes and to receive automated notifications any time new evidence potentially relevant for the question appears.

This article is part of the Epistemonikos Evidence Synthesis project. It is elaborated with a pre-established methodology, following rigorous methodological standards and internal peer review process. Each of these articles corresponds to a summary, denominated FRISBEE (Friendly Summary of Body of Evidence using Epistemonikos), whose main objective is to synthesize the body of evidence for a specific question, with a friendly format to clinical professionals. Its main resources are based on the evidence matrix of Epistemonikos and analysis of results using GRADE methodology. Further details of the methods for developing this FRISBEE are described here (<http://dx.doi.org/10.5867/medwave.2014.06.5997>)

Epistemonikos foundation is a non-for-profit organization aiming to bring information closer to health decision-makers with technology. Its main development is Epistemonikos database

[www.epistemonikos.org](http://www.epistemonikos.org).

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