

**PICO SEARCH ASSIGNMENT WORKSHEET**

**Brief description of patient problem/setting (summarize the case very briefly)**

Patient is a 59 y/o female with PMHx of pre-diabetes controlled with Ozempic presents to ED complaining of periumbilical pain radiating to the right lower quadrant x 4 days. She reported that her pain got progressively worse and was associated with nausea/vomiting. She stated that she was also constipated and bloated since last Wednesday. Has not had a bowel movement since then. Reported subjective fever. CT abdomen and pelvis was later done; showed thickening of the appendix and fat stranding around the region. Denies chest pain, SOB, night sweats, and chills. Patient was then admitted into general surgery and managed conservatively with antibiotics for acute appendicitis.

**Search question:** Clearly state the question (including outcomes or criteria to be tracked)

In adults with uncomplicated appendicitis, does conservative treatment with antibiotics compared with appendectomy lead to similar treatment success and lower risks of complications?

**Question type:** What kind of question is this?

- Prevalence
- Screening
- Diagnosis
- Prognosis
- Treatment
- Harm

**Assuming that the highest level of evidence to answer your question will be meta-analysis or systematic review, what other types of study might you include if these are not available (or if there is a much more current study of another type)? Please explain your choices.**

If meta-analyses and systematic reviews are not available, I would include randomized controlled trials (RCTs) because they allow for a direct comparison of two interventions while minimizing bias and confounding variables through random assignment. RCTs will provide accurate evidence on treatment success, complication rates, recurrence, and length of hospital stay to determine which intervention have better treatment outcomes. If RCTs are not available, a prospective cohort studies may be useful as they follow patients over time and provide clinically and real-world data on the recovery time and complications of both interventions in a large patient population.

**PICO search terms:**

P	I	C	O
Uncomplicated appendicitis	Antibiotic treatment	Appendectomy	Treatment success
Unperforated appendicitis	Conservative treatment	Surgical management	Efficacy
Acute appendicitis	Non-operative management		Length of hospital stay
Adults			Treatment complications
			Mortality
			Recurrence rate

**Search tools and strategy used:**

Please indicate what databases/tools you used, provide a list of the terms you searched together in each tool, and how many articles were returned using those terms and filters. Explain how you narrowed your choices to the few selected articles. For example, if your search returned 25 articles among the several databases used, what was the process used to determine which four articles to use?

Database	Search terms used	# or results	Filters applied
PubMed	(((((uncomplicated appendicitis) OR (acute appendicitis)) AND (antibiotic treatment)) AND (surgery)) AND (treatment outcomes)	23	Last 10 years, full text, meta-analysis, randomized controlled trial, systematic review, English, Humans, Adult 19+, MEDLINE
Cochrane Review	("uncomplicated appendicitis" OR "acute appendicitis") AND ("antibiotic treatment") AND ("appendectomy") AND ("mortality" OR "complications")	21	Last 5 years, Cochrane reviews,
Google scholar	("uncomplicated appendicitis" OR "acute appendicitis") AND ("antibiotic therapy" or "conservative management") AND (treatment outcome" OR "efficacy" OR "safety")	404	Time range: 2021-2026, Review articles, sort by relevance

For this PICO question, I used the following databases: PubMed, Cochrane Library, and Google Scholar. In the PubMed database, I applied the search terms and filters listed above, which resulted in 23 articles. I first reviewed the titles of each article to gain a general understanding of the studies. Afterward, I identified the study design for each article and read the abstracts of those whose titles were relevant to my PICO question, which was comparing conservative management with antibiotics versus surgical management for appendicitis. In the end, I selected one article from PubMed that was a randomized controlled trial with a five-year follow-up of the patient cohort.

In the Cochrane Library, using the same search terms and filters resulted in 21 articles. Similar to my process in PubMed, I reviewed the titles to determine which studies were related to my PICO question. Then I narrowed the results to three relevant articles and reviewed their abstracts. From these, I selected one article that was a systematic review and meta-analysis comparing the interventions of interest. This article was chosen because it represents a high level of evidence and was recently published, making it relevant to current clinical practice.

The same search process was used in Google Scholar. Although the initial search came out to be 404 results, I narrowed my selection to one article based on its level of evidence. Additionally, one of the filters applied was "sort by relevance", which refined my search results, making it easier to select my final article

of choice. In the end, the selected article was a systematic review evaluating the efficacy of appendectomy compared with antibiotic therapy for appendicitis.

### **Results found:**

Identify at least 3 articles (or other appropriate reputable sources) that answer your specific question with the highest available level of evidence (you will probably need to look at more than 3 articles to get the 3 most focused and highest-level articles to address your question). Please make sure that they are Medline indexed.

### **Article 1**

#### **Citation:**

Salminen, P., Tuominen, R., Paajanen, H., Rautio, T., Nordström, P., Aarnio, M., Rantanen, T., Hurme, S., Mecklin, J. P., Sand, J., Virtanen, J., Jartti, A., & Grönroos, J. M. (2018). Five-Year Follow-up of Antibiotic Therapy for Uncomplicated Acute Appendicitis in the APPAC Randomized Clinical Trial. *JAMA*, 320(12), 1259–1265. <https://doi.org/10.1001/jama.2018.13201>

**Type of article:** Long-term follow up of randomized control trial

#### **Abstract:**

##### **Abstract**

**Importance:** Short-term results support antibiotics as an alternative to surgery for treating uncomplicated acute appendicitis, but long-term outcomes are not known.

**Objective:** To determine the late recurrence rate of appendicitis after antibiotic therapy for the treatment of uncomplicated acute appendicitis.

**Design, setting, and participants:** Five-year observational follow-up of patients in the Appendicitis Acuta (APPAC) multicenter randomized clinical trial comparing appendectomy with antibiotic therapy, in which 530 patients aged 18 to 60 years with computed tomography-confirmed uncomplicated acute appendicitis were randomized to undergo an appendectomy (n = 273) or receive antibiotic therapy (n = 257). The initial trial was conducted from November 2009 to June 2012 in Finland; last follow-up was September 6, 2017. This current analysis focused on assessing the 5-year outcomes for the group of patients treated with antibiotics alone.

**Interventions:** Open appendectomy vs antibiotic therapy with intravenous ertapenem for 3 days followed by 7 days of oral levofloxacin and metronidazole.

**Main outcomes and measures:** In this analysis, prespecified secondary end points reported at 5-year follow-up included late (after 1 year) appendicitis recurrence after antibiotic treatment, complications, length of hospital stay, and sick leave.

**Results:** Of the 530 patients (201 women; 329 men) enrolled in the trial, 273 patients (median age, 35 years [IQR, 27–46]) were randomized to undergo appendectomy, and 257 (median age, 33 years, [IQR, 26–47]) were randomized to receive antibiotic therapy. In addition to 70 patients who initially received antibiotics but underwent appendectomy within the first year (27.3% [95% CI, 22.0%–33.2%]; 70/256), 30 additional antibiotic-treated patients (16.1% [95% CI, 11.2%–22.2%]; 30/186) underwent appendectomy between 1 and 5 years. The cumulative incidence of appendicitis recurrence was 34.0% (95% CI, 28.2%–40.1%; 87/256) at 2 years, 35.2% (95% CI, 29.3%–41.4%; 90/256) at 3 years, 37.1% (95% CI, 31.2%–43.3%; 95/256) at 4 years, and 39.1% (95% CI, 33.1%–45.3%; 100/256) at 5 years. Of the 85 patients in the antibiotic group who subsequently underwent appendectomy for recurrent appendicitis, 76 had uncomplicated appendicitis, 2 had complicated appendicitis, and 7 did not have appendicitis. At 5 years, the overall complication rate (surgical site infections, incisional hernias, abdominal pain, and obstructive symptoms) was 24.4% (95% CI, 19.2%–30.3%) (n = 60/246) in the appendectomy group and 6.5% (95% CI, 3.8%–10.4%) (n = 16/246) in antibiotic group (P < .001), which calculates to 17.9 percentage points (95% CI, 11.7–24.1) higher after surgery. There was no difference between groups for length of hospital stay, but there was a significant difference in sick leave (11 days more for the appendectomy group).

**Conclusions and relevance:** Among patients who were initially treated with antibiotics for uncomplicated acute appendicitis, the likelihood of late recurrence within 5 years was 39.1%. This long-term follow-up supports the feasibility of antibiotic treatment alone as an alternative to surgery for uncomplicated acute appendicitis.

**Key findings:**

- 27.3% of patients treated conservatively with antibiotics required appendectomy within the first year
- The cumulative recurrence rate of appendicitis reached 39.1% at 5 years in patients who were initially treated with antibiotics. Most of these cases were still uncomplicated appendicitis when surgery was later performed.
- The overall complication rate was higher in the appendectomy group (24.4%\_ compared to the antibiotic group (6.5%)
- Patient who underwent appendectomy had more hospital days compared with antibiotic group

**Why I chose this article:** I chose this article because it is a long term follow up of a randomized controlled trial study that compared the interventions of interest. Additionally, the study evaluated the long-term outcomes of antibiotic therapy compared with appendectomy in adults with uncomplicated appendicitis within the next 5 years. The study focused and compared treatment outcomes such as recurrences in antibiotic therapy and complications in appendectomy. Although complications were lower with antibiotics, it was found that appendicitis recurrence occurred in about 39.1% of the patients within the next 5 years. This meant that patient eventually required surgery later. This research is important for my PICO as it provides insight into whether antibiotic management can maintain treatment success over time compared to surgical management.

**Article 2****Citation:**

Doleman B, Fonnes S, Lund JN, Boyd-Carson H, Javanmard-Emamghissi H, Moug S, Hollyman M, Tierney G, Tou S, Williams JP. Appendectomy versus antibiotic treatment for acute appendicitis. Cochrane Database of Systematic Reviews 2024, Issue 4. Art. No.: CD015038. DOI: 10.1002/14651858.CD015038.pub2. Accessed 07 March 2026.

<https://doi.org/10.1002/14651858.CD015038.pub2>

**Type of article:** Systematic review and meta-analysis of randomized controlled trials

**Abstract:**

## ABSTRACT

### Background

Acute appendicitis is one of the most common emergency general surgical conditions worldwide. Uncomplicated/simple appendicitis can be treated with appendectomy or antibiotics. Some studies have suggested possible benefits with antibiotics with reduced complications, length of hospital stay, and the number of days off work. However, surgery may improve success of treatment as antibiotic treatment is associated with recurrence and future need for surgery.

### Objectives

To assess the effects of antibiotic treatment for uncomplicated/simple acute appendicitis compared with appendectomy for resolution of symptoms and complications.

### Search methods

We searched CENTRAL, MEDLINE, Embase, and two trial registers (World Health Organization International Clinical Trials Registry Platform and ClinicalTrials.gov) on 19 July 2022. We also searched for unpublished studies in conference proceedings together with reference checking and citation search. There were no restrictions on date, publication status, or language of publication.

### Selection criteria

We included parallel-group randomised controlled trials (RCTs) only. We included studies where most participants were adults with uncomplicated/simple appendicitis. Interventions included antibiotics (by any route) compared with appendectomy (open or laparoscopic).

### Data collection and analysis

We used standard methodology expected by Cochrane. We used GRADE to assess the certainty of evidence for each outcome. Primary outcomes included mortality and success of treatment, and secondary outcomes included number of participants requiring appendectomy in the antibiotic group, complications, pain, length of hospital stay, sick leave, malignancy in the antibiotic group, negative

appendectomy rate, and quality of life. Success of treatment definitions were heterogeneous although mainly based on resolution of symptoms rather than incorporation of long-term recurrence or need for surgery in the antibiotic group.

### Main results

We included 13 studies in the review covering 1675 participants randomised to antibiotics and 1683 participants randomised to appendectomy. One study was unpublished. All were conducted in secondary care and two studies received pharmaceutical funding. All studies used broad-spectrum antibiotic regimens expected to cover gastrointestinal bacteria. Most studies used predominantly laparoscopic surgery, but some included mainly open procedures. Six studies included adults and children. Almost all studies aimed to exclude participants with complicated appendicitis prior to randomisation, although one study included 12% with perforation. The diagnostic technique was clinical assessment and imaging in most studies. Only one study limited inclusion by sex (male only). Follow-up ranged from hospital admission only to seven years. Certainty of evidence was mainly affected by risk of bias (due to lack of blinding and loss to follow-up) and imprecision.

### Primary outcomes

It is uncertain whether there was any difference in mortality due to the very low-certainty evidence (Peto odds ratio (OR) 0.51, 95% confidence interval (CI) 0.05 to 4.95; 1 study, 492 participants). There may be 76 more people per 1000 having unsuccessful treatment in the antibiotic group compared with surgery, which did not reach our predefined level for clinical significance (risk ratio (RR) 0.91, 95% CI 0.87 to 0.96;  $I^2 = 69\%$ ; 7 studies, 2471 participants; low-certainty evidence).

### Secondary outcomes

At one year, 30.7% (95% CI 24.0 to 37.8;  $I^2 = 80\%$ ; 9 studies, 1396 participants) of participants in the antibiotic group required appendectomy or, alternatively, more than two-thirds of antibiotic-treated participants avoided surgery in the first year, but the evidence is very uncertain. Regarding complications, it is uncertain whether there is any difference in episodes of *Clostridium difficile* diarrhoea due to very low-certainty evidence (Peto OR 0.97, 95% CI 0.24 to 3.89; 1 study, 1332 participants). There may be a clinically significant reduction in wound infections with antibiotics (RR 0.25, 95% CI 0.09 to 0.68;  $I^2 = 16\%$ ; 9 studies, 2606 participants; low-certainty evidence). It is uncertain whether antibiotics affect the incidence of intra-abdominal abscess or collection (RR 1.58, 95% CI 0.61 to 4.07;  $I^2 = 19\%$ ; 6 studies, 1831 participants), or reoperation (Peto OR 0.13, 95% CI 0.01 to 2.16; 1 study, 492 participants) due to very low-certainty evidence, mainly due to rare events causing imprecision and risk of bias. It is uncertain if antibiotics prolonged length of hospital stay by half a day due to the very low-certainty evidence (MD 0.54, 95% CI 0.06 to 1.01;  $I^2 = 97\%$ ; 11 studies, 3192 participants). The incidence of malignancy was 0.3% (95% CI 0 to 1.5; 5 studies, 403 participants) in the antibiotic group although follow-up was variable. Antibiotics probably increased the number of negative appendectomies at surgery (RR 3.16, 95% CI 1.54 to 6.49;  $I^2 = 17\%$ ; 5 studies, 707 participants; moderate-certainty evidence).

### Authors' conclusions

Antibiotics may be associated with higher rates of unsuccessful treatment for 76 per 1000 people, although differences may not be clinically significant. It is uncertain if antibiotics increase length of hospital stay by half a day. Antibiotics may reduce wound infections. A third of the participants initially treated with antibiotics required subsequent appendectomy or two-thirds avoided surgery within one year, but the evidence is very uncertain. There were too few data from the included studies to comment on major complications.

**Key findings:**

- Antibiotics may lead to higher rates of unsuccessful treatment compared with surgery. About 30.7% of patients treated with antibiotics required appendectomy within one year due to recurrence
- Appendectomy has higher treatment success rate (~84%) compared to antibiotics (~76%)
- Antibiotic treatment may reduce wound infections compared to appendectomy
- Other complications: intra-abdominal abscess, C.diff infection, no clear difference between the two intervention groups
- No apparent difference in mortality between both interventions
- Antibiotics slightly increase hospital length of stay by roughly 1 day

**Why I chose this article:** I chose this article because it is a systematic review and meta-analysis of randomized controlled trials. It is one of the highest levels of evidence study. The article evaluated the effectiveness and safety of antibiotics versus surgery management of appendicitis in adults. It provided strong evidence regarding treatment success rates, recurrence rates, complications associated with each treatment approach. Because of the large participant size and the inclusion of multiple RCTs, the reliability of the findings is high and accurate.

**Article 3****Citation:**

Poprom, N., Numthavaj, P., Wilasrusmee, C., Rattanasiri, S., Attia, J., McEvoy, M., & Thakkinstian, A. (2019). The efficacy of antibiotic treatment versus surgical treatment of uncomplicated acute appendicitis: Systematic review and network meta-analysis of randomized controlled trials. *American Journal of Surgery*, 218(1), 192–200. <https://doi.org/10.1016/j.amjsurg.2018.10.009>

**Type of article:** Systematic review and meta-analysis of randomized controlled trials

**Abstract:****A B S T R A C T**

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**Background:** The efficacy of antibiotics in appendicitis remains controversial, and physicians are not confident in prescribing antibiotics as the first line treatment. This network meta-analysis was conducted to assess the efficacy and safety of individual antibiotics in uncomplicated appendicitis.

**Methods:** Randomized controlled trials (RCTs) were identified from MEDLINE and SCOPUS databases since inception to July 2017. Studies. Network meta-analysis was applied to estimate treatment effects and safety. Probability of being the best treatment was estimated using surface under the cumulative ranking curve (SUCRA).

**Results:** Among 9 RCTs meeting our inclusion criteria. A network meta-analysis indicated that those receiving antibiotics had about 12–32% lower chance of treatment success and lower risk of complication about 23–86%, especially Beta-lactamase than appendectomy. The overall appendicitis recurrence rate in the antibiotic group was about 18.2%. The SUCRA indicated that appendectomy was ranked first for treatment success and least complications, followed by Beta-lactamase.

**Conclusions:** Appendectomy is still the most effective treatment in uncomplicated appendicitis but it carries complications. Beta-lactamase, might be an alternative treatment if there are any contraindications for operation.

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**Key findings:**

- Patient treated with antibiotics had 12-32% lower treatment success compared to appendectomy
- Antibiotics therapy was associated with lower rates of complications compared to surgery
- Overall recurrence rate of appendicitis after antibiotic treatment was approximately 18.2%
- Appendicitis is overall the most effective treatment
- Beta-lactamase based regimens were the highest ranked antibiotics treatment after surgery based on its high efficacy.
- Penicillin was inferior to surgery and other antibiotics in all treatment outcomes

**Why I chose this article:** I chose this article because it is a systematic review and meta-analysis of RCTs. Like the 2<sup>nd</sup> article, it is of the highest level of evidence, and it analyzes outcomes such as treatment success rate, recurrence, and complications between the interventions of interest. One thing that this article included that piqued my interest was its use of multiple antibiotic regimens. I found this useful because it shows which specific antibiotic regimens were studied, rather than grouping all antibiotics together. It helps evaluate whether certain antibiotics treatments could be more effective than others as alternative to appendectomy.

**Clinical bottom line:**

In adults with uncomplicated appendicitis, appendectomy remains the most effective definitive treatment, with higher overall treatment success and lower recurrence rates. However, antibiotic therapy can be a reasonable alternative for selected patients who wish to avoid surgery and its associated risks. Patients treated with antibiotics tend to experience fewer short-term complications, such as wound infections. Although antibiotics can successfully treat appendicitis initially in many patients, evidence shows that a significant proportion will eventually require an appendectomy due to recurrence or treatment failure over time. Therefore, the clinical takeaway is that antibiotic therapy for uncomplicated appendicitis may reduce certain complications but is associated with lower overall treatment success compared with surgical management.