THE CUTTING EDGE OF PEDIATRICS

Medical Management of Appendicitis: Are We There Yet?

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Objectives

- Discuss the surgical and non-operative approaches to the treatment of appendicitis in children
- Describe the clinical outcomes associated with non-operative management of pediatric appendicitis
- Summarize recommendations for role of non-operative management in pediatric appendicitis

Pre-Test

8-yo boy presents with 1-day history of right lower quadrant abdominal pain, anorexia. He has RLQ tenderness and leukocytosis. You refer him to the ED with concern for appendicitis.

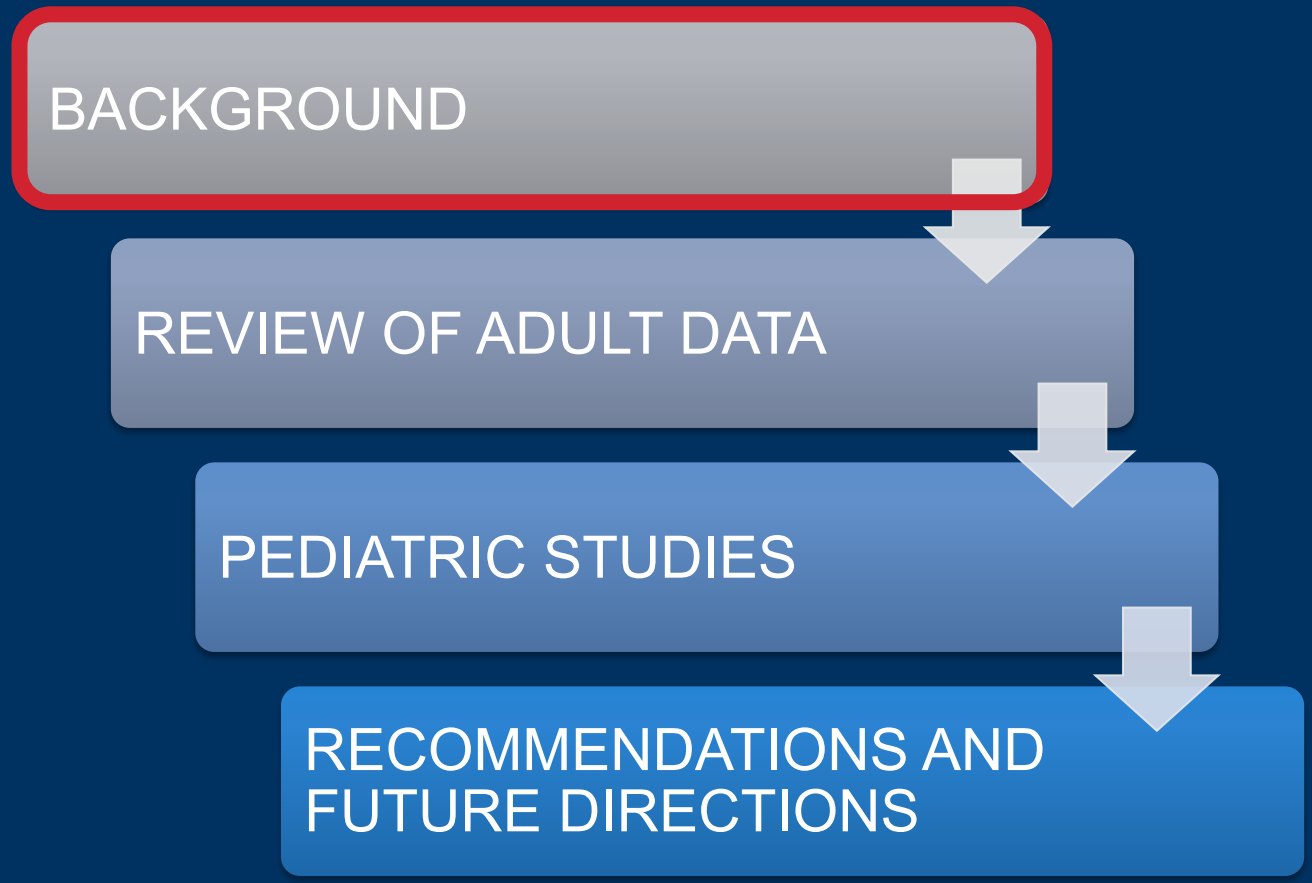
Parents ask whether treatment with IV antibiotics would be as effective as surgery.

Pre-Test

8 yo boy presents with 1 day history of right lower quadrant abdominal pain, anorexia. He has RLQ tenderness and leukocytosis. You refer him to the ED with concern for appendicitis. Parents ask whether treatment with IV antibiotics would be as effective as surgery. You state that:

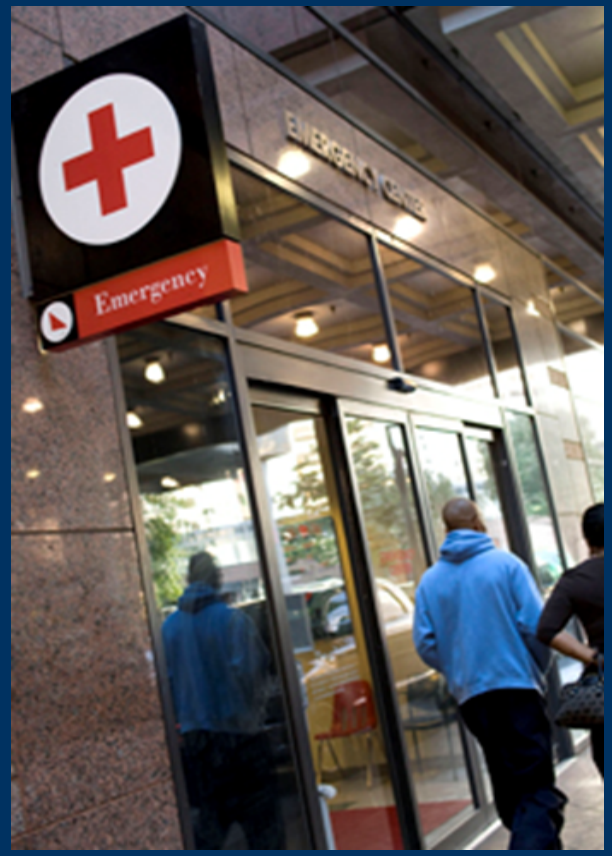
A. A CT scan is needed prior to determining eligibility for antibiotic treatment only
B. Failure rate of non-operative management (non-operative management) of acute appendicitis in children is 50%
C. A recent clinical trial in adults shows those who fail non-operative management and require appendectomy have significant complications
D. Early reports indicate success rates of 63-76% in select patients with very limited follow-up. Appendectomy remains the standard of care for this condition.

Medical Management of Appendicitis: Are We There Yet?



Background

- Appendicitis is the most common cause for emergency surgery in children
- 11.4% ED admissions
- 70,000 children hospitalized annually
- 254,000 hospital days and $650 million in charges



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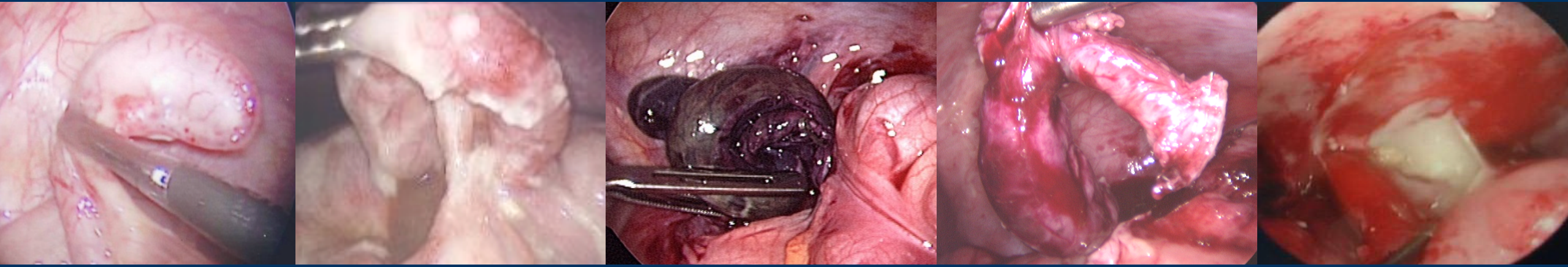


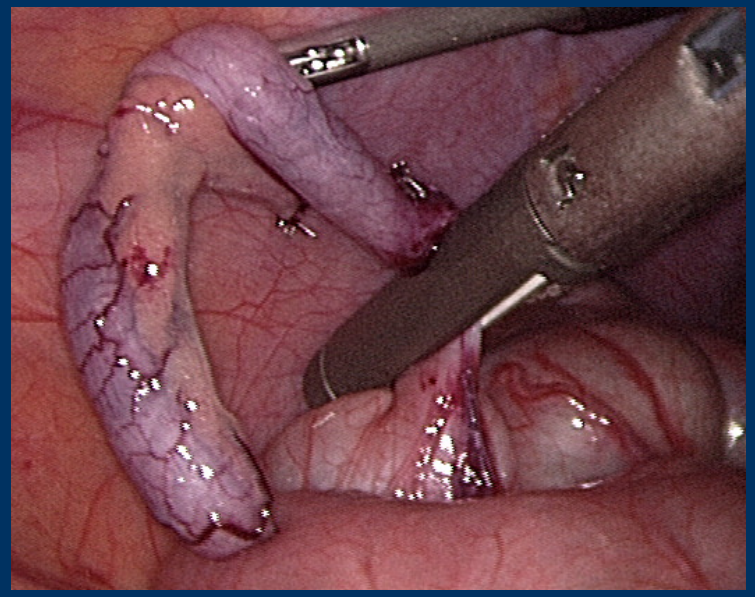
Disease Severity: 60% uncomplicated
40% complicated (gangrenous, perforated)

Predictors of Perforation: younger age, duration of symptoms > 36 hrs, fever, presence of fecalith

Laparoscopic Appendectomy

- Mainstay of treatment for appendicitis in U.S.
- Earlier recovery, lesser pain, shorter LOS

Mainstay of treatment for appendicitis in U.S.
Superficial SSI 1-3%
Deep SSI 1%; 15-30% (complicated disease)
Readmission 5-10%
Reoperation 1%



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Appendicitis Can Often Be Treated With Antibiotics

About 80 percent of patients can try medication first, study says

healthessentials | Health A-Z

How Doctors Can Treat an Inflamed Appendix Without Surgery

Antibiotics may be an alternative

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Surgery-free option for appendicitis could become the norm

By Carina Storrs, Special to CNN
Updated 3:10 PM ET, Tue June 16, 2015

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Antibiotics Resurface as Alternative to Removing Appendix

By GINA KOLATA MAY 18, 2015

Well

BODY

Treating Appendicitis Without Surgery

By NICHOLAS BAKALAR APRIL 25, 2014 11:03 AM 46

Background

Non-operative Management

Using antibiotics alone

- **Non-operative management** has been successful in multiple intra-abdominal inflammatory processes
  - Diverticulitis, acute salpingitis, tubo-ovarian abscess, Crohn's disease, necrotizing enterocolitis
- Antibiotics-first strategy used for complicated appendicitis
  - Coupled with percutaneous drainage of abscess
  - Avoid more extensive operation
- Successful appendicitis non-operative management treatment in Navy personnel while at sea

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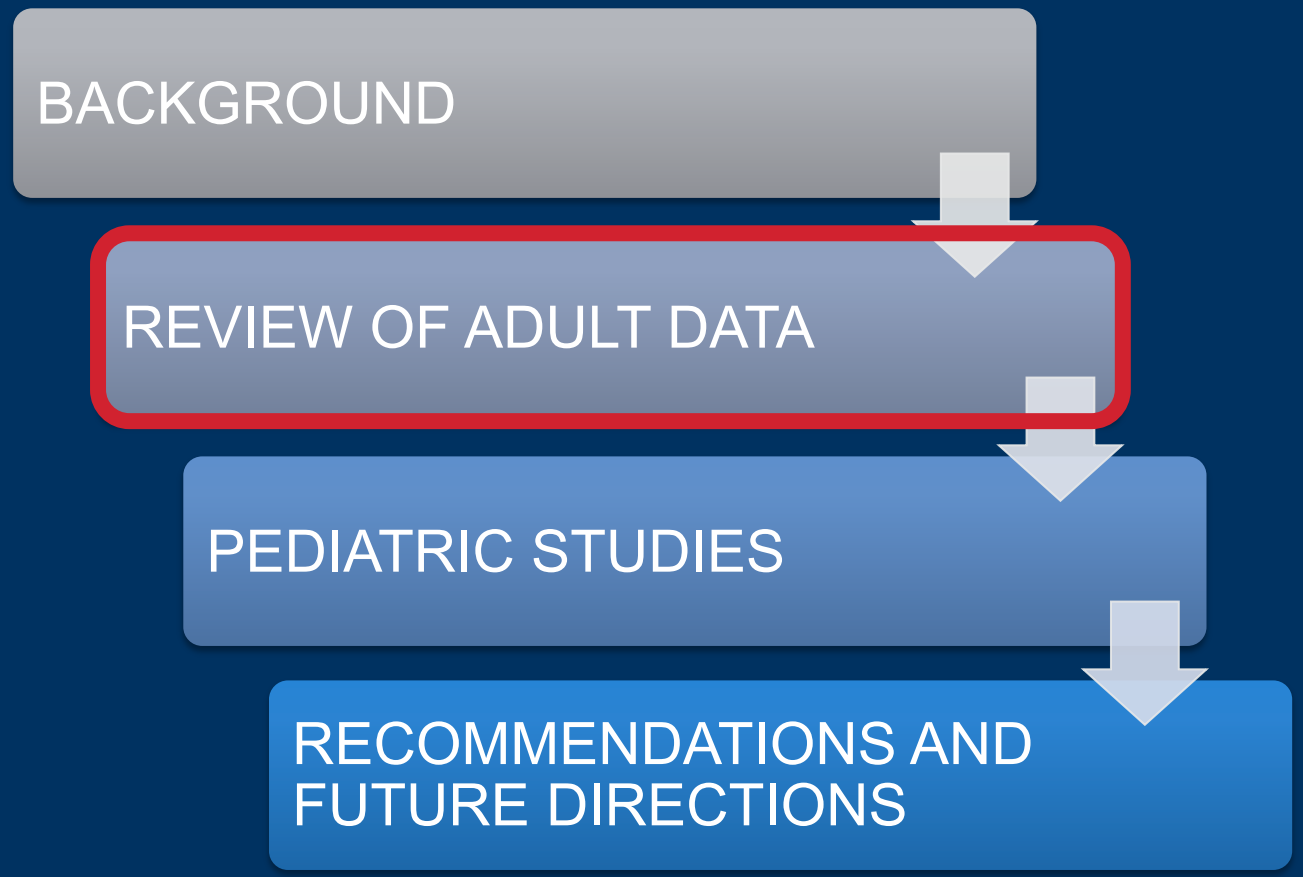
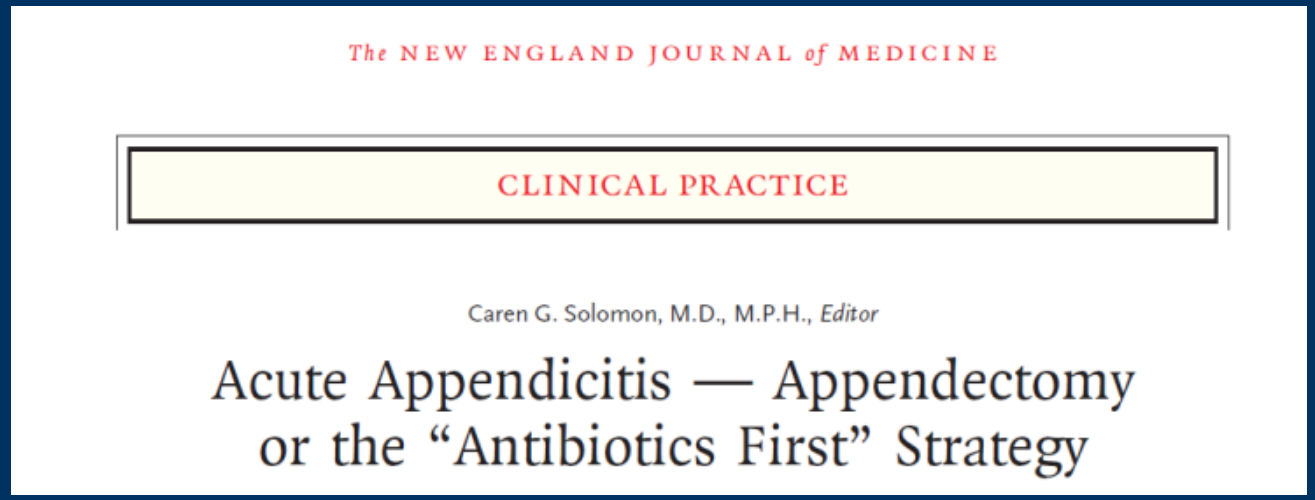


Early Adult Randomized Controlled Trials


The NEW ENGLAND JOURNAL of MEDICINE

CLINICAL PRACTICE

Caren G. Solomon, M.D., M.P.H., *Editor*

Acute Appendicitis — Appendectomy or the "Antibiotics First" Strategy

European randomized controlled trials showed

- Most patients able to avoid appendectomy
- Success rates 63-85%
- Lesser or similar pain, less narcotic use, earlier return to work
- Rate of perforation not worse for antibiotics first

Flum DR, 2015. *NEJM* 372 (20):1937-43

Original Investigation

Antibiotic Therapy vs Appendectomy for Treatment of Uncomplicated Acute Appendicitis

- Multicenter randomized clinical trial, Finland 2009-2012
- 530 patients with CT-proven appendicitis (open appy vs. antibiotics)
- Primary outcome: discharge without need for surgery, no recurrent appendicitis at 1 yr
- Efficacy 99.6% surgery vs. 73% antibiotics at 1 yr
- Treatment efficacy difference -27%
- 10% complicated appendicitis, no intra abdominal abscess, no complications

Salminen et al. *JAMA* 2015; 313: 2340-48

Review and Meta-Analysis of Randomized Controlled Trials

Non-operative management of patients with uncomplicated appendicitis: 91% success rate

→ 71% at 1 year

Non-operative management was associated with

- Less pain in the first week after treatment and…
- Quicker return to work
- Missed occult tumors in a small number of patients
- No convincing evidence of a reduction in complications

Findlay et al. *JACS* 2016; 223: 814-824

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BACKGROUND

REVIEW OF ADULT DATA

PEDIATRIC STUDIES

RECOMMENDATIONS AND FUTURE DIRECTIONS

RANDOMIZED CONTROLLED TRIAL

Nonoperative Treatment With Antibiotics Versus Surgery for Acute Nonperforated Appendicitis in Children

A Pilot Randomized Controlled Trial

- Pilot trial in Sweden, children 5-15 yrs
- Confirmed uncomplicated appendicitis by imaging
- N=50 (24 non-operative management, 26 surgery)
- 1 year follow-up
- 92% non-operative management (22/24) had initial resolution of symptoms
- 8% (2/24) failed and required surgery at index admission
- 5% (1/22) recurrent appendicitis within 1 year
- **27%** (6/22) had appendectomy during follow-up due to parental request, recurrent abdominal pain
- Overall, **63% of patients avoided surgery**

Ann Surg 2015; 261 (1): 67-71

Prospective Studies

Parental choice study, Japan[1]

- 98.7% initial success rate for non-operative management
- **29% recurrent appendicitis** at 4 years follow-up
- Non-operative management failure higher in those with appendicolith
- Satisfaction scores higher with surgery

Prospective study, Brown University[2]

- Appendectomy-free rate at 1 year **71%** (95% CI 50-87%)
- No perforation or complications
- Cost-utility: 0.007-0.03 QALM increase, $1,359 savings per non-operatively treated patient

[1]Tanaka Y, et al. *J Pediatr Surg*. 2015 Nov;50(11):1893-7
[2]Hartwich J, et al. *J Pediatr Surg*. 2016 Jan;51(1):111-6

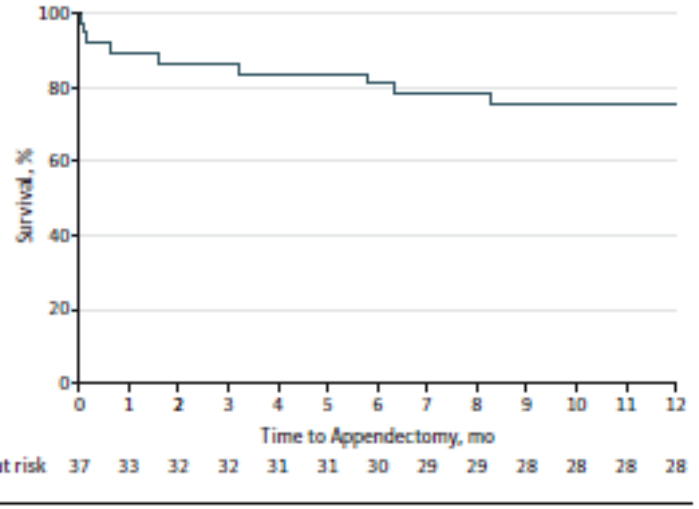
Research

Original Investigation

Effectiveness of Patient Choice in Nonoperative vs Surgical Management of Pediatric Uncomplicated Acute Appendicitis

- 65 chose appendectomy,
  37 chose non-operative management
- Non-operative management success rate 89% (95% CI 75-97) at 30 days
- 76% (95% CI 59-88) at 1 year
- Fewer disability days (8 vs. 21, p<0.001)
- Lower costs ($4,219 vs. $5,029, p=0.01)
- Children HRQOL 95.7 vs. 91.3, p=0.31
- Parent HRQOL 92 vs. 93, p=0.76

Figure 2. Kaplan-Meier Curve for the Success Rate of Nonoperative Management of Acute Appendicitis



Minneci et al. *JAMA Surg.* 2016;151(5):408-415.

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journal homepage: www.elsevier.com/locate/jpedsurg

High failure rate of nonoperative management of acute appendicitis with an appendicolith in children

- Trial stopped early over concerns with patient safety
- 60% failed non-operative management within 4.7 months
  - 52% failure rate based on two previous studies
- High proportion complicated appendicitis in surgical arm

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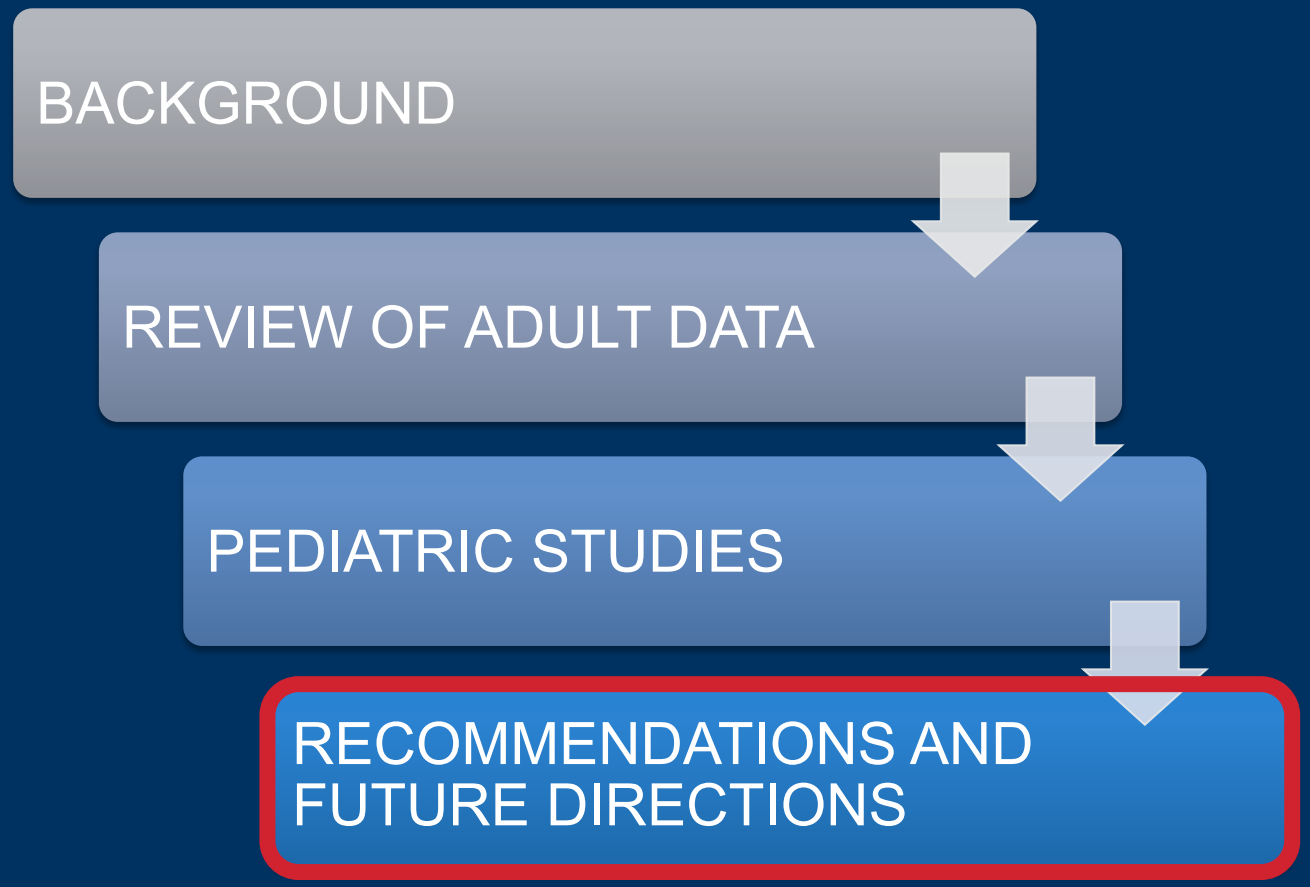


Adult Society Recommendations

- American College of Surgeons[1], Society for Surgery of the Alimentary Tract[2], World Society of Emergency Surgery[3]
- "May be effective, higher chance of recurrence"
- "Not a widely accepted treatment"
- "Inferior to traditional appendectomy…alternative treatment for patients for whom surgery is contraindicated"

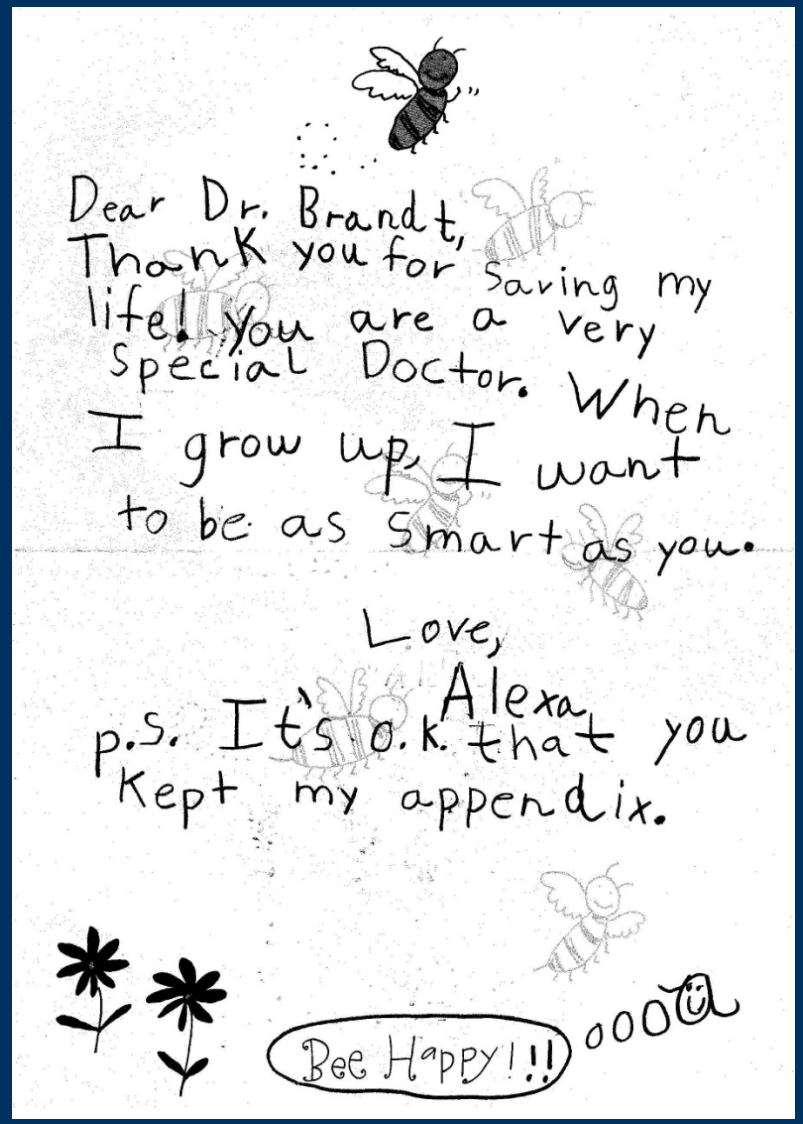
[1]American College of Surgeons. Operation brochures: appendectomy, 2014 (https:/ / www .facs .org/ education/ patient-education/ patient-resources/ operations)
[2]Society for Surgery of the Alimentary Tract. SSAT patient care guidelines: appendicitis(http://ssat .com/ guidelines/Appendicitis.cgi)
[3]Sartelli M, et al. 2013 WSES guidelines for management of intra-abdominal infections. World J Emerg Surg 2013; 8: 3

Conclusion

Appendectomy remains the gold standard for treatment of appendicitis in children

Non-operative management

- Success rate 63-76% within 1 year, low-quality evidence
- Selection important – fecalith presence is associated with unacceptable rate of failure
- Should only be offered under a clinical trial protocol



Dear Dr. Brandt,
Thank you for saving my life! You are a very special Doctor. When I grow up, I want to be as smart as you.

Love,
Alexa

p.s. It's o.k. that you kept my appendix.

Bee Happy!!!

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