Nonoperative Treatment of Appendicitis and Implications for Emergency Department Management: A Narrative Review

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For more than 100 years, physicians and patients considered appendicitis a surgical emergency requiring hospitalization for urgent removal of the obstructed and inflamed appendix to prevent rupture and sepsis. With the advent of modern imaging, uncomplicated appendicitis is identifiable, and later evidence showed that surgical delay does not increase the risk of appendiceal perforation. Perforation appears to be a separate disease, with uncomplicated appendicitis likely related to infection, which sometimes self-resolves. Most recently, studies compared nonoperative treatment of uncomplicated appendicitis with antibiotics and observation followed by selective surgery to urgent appendectomy, including 4 multicenter trials involving more than 2,000 adults and 2,000 children. The results led the American College of Surgeons to endorse nonoperative treatment of uncomplicated appendicitis as a safe alternative treatment. Furthermore, emergency department discharge and outpatient management appears feasible in as many as 90% of nonoperative treatment of uncomplicated appendicitis-treated patients. We review methods and results of these trials and evaluate implications for emergency care. [Ann Emerg Med. 2025;■:1-11.]

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INTRODUCTION

The aim of this article is to review nonoperative treatment of acute uncomplicated appendicitis for the emergency medicine clinician. We chose to critically review the 4 largest comparative trials of nonoperative treatment of uncomplicated appendicitis and urgent appendectomy to summarize methods and results, and then contextualize potential implications of nonoperative treatment of uncomplicated appendicitis for future emergency practice.[1-6] Investigations were identified through standard reference databases and article reference lists.[7-9] All studies were multicenter with >500 participants, including a recent large pediatric trial, and 3 subsequent cost-effectiveness analyses. One evaluated emergency department discharge and outpatient management and provides 2-year cancer follow-up. The studies represent approximately three-quarters of participants in comparative trials. Limitations of this narrative review include a less-than-comprehensive assessment of published studies and selections bias. Readers are referred to meta-analyses and systematic reviews of comparative studies, the last published for adults in 2025 and for children in 2020, which include smaller trials and quantitative analyses focused on appendectomy and complication rates.[7-9] Because of the dominance of the large trials, results of these meta-analyses are consistent with those presented in this review.

A BRIEF HISTORY OF OUR UNDERSTANDING OF APPENDICITIS AND ITS TREATMENT

By the end of the 19th century, Fitz established emergency appendicitis surgery as preferred over the medical treatment, which at that time was purgatives, laxatives, and bedrest.[10] It became apparent to physicians that surgery saved lives; over time, improvement in anesthesia and operative techniques, and introduction of antibiotics, made surgery safer. The advent of modern imaging in the 1990s allowed more accurate diagnosis. Uncomplicated appendicitis remained treated with urgent appendectomy; complicated (ruptured) appendicitis with abscess was treated with antibiotics and, if necessary, imaging-guided percutaneous drainage, and in some cases, later appendectomy followed.

Over this time, concepts about appendicitis pathophysiology evolved. The theory of luminal obstruction was abandoned and evidence emerged for the role of infection.[11,12] Epidemiological divergence of the increasing incidence of nonperforated and the stable incidence of perforated appendicitis suggested these are different diseases, with the latter related to unique genetic predisposition to an exaggerated inflammatory response.[13,14] More recently, evidence indicates surgical delay does not increase risk of perforation, further supporting that uncomplicated appendicitis is not a surgical emergency.[15] Some small randomized, double-blinded trials of antibiotics versus placebo for mild computed tomography (CT)-confirmed uncomplicated appendicitis in adults suggested that short-term self-resolution may occur in more than or equal to 70% of these cases.[16,17] Although people can lead healthy lives without an appendix, studies suggest a beneficial role in immunity and preserving gut microbiome, reporting an association between appendectomy and increased risk of intestinal cancer and recurrent *Clostridiodes difficile* infection.[18,19]

In 2020, based on comparative trials at that time, the American College of Surgeons, while continuing to endorse appendectomy, stated, "There is high-quality evidence that most patients with appendicitis can be managed with antibiotics instead of appendectomy," and, in 2025, added "this may result in fewer complications, less sick leave and less pain medication than surgery."[20,21]

NONOPERATIVE TREATMENT OF UNCOMPLICATED APPENDICITIS TRIAL DESIGNS

Four multicenter open-label trials compared nonoperative treatment of uncomplicated appendicitis, ie, initial antibiotics and observation, with appendectomy if worsening, no response, or recurrence, to initial urgent appendectomy (with perioperative antibiotics) in more than 2,000 adults and 2,000 children with acute uncomplicated appendicitis.[1-6] Three trials used randomized assignment and one used parent/child-directed treatment assignment in which between-group patient characteristics were similar.[2]

Trial entry criteria, methods, and outcomes are presented in the Table. Participants had localized appendicitis on examination, which was imaging confirmed and without evidence of major abscess or mass. Participant age ranged from children aged as young as 5 years to adults aged more than 80 years. Notably, the Comparison of Outcomes of antibiotic Drugs and Appendectomy (CODA) and APPY trials enrolled patients with appendicolith.[3,4] Exclusions included a prior appendicitis episode treated with antibiotics, pregnancy, immunocompromising condition, renal failure, and inflammatory bowel disease. Surgeons managed participants after hospital admission in all trials except CODA, which allowed emergency department discharge of stable nonoperative treatment of uncomplicated appendicitis-assigned participants. In all trials except Appendicitis Acuta (APPAC), most surgeries were done laparoscopically. For nonoperative treatment of uncomplicated appendicitis, trials employed various antibiotic regimens commonly used to treat community-acquired intrabdominal infection, first parenteral then oral, to complete 7 to 10 days total duration (Table).

In nonoperative treatment of uncomplicated appendicitis-assigned participants, appendectomy was performed if patients had clinical worsening or no improvement. Among trials, specific criteria for appendectomy varied from surgery for progressive infection at any time to no improvement after a 48-hour antibiotic trial unless earlier progression to severe sepsis or diffuse peritonitis. However, these conditions were neither monitored nor enforced, severe sepsis and diffuse peritonitis occurred rarely (less than 1%), and the decision to operate was subjective.

Three trials had a surgeon-defined noncomparative primary success outcome—1 year nonoperative treatment of uncomplicated appendicitis appendectomy rate—less than 20%, less than 25%, and less than 30%.[1,2,4] The Midwest Pediatric Surgical Consortium (MPSC) trial had disability as a coprimary outcome.[2] The CODA trial primarily evaluated nonoperative treatment of uncomplicated appendicitis noninferiority by a patient-centered general health measure, 30-day European Quality of Life-5 Dimensions, and also reported nonoperative treatment of uncomplicated appendicitis appendectomy rate.[3]

NONOPERATIVE TREATMENT OF UNCOMPLICATED APPENDICITIS TRIAL RESULTS

The Table shows outcomes from the 4 investigations which, among participants without appendicolith, can be summarized as follows: (1) about 90% of nonoperative treatment of uncomplicated appendicitis-assigned participants initially responded, with faster pain resolution, similar rare serious complication rate, several days less disability, and similar 30-day general health; and (2) over 1 year, about one-third of nonoperative treatment of uncomplicated appendicitis-assigned participants had appendectomy (Table).[1-4,6]

The chance of having appendectomy following nonoperative treatment of uncomplicated appendicitis

Table. Summary of major comparative clinical trials of appendectomy versus nonoperative treatment of acute uncomplicated appendicitis*.

					Secondary Outcomes Nonoperative Treatment of Acute Uncomplicated Appendicitis Vs Appendectomy (Statistical Test of Difference)		
Trial (y)	**Total No. of Participants**	**Age Range (y)**	**Notable Entry Criteria**	**Primary Outcomes Tested—Result**	**Complication/Serious Adverse Event Rate**	**Pain Resolution**	**Disability (d)**
APPAC (2015)[1]	530	18-60	Serum creatinine <1.7 mg/dL	Nonoperative treatment of acute uncomplicated appendicitis 1-y appendectomy rate <25%-27%	1-y complications—2.8% vs 20.5% vs ($P < .001$)[†,‡]	At hospital discharge (median, 3 d), median VAS/pain score—2.0 vs 3.0 ($P < .001$)	Median 7 vs 19 ($P < .001$)
CODA (2020)[3,6]	1,552	≥18	Included patients with appendicolith (27%)	30-d EQ-5D score— nonoperative treatment of acute uncomplicated appendicitis noninferior; nonoperative treatment of acute uncomplicated appendicitis 1-y appendectomy rate (observational) - no appendicolith - 36%, appendicolith - 52%	90-day NSQIP complications - 5% vs 3% (NS); serious adverse events—3% vs 3% (NS)[§]	Not reported	Mean 5.3 vs 8.7 (upper bound of 95% CI of rate ratio <1)
MPSC[‖] (2020)[2]	1,068	7-17	WBC 5-18,000/μL and pain <48 hours	Nonoperative treatment of acute uncomplicated appendicitis 1-y appendectomy rate <30%-33%	1-y complicated appendicitis—3.6% vs 3.3% (NS)[‡]	Not reported	Mean 6.6 vs 10.9 ($P < .001$)
APPY (2025)[4]	936	5-16	Included patients with appendicolith (12%)	Nonoperative treatment of acute uncomplicated appendicitis 1-y appendectomy rate <20%-34%	1-y mild-to-moderate AEs—8% vs 2% ($P < .001$)[¶]; serious adverse events 0% vs 0%	Postdischarge (median stay, 1 d) days taking pain medication—0 vs 3 ($P < .001$)	Median 1 vs 4 ($P < .0001$)

AE, Adverse event; *APPAC*, Appendicitis Acuta; *CODA*, Comparison of Outcomes of antibiotic Drugs and Appendectomy; *CI*, confidence interval; *EQ-5D*, European Quality of Life-5 Dimensions; *MSPC*, Midwest Pediatric Surgery Consortium; *NS*, nonsignificant; *NSQIP*, National Surgery Quality Improvement Program; *VAS*, visual analog scale; *WBC*, total peripheral white blood cell count.

*Trials defined uncomplicated appendicitis as clinically suspected and imaging-confirmed localized appendicitis without major abscess. Common exclusions were diffuse peritonitis, severe systemic illness (eg, severe sepsis/septic shock), pregnancy, and mass suggested on imaging. For nonoperative treatment of acute uncomplicated appendicitis, trials used various antibiotic regimens commonly used to treat community-acquired intrabdominal infection. Parenteral regimens included ertapenem (APPAC), piperacillin-tazobactam (MPSC), and others, such as cefoxitin, ceftriaxone plus metronidazole, and ciprofloxacin or levofloxacin plus metronidazole (CODA).[1-3]Parenteral antibiotic choice in the APPY trial was dictated by institutional standards.[4] Oral regimens, to complete 7 to 10 days total, included levofloxacin or ciprofloxacin plus metronidazole (APPAC, CODA, and APPY), cefdinir plus metronidazole (CODA), and amoxicillin-clavulanate (APPY).[1-4]

[†]More than 90% of surgery group complications were surgical wound infections and postoperative abdominal pain.

[‡]The APPAC and MPSC studies did not report serious complications.

[§]In the CODA trial's appendicolith subgroup, 90-day complication and serious adverse event rates in the nonoperative treatment of acute uncomplicated appendicitis and appendectomy groups were 14% vs 3% (lower bound of the 95% CI of the rate ratio more than 1) and 6% vs 4% (lower bound of the 95% CI of the rate ratio less than 1), respectively. In the subgroup without appendicoith, 90-day complication and serious adverse event rates in the nonoperative treatment of acute uncomplicated appendicitis and appendectomy groups were 2% vs 3% (lower bound of the 95% CI of the rate ratio more than 1) and 2% vs 3% (lower bound of the 95% CI of the rate ratio more than 1), respectively.

[‖]The MPSC trial had disability as a coprimary outcome.

[¶]85% of antibiotic-group mild-to-moderate AEs were gastrointestinal distress.

diminishes rapidly over time, with more than half of participants having appendectomy in the first month.[3,4] In the APPAC trial, cumulative annual appendectomy rates at 1 through 5 years were 27%, 34%, 35%, 37%, and 39%, respectively; 8% of participants who had later appendectomy had negative pathology.[5] In the CODA trial's non-appendicolith subgroup, 1- and 2-year rates were 36% and 42%, respectively.[6] Studies with longer-term outcomes, at 5 years in children and over 1 to 2 decades in adults, reported appendectomy after 1 year occurring in 3% to 12% of nonoperative treatment of uncomplicated appendicitis-managed patients and no serious late complications.[22-24] Longer-term observations are limited by lack of clinical and pathological data to confirm recurrence, and patients being lost to follow-up. Recurrence following nonoperative treatment of uncomplicated appendicitis would include an additional emergency department visit. Over 3 to 12 months, the APPY and MSPC pediatric trials found fewer or no more other return emergency department visits and the CODA trial found more adult return visits among nonoperative treatment of uncomplicated appendicitis-assigned participants.[2-4] Surgery for recurrence has been demonstrated as safe as surgery at the outset, although antibiotic retreatment is also an option.[2,5,25]

Nonserious adverse events occurred more frequently in the APPAC trial surgery group and the APPY trial nonoperative treatment of uncomplicated appendicitis group, and between-group rates in the CODA and MPSC trials were similar.[1-4] The APPAC, MPSC, and APPY trials reported no serious adverse events.[1,2,4] In the CODA trial, serious adverse events occurred in 3% of both groups, most of which were non-ICU hospitalizations unrelated to appendicitis.[3] Serious adverse events included one nonoperative treatment of uncomplicated appendicitis-treated participant with septic shock requiring pressors and one with a severe antibiotic reaction, and one surgery-treated participant requiring blood transfusion (less than 0.2% each); surgeries more extensive than appendectomy occurred in about 1% of each group. No death occurred in nonoperative treatment of uncomplicated appendicitis- or surgery-assigned participants in any of the major trials.

Pathology-negative (unneeded) appendectomy rates ranged from 1% to 8.5%.[1-4] Laparoscopic appendectomy complication rates per 1,000 operations are estimated as follows: wound infection—38, intra-abdominal abscess—20, and small bowel obstruction—3.[26,27] The 30-day case-fatality rate associated with appendectomy among patients with nonperforated appendicitis is approximately 0.5 per 1,000, and twice as high in elderly compared with adolescents.[28]

NONOPERATIVE TREATMENT OF UNCOMPLICATED APPENDICITIS TRIAL METHODOLOGICAL LIMITATIONS

Because a blinded, sham operation model is not possible, trials were open, and susceptible to biases of participants and surgeons who cared for hospitalized nonoperative treatment of uncomplicated appendicitis-assigned patients.[29] At the time, surgeons with little nonoperative treatment of uncomplicated appendicitis experience and variable clinical equipoise subjectively evaluated participants being observed while treated with antibiotics. Appendectomy was accepted as standard and safe but nonoperative treatment of uncomplicated appendicitis's safety was still being evaluated, which potentially led to premature antibiotic discontinuation and appendectomy. Almost all nonoperative treatment of uncomplicated appendicitis appendectomies during initial hospitalization were done before 48 hours among participants with unresolved localized pain, although analgesia was not standardized. In the CODA trial, about 30% fewer appendectomies happened in emergency department discharged compared with hospitalized participants (at 7 days, 9.9% versus 14.1, respectively), including when severity-adjusted (risk difference −4.0 percentage points; 95% confidence interval [CI], −8.7 to 0.6).[30] This may be explained by less opportunity for unnecessary surgery and a longer antibiotic trial interval without concern for prolonging hospitalization.

Participant-directed crossover from nonoperative treatment of uncomplicated appendicitis assignment to surgery without clinical worsening occurred in these trials. This crossover accounted for as many as 20% to 30% of early nonoperative treatment of uncomplicated appendicitis "failures."[2,3] Some later interval surgeries were performed.[1,3] In the CODA trial, those who believed that antibiotics could be completely successful prior to knowledge of their nonoperative treatment of uncomplicated appendicitis assignment had a 13 percentage point lower frequency of appendectomy at 30 days than those unsure or doubting its effectiveness (adjusted risk difference,−13.5; 95% CI −24.6 to −2.4), suggesting participant bias affected appendectomy decisions.[31] Antibiotic retreatment, which was either not allowed or used rarely in these trials, can be effective for recurrences and might have decreased the later nonoperative treatment of uncomplicated appendicitis appendectomy rate.[25] Accounting for these potential biases and trial methods, it is plausible that nonoperative treatment of uncomplicated appendicitis efficacy is more than that reflected by the major trials' results and the

1-year appendectomy rate with an adequate antibiotic trial is closer to 15%.[29]

The trials' relatively low negative appendectomy rate of 1% to 8.5% in surgery-assigned patients suggests selection bias compared with the rate among concurrent nonenrolled patients with appendicitis (16% in the APPAC trial).[1] Study eligibility criteria required confirmed appendicitis. Appendicitis would presumably be more difficult to treat medically and more likely to recur than non-appendicitis (eg, mesenteric adenitis), which may have biased against nonoperative treatment of uncomplicated appendicitis and minimized the frequency of unnecessary operations in the surgery group.

Trials excluded pregnant women and children aged less than 5 years; for these patients and adults of advanced age, there is limited nonoperative treatment of uncomplicated appendicitis experience.[32,33] It is unclear if a specific antibiotic regimen is superior as there are no comparative trials.

THE APPENDICOLITH SUBGROUP CONTROVERSY

An appendicolith is an inspissated piece of calcified stool. It is found in approximately 25% of patients with appendicitis confirmed on imaging and associated with an increased likelihood of appendiceal rupture.[34] It is unclear whether the appendicolith causes rupture or impairs healing. Controversy exists as to whether appendicolith presence is a contraindication to nonoperative treatment of uncomplicated appendicitis, and it was an exclusion criterion in two of the major trials.[1,2]

The CODA trial included adults with appendicolith (27% of participants) and found (1) more nonoperative treatment of uncomplicated appendicitis appendectomies among participants with than without appendicolith, at 1 and 2 years, 52% versus 36% and 54% versus 42%, respectively, and (2) among those with appendicolith, more complications in the nonoperative treatment of uncomplicated appendicitis than the surgery group at 90 days, occurring in 14% versus 3% of participants, respectively (rate ratio, 4.80; 95% CI 1.9 to 12.2).[3,6] As open trials, surgeons were aware of both treatment assignment and CT findings (including other reported "risk factors" for nonoperative treatment of uncomplicated appendicitis failure, eg, appendiceal diameter more than or equal to 15 mm). Knowledge of appendicolith presence possibly lowered the threshold to operate on nonoperative treatment of uncomplicated appendicitis-assigned participants.

Different complication rates between nonoperative treatment of uncomplicated appendicitis- and surgery-assigned participants may have related to more nonoperative treatment of uncomplicated appendicitis appendectomies within the first 24 and 48 hours in the appendicolith subgroup—approximately 9% and 22% of participants with and 6% and 8% without appendicolith, respectively. Rupture and associated National Surgery Quality Improvement Program-defined complications (eg, abscess) found in the first 24 to 48 hours were attributed to nonoperative treatment of uncomplicated appendicitis whereas CT-missed rupture found at initial operation among surgery-assigned participants, observed in 24% with and 13% with and without appendicolith, was not. This biased against nonoperative treatment of uncomplicated appendicitis by potentially assigning existing abnormalities missed by CT as complications, particularly in the appendicolith subgroup. Further, NOTA-assigned participants with appendicolith and slower to respond will tend to be operated early and are expected to more often be found to have complicated appendicitis than patients undergoing routine surgery; if treated only with appendectomy, this alone would not be considered a difference in adverse event rate. Within 90 days, compared with urgent appendectomy, nonoperative treatment of uncomplicated appendicitis was associated with 59 fewer appendectomies and 6 more drainage procedures per 100 participants (6.6 versus 0.6 per 100 participants; risk ratio 11.1; 95% CI 1.4 to 86.6). Serious adverse event rate was 6% versus 4% (rate ratio, 1.7; 95% CI 0.6 to 4.5), and disability days were 6.1 versus 9.1 (rate ratio, 0.7; 95% CI 0.5 to 1.1), respectively. The rate of increase in subsequent appendectomies after 90 days and through 1 year was similar among nonoperative treatment of uncomplicated appendicitis-treated participants with and without appendicolith.[6]

In 2020, the American College of Surgeons stated, "patients with appendicolith who are treated with antibiotics have a higher risk of complications than those without appendicolith."[20] The pediatric APPY study included patients with appendicolith (12%), and did not report associated outcomes separately; no serious adverse events were reported in the nonoperative treatment of uncomplicated appendicitis group.[4]

MISSED APPENDICEAL CANCER CONCERN

In rare instances, cancer may cause appendicitis or symptoms mimicking appendicitis, and it also may be found incidentally on appendectomy. In a study of 21,069 appendectomy specimens, cancer detection was at 0.9% frequency, with a lower incidence of detection among those aged less than 50 years and among those with uncomplicated appendicitis.[35] Thus, nonoperative

treatment carries a small potential risk of delayed pathologic diagnosis and disease progression. However, occult malignancy has been rarely found among CT-screened adults with uncomplicated appendicitis qualifying for nonoperative treatment of uncomplicated appendicitis (less than 1%), and this is not an issue in children.[5,36]

A 2-year follow-up of CODA-qualifying patients treated with antibiotics who were without radiographic suspicion for neoplasm found subsequently discovered cancer occurred in 5 of 1,033 (0.5%).[36] The median time to diagnosis was 3 months, and there was no evidence of significant prediagnosis progression; all tumors were stage 1 pathology. Pátková et al[22] found no late-detected cancers over a 2-decade surveillance.

EMERGENCY DEPARTMENT DISCHARGE AND OUTPATIENT MANAGEMENT

In all major trials except CODA, nonoperative treatment of uncomplicated appendicitis-assigned participants were hospitalized. The CODA trial allowed emergency department discharge and outpatient management, a feature first described in 2015 in a single-center pilot trial that demonstrated its feasibility in 14 of 15 (93%) of participants (1 was hospitalized).[37,38] In a CODA trial subanalysis, 335 (46%; range, 0% to 89% by site) of 726 nonoperative treatment of uncomplicated appendicitis-treated adults were discharged from the emergency department after receiving a longer-acting parenteral antibiotic regimen, being observed as stable, tolerating oral intake, and with pain controlled (Box 1).[30] In contrast, 95% of appendectomy-assigned participants were initially hospitalized, with the remaining 5% discharged after same-day surgery.[3] In nonoperative treatment of uncomplicated appendicitis-treated participants, discharge pain regimen included acetaminophen/ibuprofen and a limited supply of hydrocodone (eg, 10 tablets) for breakthrough symptoms. Participants were prescribed an additional 9 days of oral antibiotics, given access to telephone/clinic follow-up, and advised to call/return for worsening or no improvement after 48 hours.

In this subanalysis, outpatient management was found safe and effective. Over 7 days, serious adverse events occurred in 0.9 (95% CI 0.2 to 2.6) per 100 outpatients and 1.3 (95% CI 0.4 to 2.9) per 100 inpatients and emergency department discharge was associated with fewer appendectomies, and 1 day less disability than hospitalization (2.6 days; 95% CI 2.3 to 2.9 days versus 3.8 days; 95% CI 3.4 to 4.3 days). Compared with those who were hospitalized, the frequency of emergency department return visits within the first week was not significantly increased among nonoperative treatment of uncomplicated appendicitis-treated participants who had emergency department discharge and outpatient management. Of 25 CODA sites, the center where the pilot trial had been conducted had the highest proportion with emergency department (ED) discharge, 99 of 111 nonoperative treatment of uncomplicated appendicitis-assigned participants (89%), consistent with the pilot's results. Practice experience may increase comfort with and use of emergency department discharge.

Other adult trials have confirmed the safety of outpatient management and showed all-oral antibiotic treatment could also be succesful.[38,39] Less experience exists with outpatient treatment in children; a recent small pediatric series (n=20) found outpatient management to be feasible and effective (over 1 year, 2 [10%] had appendectomy and there were no complications), although safety will need to be demonstrated in a larger sample.[40]

COST AND POPULATION HEALTH CONSIDERATIONS

Cost-effectiveness analyses for the APAAC, MPSC, and CODA trials all favored nonoperative treatment of uncomplicated appendicitis, including for patients with appendicolith.[41-43] Based on the CODA trial, increasing nonoperative treatment of uncomplicated appendicitis treatment from 20% to 50% of uncomplicated appendicitis cases among adults in the United States would be associated with an estimated overall annual decrease in societal economic costs of $192 million.[43] Limitations of these analyses include failure to consider treatment of recurrence with antibiotics, more outpatient nonoperative treatment of uncomplicated appendicitis care and same-day surgeries, and ED discharge in the CODA trial analysis being assigned one inpatient day instead of outpatient cost.

In the CODA trial's Spanish-speaking subgroup (476 [31%] of 1,552 total participants), 83% reported poverty-level income and over half lacked insurance.[44] Disability has an exaggerated effect on disadvantaged patients, who more frequently engage in less flexible work without paid leave and who have limited savings.[45] Notably, among the Spanish-speaking cohort, the total duration and difference in lost work days related to appendectomy compared with nonoperative treatment of uncomplicated appendicitis were more than that of the overall CODA population—14 versus 7 days compared with 9 versus 5 days, respectively.[46]

Box 1. Candidates for and outcomes associated with nonoperative treatment of appendicitis

Candidates*
- Clinical diagnosis of localized appendicitis without examination findings of diffuse peritonitis or imaging evidence of abscess, phlegmon, perforation, or tumor
- Hemodynamic stability without evidence of severe sepsis/septic shock
- Nonpregnant, no immunocompromising condition or history of inflammatory bowel disease
- Age more than 5 y

Outcomes— nonoperative treatment of acute uncomplicated appendicitis versus appendectomy[1-6,22-25]
- 90% initially respond and two-thirds avoid surgery (less if appendicolith is identified)†
- After inital response, about 20% to 30% have recurrence; recurrence risk decreases with time and is uncommon after 1 y
- Appendectomy for recurrence is as safe as if done initially, and antibiotic retreatment can also be effective
- Several days faster acute pain resolution and less disability
- No more rare serious complications
- ED discharge and outpatient management is possible
- Appendectomy results in permanent cure; in up to 16% of cases, no appendicitis is found and the surgery was unnecessary
- Death has not been reported for a nonoperative treatment of acute uncomplicated appendicitis-qualified and nonoperative treatment of acute uncomplicated appendicitis- or surgery-treated patient among more than 4,000 children and adults studied in major trials

Treatment
- Intravenous ceftriaxone *plus* metronidazole, or ertapenem, or piperacillin-tazobactam intravenous‡ followed by
- Oral cephalosporin or fluoroquinolone *plus* metronidazole, or amoxicillin/clavulanate alone to complete 7 to 10 days total treatment duration
- Acetaminophen and ibuprofen; as needed hydrocodone to control pain
- As needed ondansetron for nausea

Discharge instructions
- Contact your primary care physician (or consulting surgeon) or return if worsening at any time or no improvement after 48 hours.

*Trials had varied nonoperative treatment of acute uncomplicated appendicitis qualification. Some trials excluded patients with imaging-identified appendicolith, a total white blood cell count less than 5,000/μL or more than 18,000/μL, or abdominal pain duration of more than 48 hours.[1-4] Pediatric trials did not enroll children aged less than 5 years, and one adult trial excluded patients aged >60 years.
†Nonoperative treatment of acute uncomplicated appendicitis appendectomy rate is an estimate of the rate after 1 year reported from 4 major comparative trials involving more than 2,000 children and 2,000 adults, which included some nonoperative treatment of acute uncomplicated appendicitis-assigned participants who later elected to have appendectomy without having had clinical worsening, including interval surgeries, and some with limited antibiotic trials (ie, less than 48 hours), and may underestimate nonoperative treatment of acute uncomplicated appendicitis's efficacy.[29] Antibiotic retreatment has also been demonstrated to be effective.[25]
‡Treatment with oral antibiotics alone (eg, moxifloxacin) has also been demonstrated to be effective.[38]

NONOPERATIVE TREATMENT OF UNCOMPLICATED APPENDICITIS AND EMERGENCY DEPARTMENT CARE NOW

A US national database report from 2016 to 2020 indicated that 11.7% of adults with acute uncomplicated appendicitis got nonoperative treatment of uncomplicated appendicitis.[47] Nonoperative treatment of uncomplicated appendicitis was used more among older adults with comorbidities, suggesting a lower rate among those without increased perioperative risk.

Slow uptake among patients may be due to a retained belief, now disproven, that an inflamed appendix will rupture and be fatal if not removed immediately.[48] However, based on surveys, once informed, most US adults and families with children indicated they would favor nonoperative treatment of uncomplicated appendicitis even if the associated appendectomy rate was 50%.[2,49] In the MPSC investigation, after receiving standardized information about treatment options, 35% of families chose nonoperative treatment of uncomplicated appendicitis, suggesting that currently, patient-shared decisionmaking may be incomplete or inconsistent.[2] Although some parents may prioritize sparing their child potential psychological trauma associated with hospitalization and surgery, others may want to avoid the anxiety of anticipated future episodes of abdominal pain.[50] Work responsibilities and expected future travel away from home may affect treatment choice. The established safe possibility of emergency department discharge and recovery at home may increase interest in nonoperative treatment of uncomplicated appendicitis. Slow uptake among surgeons may be due to a perspective of futility based on surgeon-defined appendectomy thresholds being exceeded in the major trials and effectiveness judged by first-time permanent cure as opposed to avoiding surgery, pain, and disability at no additional risk if appendicitis reoccurs.

Professional society guidelines and authors of all major trials emphasize that the choice between nonoperative treatment of uncomplicated appendicitis and appendectomy is optimal when the patient is informed of each approach and expected outcomes and engaged in shared decisionmaking. Emergency physicians routinely assist in

informing patients of what to expect. Many people with appendicitis will ask about their treatment options and nonoperative treatment of uncomplicated appendicitis, requiring emergency physicians to be knowledgeable and start an informed patient-shared decisionmaking process. Box 1 describes nonoperative treatment of uncomplicated appendicitis candidates, comparison of nonoperative treatment of uncomplicated appendicitis and appendectomy outcomes, and nonoperative treatment of uncomplicated appendicitis treatment.

With the safety of both nonoperative treatment of uncomplicated appendicitis and delayed appendectomy, emergency physicians are assisting on-call surgeons and operating room staff in deferring off-hour surgeries by placing stable patients on antibiotics to be seen in the morning. Demonstration that as many as 90% of emergency department adult patients presenting with acute uncomplicated appendicitis can be safely sent home on antibiotics has invited an even greater role for emergency physicians, who, in some cases, are now facilitating emergency department discharges following formal surgical consultation.

NONOPERATIVE TREATMENT OF UNCOMPLICATED APPENDICITIS AND EMERGENCY DEPARTMENT CARE GOING FORWARD

It would be logical to next see emergency physicians engaging patients primarily in shared decisionmaking regarding appendectomy or nonoperative treatment of uncomplicated appendicitis, with consideration of outpatient management. Surgical consultation could be obtained for patients wishing to further consider that option and nonoperative treatment of uncomplicated appendicitis-treated patients requiring inpatient observation. In the recent pediatric nonoperative treatment of uncomplicated appendicitis emergency department discharge series, Froelich at al[41] suggested outpatient management could be adopted at hospitals without surgical services (eg, rural centers); these patients would be under the care of an on-site emergency physician, perhaps in consultation with a surgeon at a regional pediatric center.[41] Telemedical consultation could facilitate emergency department care and primary care physician follow-up. Box 2 shows an example of an appendicitis treatment shared decisionmaking dialog and answers to common questions.

A 2025 American College of Surgeons report noted a growing shortage and maldistribution of general surgeons.[51] It has been estimated that about 10% of the US population experiences low access to any hospital with emergency surgical services, particularly in certain micrometropolitan and rural areas and most affecting uninsured and publicly insured minority comminuties.[52] Further, hospital operating capacity is increasingly challenged by higher priority surgeries. This new care model for appendicitis could improve critical surgical capacity for communities generally.

There are potential barriers to emergency physicians assuming a greater role in initial management of

Box 2. Example of uncomplicated appendicitis treatment shared decisionmaking dialog

Initiating shared decisionmaking statement

"There are two safe options for treatment of acute uncomplicated appendicitis with different advantages and disadvantages. The best choice depends on which outcomes are most important to you. Let's discuss."

Common questions and suggested answers

Q: "Won't the appendix burst and cause me to be very ill if I don't get surgery right away?"

A: "No, you have uncomplicated appendicitis, which can be safely treated with antibiotics alone or surgery."

Q: "My abdomen hurts so bad. Will my pain stop if you take out my appendix as soon as possible?"

A: "We can relieve your pain with medications now. The pain and need for pain medication stops and you can get back to work or school a few days sooner with antibiotic treatment compared to surgery to remove your appendix."

Q: "Which treatment will prevent me from experiencing this condition again?"

A: "If you choose to have surgery to remove the appendix, you will not experience appendicitis again. If you choose antibiotics, you will most likely avoid surgery now, but there is a risk of appendicitis coming back and needing future medical care. Let's review the outcomes you can expect with each treatment in detail to help you decide which you want."

Q: "If I get antibiotics and respond, will I have to worry about appendicitis coming back worse?"

A: "As time passes, so does the risk of appendicitis coming back. It is uncommon to come back after one year. If appendicitis should come back, it is no more difficult to treat than it is now. Re-treatment with antibiotics also is an option."

Q: "Will I need to stay overnight in the hospital?"

A: "If you choose to be treated with antibiotics, your condition remains stable, you are able to drink, and your pain can be controlled, then you can go home on oral antibiotics and medications to treat your pain. If you choose to have surgery, usually you will have to stay overnight in the hospital; sometimes we can arrange same-day outpatient surgery."

Q: "Surgery and general anesthesia scare me. I/someone I know had a bad previous experience."

A: "Each surgery is different. If you might want surgery, it is best to discuss this with a surgeon, whom I am happy to call for you."

appendicitis. Inertia must be overcome, particularly because of new responsibilities and care steps; this can be facilitated through education. Until present, appendicitis has been the surgeon's disease, but this followed from it being considered a surgical emergency requiring inpatient care. As patient options expand, surgeons may welcome emergency physicians' help to manage patients who choose nonoperative treatment of uncomplicated appendicitis and can be discharged on antibiotics. Codevelopment of interdepartmental protocols and case review would facilitate this care model. Patients' continuing care physicians would need to be comfortable with nonoperative treatment of uncomplicated appendicitis to advise and follow patients, whether they are surgeons or primary care.

New practices and responsibilities can arouse uncertainty about medical-legal risk. As with any treatment, an informed discussion is key. Close physician and site surveillance to assess care and outcomes can ease concerns. Virtual surgical consultation to review indications and coordinate follow-up would offer an added layer of security. Most importantly, nonoperative treatment of uncomplicated appendicitis data show safety that rivals traditional approaches.

Regarding concern for missing appendicitis, empirical outpatient antibiotics are now an option for low-risk cases to avoid CT-imaging-associated radiation for children and young adults and a greater risk of unnecessary surgery. Treatment of appendicitis recurrence with antibiotics could become an increasingly considered approach.

Clinical trials demonstrate the safety and efficacy of nonoperative treatment of uncomplicated appendicitis compared with initial appendectomy for acute uncomplicated appendicitis, earning the endorsement of surgical societies like the American College of Surgeons. Nonoperative treatment of uncomplicated appendicitis is surgery sparing and associated with less pain and faster recovery. Emergency department discharge and outpatient management is feasible in as many as 90% of nonoperative treatment of uncomplicated appendicitis-treated patients. Recurrence after nonoperative treatment of uncomplicated appendicitis can occur but the likelihood diminishes over time and its treatment poses no additional risk. Although uncomplicated appendicitis can no longer be considered a surgical emergency and appendectomy is no longer the only treatment option, it remains a standard approach that results in first-time cure.

Nonoperative treatment of uncomplicated appendicitis will be increasingly considered as experience and confidence grows among physicians and as awareness grows among patients in this new treatment option. Emergency physicians are being asked about nonoperative treatment of uncomplicated appendicitis and have an important role now to inform patients of their treatment options and expected associated outcomes, and an emerging role in expanding access to safe and cost-effective care for patients with appendicitis, including those who can be managed by nonoperative treatment of uncomplicated appendicitis as outpatients.

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