ACUTE APPENDICITIS: A COMPREHENSIVE EVIDENCE-BASED REVIEW OF A COMMON SURGICAL DISEASE

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Abstract
Acute appendicitis remains among the most frequent indications for urgent abdominal surgery worldwide and continues to evolve as a disease area due to advances in risk stratification, imaging, minimally invasive surgery, and antibiotic-first strategies for selected patients. This review synthesizes current evidence on definitions, etiopathogenesis, clinical presentation, diagnostic pathways, non-operative and operative treatments, complications, prognosis, and emerging approaches—including outpatient antibiotic protocols, refined imaging algorithms, and shared decision-making frameworks. Emphasis is placed on practical, evidence-based management tailored to disease severity and patient factors, with attention to ongoing controversies and future research directions.

Keywords: acute appendicitis, appendectomy, antibiotics-first, AIR score, Alvarado score, CT imaging, laparoscopic surgery, appendicolith, complicated appendicitis

Introduction

Acute appendicitis (AA) is a leading cause of acute abdomen and emergency hospital admission, particularly in adolescents and young adults, but it occurs across all ages. Historically, appendectomy was considered definitive and urgent for virtually all patients. Over the last decade, however, practice has shifted toward (i) more systematic clinical risk stratification, (ii) optimized imaging pathways to reduce negative appendectomy, and (iii) selective non-operative management (NOM) with antibiotics for imaging-confirmed uncomplicated disease. Major guidelines—such as the World Society of Emergency Surgery (WSES) 2020 update and the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) guideline—reflect this nuanced approach, emphasizing disease severity, appendicolith status, and shared decision-making.

Methods

A targeted narrative literature review was performed focusing on contemporary evidence relevant to epidemiology, diagnostic strategies, surgical and non-surgical management, and outcomes in acute appendicitis. Priority was given to international guidelines, randomized trials comparing antibiotics with appendectomy, and recent systematic reviews/meta-analyses on diagnostic scoring systems, imaging, and operative approaches.

Definition and Classification

Acute appendicitis is inflammation of the vermiform appendix, typically presenting as acute right lower quadrant (RLQ) abdominal pain. Clinically, AA is commonly categorized into:

- Uncomplicated appendicitis: inflamed appendix without perforation, abscess, or phlegmon.
- Complicated appendicitis: perforation, gangrene, diffuse peritonitis, periappendiceal abscess, or inflammatory phlegmon.

This distinction is central to management decisions, because uncomplicated disease may be eligible for NOM, while complicated disease generally requires source control and broader antibiotic strategies.

Etiology, Pathogenesis, and Risk Factors

Etiology and Pathogenesis

The classic pathophysiologic model involves luminal obstruction (e.g., fecalith/appendicolith, lymphoid hyperplasia), leading to increased intraluminal pressure, venous congestion, bacterial overgrowth, ischemia, and potential perforation. Importantly, contemporary imaging and histopathology data suggest appendicitis may represent a spectrum of inflammatory phenotypes rather than a single linear progression in all patients—supporting why some cases respond to antibiotics alone.

Risk Factors

- Age: peak incidence in teens to young adults.
- Appendicolith: associated with increased risk of complications and higher likelihood of failure with antibiotics-first strategies.
- Diagnostic context: pregnancy, extremes of age, and immunocompromised states can produce atypical presentations and higher diagnostic uncertainty, increasing reliance on imaging algorithms.

Clinical Presentation

Typical Symptoms

- Periumbilical pain migrating to RLQ
- Anorexia, nausea, vomiting
- Low-grade fever
- Worsening pain with movement/cough

Physical Findings

- RLQ tenderness (McBurney point), guarding, rebound
- Rovsing, psoas, obturator signs (variable sensitivity)
- In complicated disease: generalized peritonitis, tachycardia, systemic toxicity

Atypical Presentations

- Children: non-specific abdominal pain, irritability, diarrhea
- Older adults: less pronounced pain and fever; higher perforation risk
- Pregnancy: displaced appendix; pain may be higher; imaging strategy differs

Diagnosis

Accurate diagnosis balances speed, avoidance of missed perforation, and reduction of unnecessary surgery. Modern pathways integrate clinical scoring, labs, and imaging.

Laboratory Tests

- CBC: leukocytosis (not universal)
- CRP: supports inflammation; may help severity assessment when combined with clinical scoring

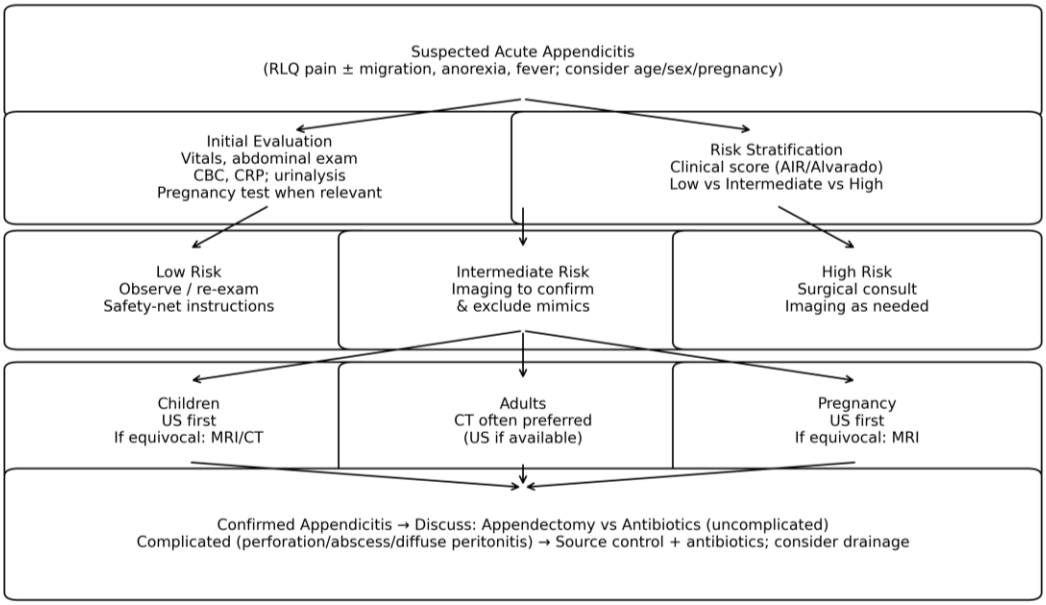

Figure 1. Practical Diagnostic Pathway for Suspected Acute Appendicitis

Clinical Scoring Systems

Scores are best used to risk-stratify rather than replace imaging.

- Alvarado score: widely used; moderate accuracy overall; useful as an adjunct, especially in children but insufficient as a stand-alone test.
- AIR (Appendicitis Inflammatory Response) score: designed to improve discrimination and identify higher-risk (potentially complicated) cases; prospective validations support its utility for decision support and triage.

Imaging

Imaging choice varies by age and pregnancy status and has become central to reducing negative appendectomy.

- Adults: CT is commonly suggested as an initial modality because it is highly accurate and can identify alternative diagnoses.
- Children: ultrasound (US) is generally preferred first; MRI or CT is used when US is equivocal.
- Pregnancy: US first; if non-diagnostic, MRI is suggested as the next step.

Treatment Options

Treatment is determined by disease severity, appendicolith status, patient comorbidity, local resources, and patient values.

Non-Operative Management (Antibiotics-First) for Uncomplicated Appendicitis

Randomized evidence supports antibiotics as a reasonable option for selected patients with imaging-confirmed uncomplicated appendicitis.

- The CODA trial showed antibiotics were noninferior to appendectomy on a general health-status measure in the short term, but a substantial minority required appendectomy within months; outcomes were worse when an appendicolith was present.
- Recent meta-analytic evidence suggests that many adults avoid surgery at 1 year with antibiotics-first, but appendicolith increases complication risk and step-up appendectomy rates.
- Other meta-analyses report lower "complication-free" success with antibiotics compared with surgery, emphasizing the importance of counseling about recurrence and failure risk.

Practical implications: Antibiotics-first management is best framed as a shared decision in which patients accept a higher probability of recurrence/late appendectomy in exchange for avoiding immediate surgery.

Operative Management: Appendectomy

Appendectomy remains the most definitive option and is mandatory or strongly preferred in many settings (e.g., diffuse peritonitis, failure of antibiotics, suspected neoplasm, unclear diagnosis with clinical deterioration).

- Laparoscopic appendectomy is widely favored due to improved recovery, lower wound complications in many settings, and better visualization—especially important in females of reproductive age and in diagnostic uncertainty. Guideline recommendations and large observational data continue to support laparoscopy as the dominant approach where available.
- In children and complicated appendicitis, meta-analytic evidence supports laparoscopy's overall favorable complication profile compared with open surgery.

Complicated Appendicitis (Abscess, Phlegmon, Perforation)

Management is more individualized:

- Diffuse peritonitis/perforation: urgent surgery plus antibiotics is standard.
- Abscess/phlegmon: antibiotics with or without percutaneous drainage may be appropriate, with surgery considered as a step-up strategy or interval appendectomy in selected cases depending on recurrence risk and suspicion of other pathology.

Potential Complications

Disease-Related

- Perforation → peritonitis, sepsis
- Periappendiceal abscess or phlegmon
- Bowel obstruction (ileus or inflammatory adhesions)
- Rare: pylephlebitis (portal venous thrombosis), especially in delayed presentations

Treatment-Related

- Postoperative surgical site infection (SSI), intra-abdominal abscess
- Anesthesia-related complications
- With antibiotics-first: recurrence, delayed perforation (uncommon with appropriate selection), and antibiotic adverse effects

Meta-analytic and guideline syntheses emphasize that appendicolith status meaningfully increases complication risk in antibiotic-first strategies.

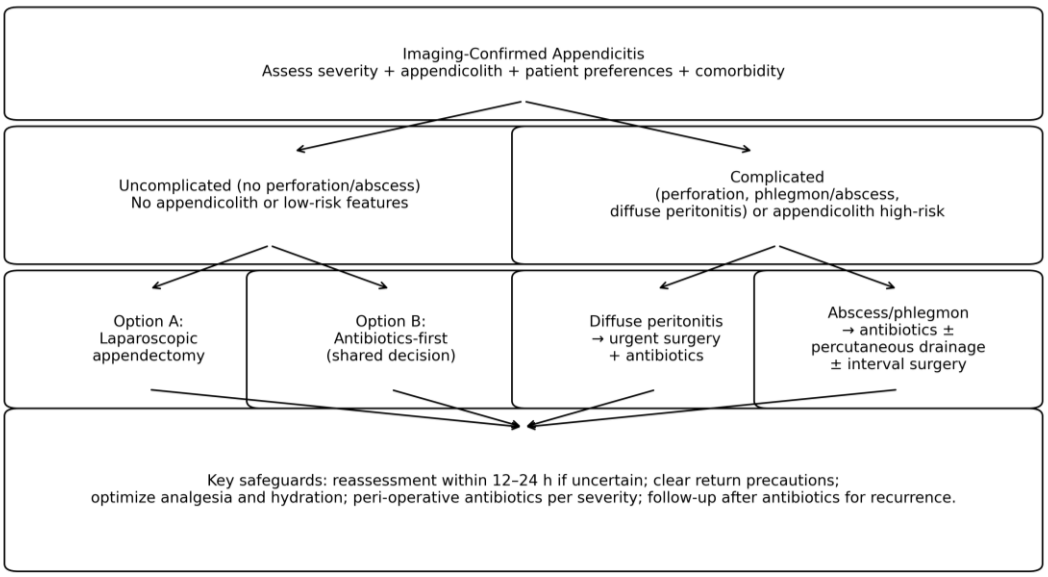

Figure 2. Contemporary Management Framework for Acute Appendicitis

Prognosis

Overall prognosis is excellent with timely diagnosis and appropriate management. Uncomplicated appendicitis treated surgically has high definitive cure rates. Antibiotics-first strategies can yield good quality-of-life outcomes in the short term but carry a measurable probability of recurrence or later appendectomy, particularly when appendicolith is present.

In complicated appendicitis, prognosis depends on time to source control, physiologic reserve, and adequacy of antibiotic therapy and drainage when needed.

Recent Advances and Evolving Controversies

1. Refined imaging pathways (age-/pregnancy-specific): Updated guidance increasingly formalizes "US-first" strategies in children and pregnancy, with MRI as second-line, while CT remains central in adults due to diagnostic breadth.
2. Guideline-driven shared decision-making: SAGES (2024) highlights persistent controversies and supports individualized decisions between antibiotics and surgery, anchored in evidence quality and patient preferences.
3. Improved risk stratification: AIR score evidence (including pooled diagnostic accuracy analyses) supports more reliable triage into low-, intermediate-, and high-risk groups, potentially reducing unnecessary imaging or operations in select settings.
4. Antibiotic-first optimization: Contemporary meta-analyses continue to refine which subgroups are most suitable (e.g., imaging-confirmed uncomplicated disease without appendicolith) and how outcomes should be communicated (recurrence vs immediate surgical risk).
5. Minimally invasive surgery as dominant standard: Large-scale practice patterns demonstrate increasing laparoscopic utilization over time, reinforcing laparoscopy's central role when resources and expertise permit.

Conclusion

Acute appendicitis is no longer managed with a single default strategy. Instead, it is best approached as a spectrum of disease severity requiring structured clinical assessment, judicious imaging, and

evidence-based tailoring of therapy. Appendectomy—particularly laparoscopic—remains definitive, broadly applicable, and highly effective. Antibiotics-first management is an increasingly validated option for selected patients with imaging-confirmed uncomplicated appendicitis, provided clinicians communicate recurrence and failure risks clearly and screen carefully for high-risk features such as appendicolith. As updated guidelines and meta-analyses continue to sharpen diagnostic and therapeutic thresholds, modern appendicitis care is increasingly characterized by risk stratification, minimally invasive techniques, and shared decision-making that aligns outcomes with patient priorities.

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