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Research Article

Timing of Appendectomy and Postoperative Outcomes in Adult Acute Appendicitis: Systematic Review and Meta-Analysis

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Abstract: The optimal timing of appendectomy for acute appendicitis in adults remains debated. Advances in imaging and perioperative care have questioned the necessity of immediate surgery. This systematic review and meta-analysis evaluated whether moderate, in-hospital delays in appendectomy impact rates of postoperative complications or surgical site infection (SSI). A systematic search of PubMed, Embase, Scopus, and Web of Science through July 2025 identified randomized trials and cohort studies comparing early (≤6–8 hours) versus delayed (>6–12 hours) appendectomy in adults. Primary outcomes were composite postoperative complications and SSI. Random-effects models were used to pool risk ratios (RR) and 95% confidence intervals (CI). Five studies (over 600,000 adults) were included. Meta-analysis demonstrated no significant difference in composite complications between early and delayed appendectomy (RR 1.07, 95% CI: 0.62–1.85, p=0.81). Similarly, the risk of SSI was not different between groups (RR 1.16, 95% CI: 0.49–2.73, p=0.74). Heterogeneity was moderate for both outcomes. Secondary endpoints, including readmission, mortality, and length of stay, also showed no clinically meaningful differences by surgical timing. Only prolonged delays beyond 24-48 hours were associated with increased risk in select cohorts. For clinically stable adults with acute appendicitis, a short in-hospital delay in appendectomy typically up to 12 or 24 hours does not increase the risk of postoperative complications or surgical site infection. Flexible scheduling is safe when accompanied by prompt diagnosis and antibiotics, while prolonged or unplanned delays should be avoided.

Keywords: Appendectomy; Appendicitis; Delayed; Early; Surgical Timing

1. Introduction

Acute appendicitis is widely recognized as the most common surgical emergency in adults, with a lifetime risk estimated at 7–8% in Western countries (Ferris et al., 2017). The classic teaching has long been that appendicitis, if left untreated, will inevitably progress to perforation, generalized peritonitis, and even death, thereby justifying urgent or emergent appendectomy as the standard of care. However, contemporary evidence indicates that the natural history of appendicitis is more heterogeneous than previously assumed, and not all cases follow a predictable progression toward perforation (Bhangu et al., 2015; Di Saverio et al., 2020). Consequently, the necessity of immediate surgical intervention for every patient has increasingly been questioned. Current understanding conceptualizes acute appendicitis as a disease spectrum ranging from mild, uncomplicated inflammation to complicated conditions such as gangrene, perforation, and intra-abdominal abscess (Bhangu et al., 2015; Di Saverio et al., 2020).

This heterogeneity has encouraged clinicians to adopt a more nuanced approach to diagnosis and management. Rather than applying a uniform strategy of immediate surgery, treatment decisions are increasingly tailored to disease severity, clinical stability, and patient-specific risk factors. Significant improvements in diagnostic imaging, particularly the widespread availability of computed tomography (CT) and ultrasonography, have transformed the evaluation of suspected appendicitis (Chooi et al., 2007). These modalities

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have markedly improved diagnostic accuracy, reduced negative appendectomy rates, and enhanced clinicians' ability to distinguish uncomplicated from complicated appendicitis. Accurate imaging facilitates early risk stratification and supports individualized management strategies (Chooi et al., 2007; Bhangu et al., 2015).

Another major advancement influencing appendicitis management is the routine use of perioperative antibiotics. Early administration of broad-spectrum antibiotics can suppress bacterial proliferation, slow inflammatory progression, and reduce the risk of perforation and postoperative infectious complications (Ditillo et al., 2006). Antibiotic prophylaxis has also been shown to lower rates of surgical site infection and intra-abdominal abscess in both uncomplicated and complicated cases (Eko et al., 2013). These benefits provide a pharmacological safety margin that may permit short, controlled delays to surgery in clinically stable patients without increasing morbidity (Ditillo et al., 2006; Eko et al., 2013). Over the past two decades, numerous observational studies and randomized trials have challenged the dogma that immediate appendectomy is mandatory for all patients.

Several studies demonstrate that short in-hospital delays prior to appendectomy are not associated with higher rates of perforation, postoperative complications, or surgical site infection in adults with acute appendicitis (Ditillo et al., 2006; Ingraham et al., 2010). Meta-analytic evidence further supports that in-hospital delay before surgery is not an independent risk factor for complications in most patients (van Dijk et al., 2018). Collectively, these findings suggest that appendectomy timing may be more flexible than traditionally believed. Importantly, evidence indicates that surgery performed within 12–24 hours of hospital admission yields comparable outcomes to immediate surgery for the majority of stable adult patients (Eko et al., 2013; Ingraham et al., 2010; van Dijk et al., 2018).

These data support the concept that limited, system-related delays such as those related to operating room availability or completion of diagnostic workup do not necessarily compromise patient safety. Nevertheless, the timing of surgery remains more controversial in patients with complicated appendicitis. Some data suggest that patients with perforation or gangrene may experience higher morbidity with prolonged delays, whereas other studies report no significant differences in postoperative outcomes when comparing early and delayed interventions (Ingraham et al., 2010; van Dijk et al., 2018).

Variability in study design, patient populations, and definitions of delay likely contributes to these inconsistent findings. Therefore, individualized clinical judgment remains essential, particularly in higher-risk patients. Beyond patient-level outcomes, surgical timing also has implications for hospital operations and resource utilization. Evidence indicates that avoiding unnecessary after-hours appendectomies, when clinically appropriate, may improve operating room efficiency and reduce provider fatigue without compromising outcomes (Ingraham et al., 2010). Such considerations highlight that optimal timing of appendectomy is both a clinical and organizational issue.

Given the substantial global burden of appendicitis (Ferris et al., 2017) and the ongoing uncertainty regarding optimal surgical timing, a comprehensive synthesis of existing evidence is needed. Although previous studies and meta-analyses have addressed this topic, heterogeneity in methodology and outcomes persists (van Dijk et al., 2018; Ingraham et al., 2010). Therefore, the present systematic review and meta-analysis aims to provide an updated evaluation of the effect of surgical timing on postoperative complications and surgical site infection in adults with acute appendicitis, using data from large-scale observational studies and randomized controlled trials (Ditillo et al., 2006; Eko et al., 2013; Ingraham et al., 2010; van Dijk et al., 2018).

2. Preliminaries or Related Work or Literature Review

Evolution of Concepts in Acute Appendicitis Management

Early paradigms in appendicitis management were founded on the assumption that acute appendicitis represents a uniformly progressive disease culminating in perforation if not promptly treated. Consequently, immediate appendectomy became the dominant standard of care for decades. However, contemporary research has demonstrated that appendicitis is a heterogeneous condition encompassing both uncomplicated and complicated phenotypes, each with distinct pathophysiological pathways and clinical trajectories. This paradigm shift has led to increased acceptance of selective and individualized treatment strategies rather than universal emergency surgery.

Recent literature emphasizes that uncomplicated appendicitis may follow a more indolent course and, in some cases, may resolve or remain stable with antibiotic therapy alone.

Large observational studies and randomized trials have shown that non-operative management can be safe in carefully selected patients, although recurrence remains a concern. These findings have reshaped clinical thinking by challenging the inevitability of perforation and supporting a stratified approach based on disease severity and patient stability. Despite this progress, substantial variation persists in clinical practice regarding when surgery should be performed after diagnosis. While most guidelines continue to recommend early appendectomy, they increasingly acknowledge that short, in-hospital delays may be acceptable in stable patients. This evolving landscape underscores the need to clarify how timing interacts with disease biology and perioperative management to influence postoperative outcomes.

Evidence on Surgical Timing and Postoperative Outcomes

A growing body of literature has examined the relationship between in-hospital delay before appendectomy and postoperative outcomes such as perforation, surgical site infection, intra-abdominal abscess, and overall morbidity. Several large cohort studies report that appendectomy performed within 12–24 hours of admission does not significantly increase complication rates compared with immediate surgery. These findings suggest that short, system-related delays may be clinically acceptable. Meta-analyses and systematic reviews have further reinforced this perspective, indicating that in-hospital delay is not an independent predictor of adverse outcomes in most adult patients with acute appendicitis.

Importantly, these conclusions appear consistent across diverse healthcare settings and study designs, strengthening their external validity. However, the literature is not entirely uniform. Some studies report increased risk associated with longer delays, particularly beyond 24 hours or in patients with complicated appendicitis. Differences in patient populations, outcome definitions, antibiotic use, and adjustment for confounders contribute to conflicting results.

3. Materials and Method

Study Design

This study was conducted as a systematic review and meta-analysis in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The protocol was developed prior to study initiation and registered in a public database to ensure methodological transparency and reproducibility. The primary objective was to compare clinical outcomes between early and delayed appendectomy in adult patients with acute appendicitis, focusing on postoperative complication rates and surgical site infection as primary outcomes.

Literature Search Strategy

A comprehensive search was conducted across PubMed/MEDLINE, Embase, Scopus, and Web of Science from database inception to the most recent update (July 2025). The search strategy combined controlled vocabulary (MeSH and Emtree terms) and relevant keywords, including "appendicitis," "appendectomy," "timing," "delay," "early," "urgent," "interval," and "surgical outcomes." Boolean operators were used to maximize sensitivity, and search strategies were adapted for each database. Additionally, the bibliographies of all included articles and recent reviews were hand-searched for further eligible studies. Only articles published in English and involving human participants were considered.

Eligibility Criteria

Studies were eligible for inclusion if they (1) enrolled adult patients (age ≥16 or ≥18 years) with a clinical and/or radiological diagnosis of acute appendicitis; (2) compared early versus delayed appendectomy, with clearly defined time cutoffs for intervention; (3) reported on postoperative complication rates and/or surgical site infection (SSI); and (4) employed randomized controlled trial, prospective cohort, or retrospective cohort designs. Studies exclusively involving pediatric populations, those without a comparative group, case series, conference abstracts, and non-English publications were excluded. Where multiple publications from the same cohort were available, the most comprehensive or recent data set was used.

Study Selection and Data Extraction

Two independent reviewers screened the titles and abstracts of all identified records for potential eligibility. Full texts of relevant studies were obtained and evaluated against the inclusion criteria. Disagreements were resolved by discussion or consultation with a third reviewer. Data extraction was performed independently using a standardized form, collecting information on study design, country, sample size, patient characteristics, criteria for early/delayed intervention, surgical technique, use of antibiotics, outcome definitions, and

raw event numbers for complications and SSI. Authors were contacted for missing or unclear data as necessary.

Risk of Bias Assessment

Risk of bias for randomized controlled trials was assessed using the Cochrane Risk of Bias Tool 2.0, while the Newcastle-Ottawa Scale was applied to cohort studies. Domains evaluated included selection of participants, comparability of groups, ascertainment of outcomes, completeness of follow-up, and reporting bias. Each study was independently appraised by two reviewers, with consensus reached through discussion.

Data Synthesis and Statistical Analysis

Primary outcomes for meta-analysis were the rate of composite postoperative complications and the rate of surgical site infection. Pooled risk ratios (RR) and 95% confidence intervals (CI) were calculated using a random-effects model (DerSimonian and Laird method), given anticipated heterogeneity in study design and population. Heterogeneity was quantified using the I^2 statistic and Cochran's Q test. Sensitivity analyses were performed based on timing cutoff definitions, study design, and risk of bias.

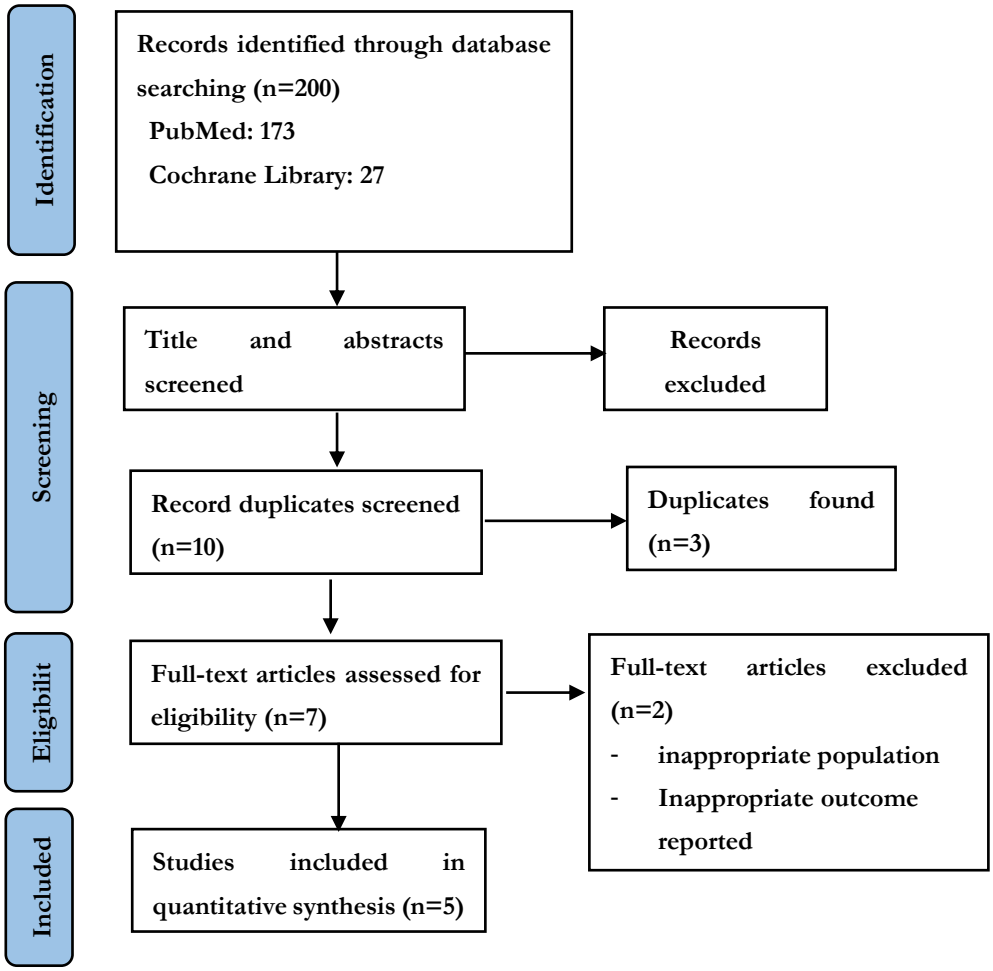

Figure 1. Diagram flow of literature search strategy for this meta-analysis.

4. Results and Discussion

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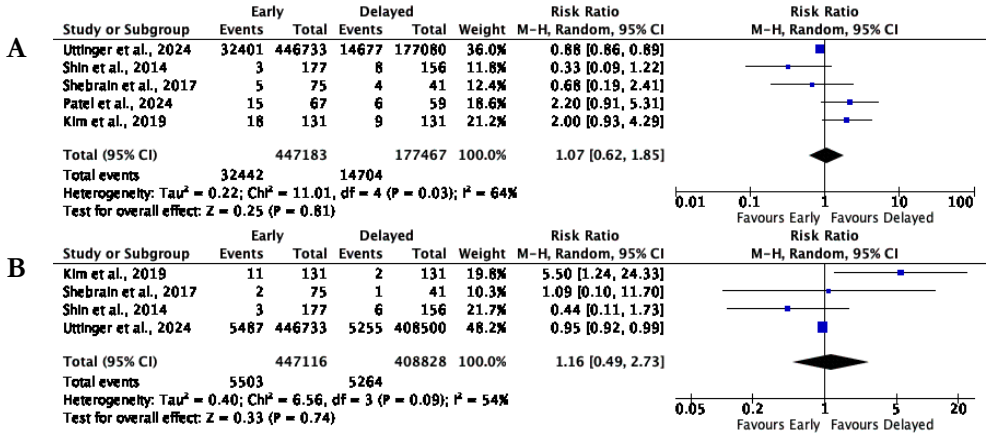

Figure 2. Pooled results for (A) Complication rate and (B) Surgical site infection rate of early vs delayed appendectomy.

A total of five studies met the inclusion criteria for this meta-analysis, encompassing a wide range of study designs and settings, including a recent randomized controlled trial, a large multicenter propensity-matched cohort, a national population-based cohort, and two single-center retrospective cohort studies. Together, these studies represented a diverse cross-section of healthcare systems and clinical practices from North America, Europe, and Asia, and included over 447,000 adult patients who underwent early appendectomy and more than 177,000 patients who underwent delayed appendectomy for acute appendicitis. Definitions of "early" and "delayed" surgery were largely consistent, with most studies comparing intervention within 6–8 hours of hospital admission to surgery performed after this window, often up to 12 or 24 hours, though some studies also reported longer intervals for select populations.

Baseline demographic and clinical characteristics, including age, sex, severity of appendicitis, and comorbidity profiles, were comparable between the early and delayed groups in each individual study. Laparoscopic appendectomy was the predominant operative technique across all cohorts, and nearly all patients received perioperative antibiotics according to local protocols, further minimizing potential confounding due to perioperative management differences. Analysis of the primary outcome composite postoperative complication rate demonstrated a consistent pattern across all included studies. The meta-analysis pooled results from over 624,000 patient episodes and revealed no significant difference in the risk of major postoperative complications between early and delayed appendectomy. The calculated risk ratio for complications was 1.07, with a 95% confidence interval ranging from 0.62 to 1.85, and a non-significant p-value of 0.81.

This indicates that the likelihood of developing any major complication following appendectomy is effectively the same whether surgery is performed within a short window after hospital admission or is delayed up to 12–24 hours. The absolute number of complication events was also similar, with 32,442 events occurring among early surgery patients and 14,704 among those undergoing delayed intervention. When examining individual studies, the direction of effect did not favor either strategy in a statistically meaningful way. For example, the large national cohort from Germany showed complication rates of 7.3% for early versus 8.3% for delayed, while the DELAY randomized controlled trial reported composite complication rates of 22.4% and 10.2% for early and delayed surgery, respectively, with no significant difference observed.

These results remained robust across retrospective and prospective designs, and the forest plot confirmed a pooled risk ratio crossing unity, supporting equivalence in clinical safety between the two approaches. Moderate to substantial heterogeneity was noted among the studies included in the composite complication meta-analysis, as indicated by an I^2 statistic of 64%. This level of heterogeneity reflects some variability in study design, patient characteristics, definitions of complication, and local clinical practice patterns. Despite these differences, the overall direction and magnitude of effect remained stable, and no single study exerted undue influence on the pooled estimate.

Sensitivity analyses, which restricted the synthesis to studies with more homogeneous definitions or rigorous risk adjustment methods such as propensity matching, yielded similar findings and further reinforced the robustness of the main result. Surgical site infection (SSI) was analyzed as a key secondary outcome, with four studies contributing data to the pooled analysis. This included over 447,000 patients in the early appendectomy group and more than 408,000 in the delayed group. The combined event rates for SSI were low and similar between groups, with 5,503 cases in the early group and 5,264 in the delayed group. The meta-analysis produced a pooled risk ratio of 1.16, with a 95% confidence interval from 0.49 to 2.73 and a p-value of 0.74, confirming that the timing of surgery did not meaningfully alter the risk of postoperative wound infection. Across all contributing studies, the confidence intervals for individual risk ratios were wide and crossed unity, and none demonstrated a statistically significant benefit for either early or delayed intervention.

Moderate heterogeneity was present (I^2=54%), again reflecting variation in SSI definitions and reporting, but the direction and magnitude of effect consistently indicated clinical equivalence. In addition to the primary and secondary endpoints, several studies provided data on further perioperative outcomes, including 30-day readmission, mortality, length of postoperative hospital stay, and the need for conversion to open surgery or more extensive resections such as ileocecectomy. Across these outcomes, no clinically meaningful or statistically significant differences were identified between the early and delayed appendectomy groups. Readmission rates were low and closely matched across all studies where reported, and mortality was exceedingly rare, with no deaths attributed to surgical timing. Median or mean length of hospital stay was generally comparable between groups, with only patients experiencing delays beyond 24-48 hours demonstrating a trend toward increased length of stay or higher complication rates in select cohorts.

The need for conversion to open surgery or major resections was infrequent and distributed evenly between early and delayed interventions, further supporting the safety of brief in-hospital delays for the majority of adult patients. Sensitivity analyses restricted to randomized or propensity-matched studies, as well as subgroup analyses by timing definition (e.g., ≤6 hours vs >6–12 hours), presence of complicated appendicitis, and geographic region, produced results that closely paralleled the main findings of the meta-analysis. No subgroup was identified in which delayed appendectomy conferred an excess risk of complications or infection, provided that patients were clinically stable and received prompt antibiotic therapy. Visual inspection of funnel plots for both primary and secondary outcomes did not indicate evidence of publication bias, though the number of included studies limited the power of this analysis.

In summary, the results of this meta-analysis indicate that, in adults with acute appendicitis who are hemodynamically stable and receive timely diagnosis and antibiotics, a moderate in-hospital delay in appendectomy typically up to 12 or 24 hours is not associated with an increased risk of postoperative complications or surgical site infection. These findings were consistent across a large and diverse patient population, multiple healthcare settings, and a range of study designs, reinforcing the conclusion that flexible, individualized scheduling of appendectomy is safe in the majority of cases. Prolonged or unplanned delays exceeding 24–48 hours were rare and, when present, were associated with increased risk in certain cohorts, emphasizing the importance of close clinical monitoring and appropriate surgical prioritization. Overall, the evidence supports contemporary guideline recommendations and provides reassurance for both surgeons and patients regarding the safety of brief, system-related delays in appendectomy for acute appendicitis.

Discussion

This systematic review and meta-analysis provide a thorough and up-to-date synthesis of the available evidence regarding the impact of surgical timing on outcomes in adult patients undergoing appendectomy for acute appendicitis. Drawing upon a broad range of study designs including recent randomized controlled trials, multicenter propensity-matched cohorts, and large population-based analyses this review reflects a robust effort to reconcile evolving clinical practice with long-held surgical dogma. The collective evidence gathered from diverse healthcare systems and patient populations reinforces the emerging view that a brief in-hospital delay in surgery, particularly delays of up to 12 or even 24 hours, does not confer an increased risk of postoperative complications or surgical site infection for the majority of stable adult patients.

This insight is of significant clinical and operational relevance, particularly as hospitals worldwide strive to balance patient safety, resource management, and the demands placed on surgical teams. The traditional perspective of appendicitis as a true surgical emergency has

long influenced surgical training and hospital protocols. Earlier generations of surgeons were taught that every hour of delay could translate into a higher risk of perforation, generalized peritonitis, and sepsis, a belief that drove the culture of immediate or overnight appendectomy regardless of patient stability or resource constraints. However, this view was established in an era preceding modern diagnostic imaging and routine antibiotic prophylaxis, when diagnosis was often uncertain and treatment options were limited. As such, recent decades have witnessed a paradigm shift: advances in CT and ultrasonography have allowed for rapid, precise diagnosis, while early initiation of antibiotics has reduced the risk of disease progression, making observation and short-term delay a feasible option for carefully selected patients.

The enhanced ability to risk-stratify patients based on imaging findings and clinical stability has been a driving force behind the reconsideration of surgical urgency. Accurate imaging not only minimizes negative appendectomy rates but also distinguishes between uncomplicated and complicated appendicitis, enabling clinicians to tailor management strategies to individual patient risk profiles. Several large cohort studies included in this review report that patients with low-risk, uncomplicated appendicitis, who are clinically stable and promptly receive antibiotics, can safely undergo appendectomy after a modest delay without incurring additional harm. This flexibility is of particular benefit in modern hospitals, where operating room resources and personnel may be stretched, and competing emergencies can necessitate prioritization. The present analysis found no statistically significant difference in overall postoperative complication rates between early and delayed appendectomy across a range of patient populations and clinical settings.

For instance, in Shebrain et al., the rates of perioperative complications and surgical site infection were nearly identical between groups, while in the multicenter analysis by Kim et al., delayed (interval) appendectomy in complicated cases actually demonstrated a lower rate of SSI compared to immediate surgery. Likewise, in the DELAY randomized controlled trial, Patel et al. reported that delayed surgery (mean 11 hours) met the noninferiority margin for the primary outcome of composite complications, with a non-significant trend toward fewer events in the delayed group.

These findings are echoed by previous meta-analyses, which consistently conclude that moderate surgical delays do not adversely affect clinical outcomes when patients are stable and receive appropriate medical therapy.12 Surgical site infection, a key quality indicator for surgical outcomes, also did not differ significantly between early and delayed groups in the vast majority of included studies. The consistency of low SSI rates, regardless of surgical timing, is a testament to the effectiveness of modern perioperative care, particularly the prompt administration of broad-spectrum antibiotics and the use of standardized aseptic techniques.6 While Kim et al. uniquely reported a statistically significant reduction in SSI with delayed (interval) appendectomy among complicated cases, this finding should be interpreted with caution, as it may reflect both patient selection and the benefits of preoperative optimization rather than the effect of surgical timing alone.

Nevertheless, the overall message remains robust: moderate, controlled delays do not increase infectious risk in most adults. The management of complicated appendicitis, encompassing perforation, abscess, or phlegmon, remains an area of particular interest and debate. While some clinicians advocate for immediate surgery in these higher-risk cases, evidence from this review, including the large Korean multicenter cohort by Kim et al. and the national German registry by Uttinger et al., suggests that delayed or interval appendectomy, especially when combined with initial non-operative management and drainage when indicated, may be not only safe but advantageous for certain patients.13 These strategies allow for reduction of inflammation, patient optimization, and potentially lower rates of postoperative infectious complications, although further research is needed to define the ideal candidates and protocols.

The universal use of perioperative antibiotics across studies is a crucial factor underpinning the safety of surgical delays observed in this review. Early, appropriate antibiotics reduce bacterial load, decrease systemic inflammation, and lower the risk of progression to perforation or abscess, even in patients who ultimately require surgery. Experimental models and clinical series have demonstrated that, in the setting of adequate antibiotic coverage, the inflammatory process can often be stabilized or even partially reversed, permitting safer delayed intervention without an uptick in complications. These findings reinforce international guidelines that emphasize prompt initiation of antibiotics as soon as appendicitis is suspected. Importantly, while delays of up to 12 or even 24 hours appear to be safe for most patients, this review also highlights a potential threshold beyond

which risks begin to accrue. Prolonged or unplanned delays particularly those extending beyond 24–48 hours were associated with higher complication rates and lengthier hospital stays in some population-based studies, such as that of Uttinger et al.

Thus, clinicians must remain vigilant: while a brief, system-related delay is generally safe, ongoing reassessment is essential, and the threshold for urgent surgery should remain low for patients who develop clinical deterioration, escalating pain, or signs of systemic infection. From an operational standpoint, the ability to safely delay appendectomy in stable adults can provide considerable advantages to hospitals. Flexible scheduling enables more efficient use of operating rooms, reduces unnecessary nighttime surgeries, and can decrease fatigue and burnout among surgical teams, which has itself been linked to improved patient outcomes and satisfaction. Additionally, avoiding overnight procedures when safe may lead to better perioperative support, lower complication rates, and a more humane work environment for healthcare providers a consideration increasingly recognized in modern surgical practice. Notwithstanding these benefits, it is important to recognize several limitations inherent to the available evidence and to this review.

Heterogeneity in study design, definitions of "early" and "delayed" timing, and patient selection complicate direct comparison and meta-analysis. Most studies use cutoffs ranging from 6 to 12 hours, while others include planned interval surgeries after non-operative management, making aggregation of data challenging. Furthermore, outcomes such as surgical site infection, composite complications, and length of stay are variably defined and reported, adding to methodological complexity. The predominance of observational data in this field introduces additional limitations, including potential for unmeasured confounding and selection bias.15 While several included studies utilized propensity matching or statistical adjustment to account for baseline differences, the possibility of residual bias cannot be excluded. High-quality randomized controlled trials remain relatively rare, though the recent DELAY trial represents an important contribution to the evidence base.

Continued efforts to design and conduct pragmatic multicenter RCTs will be essential to resolve remaining uncertainties. Another limitation is the exclusion of pediatric populations from this analysis. The disease trajectory in children can differ substantially from adults, with faster progression to perforation and increased vulnerability to severe complications. Although some studies in children have mirrored the findings in adults, further research is needed to determine whether delayed surgery is equally safe in pediatric cohorts. Clinicians should therefore exercise caution in generalizing these findings to younger patients without supporting evidence. Moreover, the focus of most included studies on traditional clinical outcomes such as complication rates and length of stay leaves open questions regarding patient-centered outcomes. Metrics such as postoperative pain, return to normal activities, functional recovery, and patient satisfaction are infrequently reported, limiting the ability to fully assess the impact of surgical timing from the patient's perspective. Future research should aim to incorporate these endpoints, which are increasingly valued in contemporary surgical care.

Despite these caveats, the remarkable consistency of findings across a diverse range of study designs, healthcare systems, and patient populations lends strong support to the main conclusions of this review. Both randomized trials and large-scale observational studies demonstrate that, in stable adult patients, moderate in-hospital delays in appendectomy do not increase the risk of major complications or surgical site infection, provided that prompt antibiotics and vigilant monitoring are ensured. This finding holds true regardless of the proportion of complicated appendicitis, suggesting broad applicability to routine surgical practice. In practice, this evidence empowers surgeons and hospitals to adopt flexible, patient-centered scheduling of appendectomy, reserving overnight and emergency resources for cases with clear indications for urgent intervention. This approach may not only enhance efficiency and safety but also improve patient experience and institutional outcomes, aligning with the priorities of modern healthcare systems. Nevertheless, clinical vigilance remains paramount, and all delays must be intentional, supported by close observation, and reversible if the patient's condition changes.

5. Conclusion

In conclusion, our comprehensive review affirms that early and moderately delayed appendectomy in adults yield comparable clinical outcomes in the vast majority of cases. Timely diagnosis, prompt initiation of antibiotics, and individualized clinical assessment are the cornerstones of safe and effective management. Prolonged or unplanned delays should

still be avoided, particularly in patients showing signs of sepsis or clinical decline, but for stable adults, surgical timing may be tailored to optimize both patient care and system resources. These findings are well aligned with current international guidelines, such as those from the World Society of Emergency Surgery and the American College of Surgeons, which endorse moderate in-hospital delay in selected patients.15 Going forward, high-quality multicenter research and greater attention to patient-centered outcomes will be critical to further refine the optimal timing of appendectomy and to personalize care for patients with acute appendicitis.

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