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ACUTE APPENDICITIS: SURGICAL APPROACHES

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Abstract: Acute appendicitis is the leading cause of acute abdomen and one of the most common surgical emergencies worldwide. Traditionally, appendectomy - initially open and currently preferably laparoscopic - is the gold standard treatment, offering high rates of resolution and rapid recovery, with lower morbidity compared to open surgery. However, accurate diagnosis, especially in differentiating between complicated and uncomplicated cases, remains challenging, even with the use of imaging tests and clinical scores. Recently, conservative treatment with antibiotics has been proposed as a viable alternative for uncomplicated appendicitis, especially in selected patients. Trials such as the CODA Trial have shown that this approach can be effective in the short term, with a lower rate of immediate complications, but around 30% of patients treated with antibiotics subsequently require surgery. Surgery remains fundamental for identifying unexpected differential diagnoses, such as neoplasms, and avoiding recurrences and therapeutic failures. This review critically discusses surgical strategies - especially laparoscopy - and the growing adoption of antibiotic therapy, highlighting the advantages, risks, limitations and clinical applicability of each.

INTRODUCTION

Acute appendicitis is the most prevalent abdominal inflammatory condition in clinical practice, representing the main cause of acute abdomen in various age groups. Its annual incidence is estimated at around 100 cases per 100,000 inhabitants, with a cumulative lifetime risk of around 8.6% in men and 6.7% in women, although women are more likely to undergo appendectomy throughout their lives. (Bom et al., 2021; Téoule et al., 2020) In Germany, for example, more than 108,000 appendectomies are carried out every year, and the procedure is one of the most common in the surgical setting. (Téoule et al., 2020)

It is one of the most prevalent etiologies of abdominal pain in emergency care. Historically, all clinical presentations of appendicitis have been managed with an absolute indication for appendectomy. (Prechal et al., 2019) Despite its widespread occurrence, the diagnosis of appendicitis still represents a clinical challenge, and there are differences between international guidelines regarding the standardization of diagnostic criteria and the indication of imaging tests, especially in the early stages of the disease. (Bom et al., 2021)

A large number of guidelines do not give clear guidance on how to differentiate between uncomplicated and complicated appendicitis, despite stating that complicated appendicitis should be treated more urgently and that uncomplicated appendicitis can be treated with antibiotics alone. (BOM, W. J. et al. 2021)

Imaging seems to be an essential step in differentiating between them. CT features such as abscess, extraluminal air, intra- and extraluminal appendicolith and periappendicular fluid as associated with complicated acute appendicitis. Although high specificity is achieved, all parameters have low sensitivity and are unable to reliably rule out complicated appendicitis (BOM, W. J. et al. 2021).

Historically, appendectomy - initially open and more recently laparoscopic - has established itself as the gold standard treatment for acute appendicitis. The laparoscopic approach, in particular, has progressively replaced the open technique and is currently considered the method of choice for uncomplicated cases, due to its lower morbidity and better postoperative recovery profile. (Köhler et al., 2021; Téoule et al., 2020) Even so, around a quarter of surgeries in children are still performed by the open route, and there is no unequivocal consensus on the absolute superiority of laparoscopy in all population subgroups. (Téoule et al., 2020)

In recent years, however, several clinical investigations have challenged the hegemony of the surgical approach, proposing non-operative treatment with antibiotics as a safe and effective alternative for cases of uncomplicated appendicitis. Randomized clinical trials and meta-analyses suggest that antibiotic therapy can, in appropriately selected patients, achieve satisfactory outcomes with a lower incidence of surgical complications, reduced post-operative pain and faster recovery, as well as offering systemic benefits such as reduced hospital demand and operating costs (De Almeida Leite et al., 2022; Köhler et al., 2021).

Despite these advances, there is still debate as to the widespread applicability of this conservative strategy. The clinical variability of appendicitis, the possibility of progression to complicated forms and the limitations of diagnostic methods, even with advances in computed tomography and clinical scoring models, impose caution in the selection of patients for non-surgical treatment. (Bom et al., 2021; De Almeida Leite et al., 2022) Thus, understanding the nuances surrounding surgical approaches to acute appendicitis, in contrast to emerging therapeutic alternatives, is fundamental for individualized, evidence-based management.

Appendectomy consists of the surgical removal of the inflamed vermiform appendix, eliminating both the luminal obstruction and the primary focus of bacterial infection. As it involves complete excision of the affected organ, the procedure is associated with high rates of clinical resolution and definitive relief of symptoms (Doleman et al., 2024).

The main advantage of antibiotic therapy is the possibility of avoiding post-operative complications inherent to appendectomy, such as surgical site infection, the formation of intestinal adhesions and incisional hernias. In addition, exposure to anesthetic risks is reduced, a factor that is especially relevant in patients with comorbidities. Other potential benefits include shorter hospital stays, faster return to work and a reduction in overall treatment

costs. On the other hand, in addition to the risk of recurrence and the negative epidemiological impact of increased bacterial resistance to antimicrobials, the main risk associated with the conservative approach is therapeutic failure, since appendicitis can evolve into a complicated form, requiring emergency surgical intervention, which is often more invasive and has higher morbidity and mortality rates (Prechal et al., 2019).

This article aims to critically review the surgical strategies applied to acute appendicitis, with an emphasis on the current indications for laparoscopic appendectomy, its advantages and limitations, as well as discussing the emerging role of antibiotic therapy as a possible conservative approach in uncomplicated cases.

METHODOLOGY

The aim of this literature review is to gather and critically analyze current surgical approaches to the treatment of acute appendicitis, in the light of the most recent evidence available in the scientific literature. To carry out the theoretical survey, a systematic search was conducted in the PubMed database, considering publications from the last five years. The combined descriptors "Acute appendicitis", "Surgery", "Treatment" and "Diagnosis" were used to identify relevant and up-to-date studies.

The analysis included articles available in full that directly or indirectly addressed the diagnosis, management and surgical options related to acute appendicitis. Publications in different languages were accepted, as long as they were accessible, methodologically clear, thematically pertinent and scientifically relevant. Original studies, narrative reviews and update articles were considered. Exclusion criteria included duplicate publications, studies outside the proposed scope and articles unavailable on the PubMed database.

RESULTS AND DISCUSSION

Analysis of the studies reviewed shows that laparoscopic appendectomy has become the standard procedure for treating acute appendicitis in countries such as Germany, where it accounts for more than 95% of cases operated on. The laparoscopic technique has shown important advantages over open surgery, such as shorter hospital stays, lower rates of surgical wound infection and lower mortality, with significantly lower complication rates (1.5% versus 11.9% for healing disorders; mortality of 0.1% versus 1.2%). (Téoule et al., 2020), 2020) In addition, laparoscopy provided better visualization of the abdominal cavity, allowing other possible causes of the clinical condition to be identified, and was safer in patients with other comorbidities, such as obesity. (Destek et al., 2023)

The multicenter randomized study conducted by the CODA Collaborative, which included more than 1,500 patients with uncomplicated acute appendicitis, showed that antibiotic therapy was non-inferior to laparoscopic appendectomy in the primary outcome of health status at 30 days. However, it was observed that approximately 30% of patients initially treated with antibiotics required surgery within 90 days of starting conservative treatment, which raises questions about the durability and effectiveness of the non-surgical approach. (Köhler et al., 2021) However, in elderly patients with frailty, the choice of non-surgical treatment is associated with up to three times greater risk of death when compared to immediate surgical treatment. However, when successful, the results are similar to those observed with immediate surgical intervention (Ashbrook et al., 2024).

Despite the high success rate of laparoscopy, histopathological data reveals that even an apparently normal appendix can hide significant alterations, such as endometriosis, neoplasms or the presence of parasites, which are

identified in up to 29% of the cases analyzed. In addition, post-operative complications, although rare, can occur, including infection, abscesses, adhesions, incisional hernias and stump appendicitis. In 0.5% of the children operated on, neuroendocrine tumors of the appendix were incidentally identified, requiring, in some cases, complementary surgical procedures such as hemicolectomy or ileocecal resection (Téoule et al., 2020).

Acute appendicitis represents one of the most common surgical emergencies worldwide and has therefore been the subject of numerous investigations aimed at optimizing its diagnosis and treatment. The introduction of laparoscopic appendectomy has transformed the therapeutic scenario, offering a safe, effective and less invasive alternative to open surgery. Its advantages, such as a lower infection rate, faster recovery and lower morbidity, have been widely proven in observational studies and controlled trials, consolidating it as the preferred surgical approach in international guidelines, such as those of the WSES. (Téoule et al., 2020)

However, the contemporary discussion on the management of uncomplicated acute appendicitis has turned to the viability of antibiotic therapy as an initial strategy, especially in the face of the search for less invasive treatments and the need to rationalize hospital resources. Studies such as the CODA Trial have shown that antibiotics can be a safe alternative in certain patients, with clinical outcomes comparable to those of surgery in the short term. This approach, in addition to avoiding the risks inherent to any surgical procedure, such as infection, bleeding and damage to adjacent organs, can reduce hospitalization time and costs, as well as allowing outpatient management of many cases (Köhler et al., 2021).

Despite these potential benefits, it is important to consider that a significant proportion of patients initially treated with antibiotics evolve with therapeutic failure, requiring surgery in a relatively short period of time. This recurrence rate of around 30% implies the need for careful patient selection, as well as adequate communication of the risks and expectations involved in conservative treatment. The lack of standardization in antibiotic regimens, as well as the difficulty in reliably distinguishing between complicated and uncomplicated cases on the basis of clinical assessment and imaging tests alone, further limits the widespread adoption of this strategy. (Téoule et al., 2020), 2020) The exclusive use of antibiotic therapy in the general population is also associated with a higher risk of prolonged hospitalization, the need for a procedure to perform drainage, adverse reactions to drug treatment, subsequent hospitalizations and recurrence of emergency department visits, when compared to the surgical approach. (Ashbrook et al.,2024)

In addition, surgical treatment allows for histopathological analysis of the appendix, making it possible to identify unexpected conditions such as tumors, appendicoliths and parasitic infections, which may not be detected or adequately treated with antibiotics alone. This diagnostic limitation of conservative therapy should be considered, especially in pediatric populations or in patients at increased risk of malignant appendix disease. (Téoule et al., 2020)

Therefore, although the most recent data point to the non-inferiority of antibiotics in certain circumstances, it is not yet possible to state with certainty the equivalence between surgical and conservative treatment. The lack of direct comparative studies between laparoscopic appendectomy and antibiotic therapy restricts the generalizability of the available conclusions, and highlights the need for new robust clinical trials that explore not only the immediate clinical outcomes, but also the medium and long-term effects, including recurrence, complications and quality of life.

In short, the choice of treatment for acute appendicitis should be individualized, taking

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into account the clinical presentation, available resources, patient preferences and the experience of the medical team. Laparoscopic appendectomy remains the reference approach, especially given its proven safety and efficacy profile. However, non-surgical treatment with antibiotics is emerging as a viable alternative in selected cases, paving the way for a more flexible therapeutic paradigm, provided it is supported by solid scientific evidence and adequate monitoring.

CONCLUSION

Laparoscopic appendectomy remains the reference therapeutic approach for acute appendicitis, supported by its efficacy, safety and lower morbidity. Despite this, antibiotic therapy has emerged as a valid alternative for cases of uncomplicated appendicitis, provided there is careful patient selection and rigorous follow-up. Conservative treatment can reduce costs and length of stay, but is associated with a higher risk of recurrence, the need for late surgery and diagnostic limitations.

Therefore, the choice between surgical intervention and drug therapy must be individualized, taking into account the clinical presentation, available resources, the experience of the medical team and the patient's preferences. Although promising, the non-surgical strategy requires more robust evidence and clear guidelines to ensure safety and efficacy in the management of acute appendicitis.

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