



Appendicitis in the Geriatric Population: A Literature Review

Inamullah ^{*1}, Tejeswi S Gutti ¹, Burhan Khan ¹, Affan Asim ², Syed Muhammad Ali ¹

¹Acute Care Surgery, Hamad Medical Corporation, 3050, Qatar.

²Intern General Surgery. Dow Hospital. Ojha campus. Karachi, Pakistan.

*Corresponding author: Inamullah; inam_jpmc@yahoo.com

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Abstract

Objective: This literature review examines the unique characteristics, challenges, and management strategies for appendicitis in the geriatric population, an age group often facing atypical symptom presentations and increased morbidity and mortality rates. **Methods:** A systematic review was conducted across multiple academic databases, including PubMed, Medline, and Google Scholar, to identify relevant articles on appendicitis in elderly patients, published up to June 2024. Keywords such as "appendicitis," "geriatric," "elderly," and "appendectomy" were used to retrieve studies examining the epidemiology, clinical presentation, diagnosis, treatment, and outcomes for elderly patients. **Results:** Elderly patients with appendicitis frequently present atypically, with symptoms that are often subtle or overlap with other age-related conditions, increasing diagnostic delays and complication rates. A higher incidence of perforation, longer hospital stays, and elevated rates of malignancy were noted in this population. Imaging, especially CT scans, emerged as a critical diagnostic tool due to the reduced sensitivity of traditional scoring systems in elderly patients. Treatment approaches, including surgical and conservative methods, highlight a need for individualized management given the higher risk of postoperative complications and frailty in geriatric patients. **Conclusion:** Appendicitis in elderly patients presents diagnostic and therapeutic challenges distinct from younger populations. Timely diagnosis, the use of advanced imaging, and judicious treatment selection are crucial to improving outcomes in this demographic. Further research is needed to refine diagnostic scoring systems and optimize treatment protocols specific to elderly patients with appendicitis.

Keywords: Acute Appendicitis, Geriatric Population, Diagnosis, Management Strategies, Appendectomy, Complications, Aging and Surgery.

Introduction

Appendicitis is a common surgical emergency that primarily affects younger patients, with an 8% lifetime documented evidence of the ailment ^[1]. Young people account for about 90% of instances, with only 10% of occurrences occurring in older adults over the age of 60 ^[2]. However, because of atypical clinical presentations and higher rates of morbidity and mortality, its occurrence in the geriatric population, typically 65 years of age and older, presents special concerns ^[3]. The number of elderly patients in the United States is predicted to triple over the next 30 years due to rising life expectancy ^[4]. Consequently, it is anticipated that in the future, more elderly patients may require surgery for acute appendicitis.

The term "elderly" has an imprecise definition. It has traditionally been linked to people 65 years of age or older, but in light of improvements in physical capabilities over the last 10 to 20 years, the World Health Organisation and the Japanese Geriatrics Society have recently suggested raising this threshold to 75 years of age or older ^[5]. According to the available research, the age range for people classified as "elderly" is 60-80 years old ^[6]. As a result, the term "elderly" will be used in this text in a way that is consistent with the conclusions of these reviewed studies.

Methods

For this literature review, a systematic search was conducted in academic databases, including PubMed, Medline, and Google Scholar, to identify relevant articles published up to June 2024. Keywords such as "appendicitis," "geriatric," "elderly," and "appendectomy" were used to retrieve pertinent studies.

Epidemiology

Although appendicitis is less common in older adults than in younger age groups, it is linked to a higher incidence of complications. Older persons have a significantly higher incidence of perforated appendicitis. Comparing geriatric patients to a younger adult group revealed longer hospital stays, a higher rate of tumour or malignancy diagnoses, and more 30-day readmissions. Geriatric patients also had a higher chance of postoperative abscesses and intraoperative perforations or abscesses ^[4].

Clinical Presentation

A number of variables, including the patient's age, the length of time since the onset of symptoms, and changes in the appendix's anatomical location, might affect how acute appendicitis presents clinically ^[7]. Elderly patients may present differently from younger

patients with acute appendicitis due to changes in the anatomy of the appendix with ageing. On the basis of the way the symptoms appear, the clinical presentation can be divided into two groups: typical and atypical [7].

Elderly people often do not display all of the typical symptoms of acute appendicitis, which include pain in the right lower quadrant, fever, anorexia, and vomiting [8]. Similar to this, 25% of persons in the old age group with appendicitis do not have right lower quadrant discomfort [9].

Elderly patients may also experience the typical symptoms associated with acute appendicitis: vomiting (45.5-68.3%), nausea and anorexia (57.6-67.0%), shifting pain (30.3-45.1%), right iliac fossa pain (60.6%), and pyrexia (21.2-26.8%) [10]. Typical signs like 40% of cases have rebound pain with guarding, 9% have tenderness in the right lower quadrant or at McBurney's point, and 7% have an abdominal mass palpable. Surprisingly, rebound pain and tenderness are seen in 54% of older age appendicitis patients [11].

Atypical symptoms such as disorientation, constipation, generalised abdominal pain, and evidence of peritonitis are frequently observed in elderly people suffering from appendicitis [12] and because of these atypical symptoms, geriatric patients may experience more complications compared to younger [13], like increased perforation rates compared to younger patients, which may be associated with a diagnostic delay due to both late admission and a lack of typical signs and symptoms [14]. And 20% -30% of the aged population with acute infection will have a decreased or absent fever response because of a lower basal temperature, a diminished thermoregulatory response, and anomalies in the generation of endogenous pyrogens and their reaction [15].

Diagnosis

Diagnosing geriatric patients can be difficult because their symptoms often overlap with those of other age-related conditions and over 50% may be misdiagnosed [16].

Scoring system Several scoring systems for diagnosing acute appendicitis, including the Alvarado score, RIPASA, and Lintula score, have been designed for younger individuals. However, their effectiveness and reliability in elderly patients remain unproven. The most common is The Alvarado scoring system [17] is the most frequently utilized and incorporates several criteria, including leukocytosis ($WBC > 10 \times 10^3/\mu L$) and the neutrophil-to-WBC ratio, along with various clinical features. Although many studies have examined the accuracy of this scoring system in diagnosing appendicitis, few have focused exclusively on the predictive significance of preoperative laboratory parameters. Moreover, there are lack of researches on the predictive value of these scoring systems and laboratory tests specifically in older patients.

McKay *et al.* [18] found that scores of 3 or lower had a sensitivity of 96.2% and a specificity of 67% for indicating the absence of appendicitis, while scores of 7 or higher demonstrated a sensitivity of 77% and a specificity of 100% for confirming the presence of appendicitis. These results indicate that the Alvarado score could be applicable in the geriatric population.

Ali *et al.* [8], In their study, they found that both the Alvarado and Lintula scores show strong sensitivity and specificity for diagnosing acute appendicitis in the elderly. The accuracy of these scores improves when the factors of "nausea" and "absent, tingling, or high-pitched bowel sounds" are removed.

Revising the Alvarado score to five or higher can facilitate a timely diagnosis [19], but it does not aid in distinguishing between complicated and uncomplicated appendicitis [20].

Inflammatory markers in acute appendicitis can vary due to several factors, including bone marrow capacity, liver synthesis

function, comorbidities, and medications and The age of the patient One of the key variables influencing the level of inflammatory marker increase is the WBC count. Although numerous research has assessed the advantages of utilizing WBC, no agreement has yet been established [21].

Styrud *et al.* [22] looked into 47 patients over the age of 80 who had appendectomies following a preoperative diagnosis of appendicitis. They observed an increased rate of complications in the elderly group. However, the study revealed no significant difference in inflammatory markers between the older and younger patients. Thus, elevated inflammatory markers were not linked to complications in the geriatric population.

Paaanen *et al.* [23] studied the preoperative white blood cell (WBC) and C-reactive protein (CRP) levels in a cohort of 6,000 patients with acute appendicitis, covering all age groups from infants to the elderly. Their ROC analysis demonstrated that WBC was more accurate than CRP in diagnosing appendicitis across all age groups, except for infants and those over 80. CRP levels were consistently elevated in patients with perforated appendicitis across all ages. However, systemic infections tended to cause less leukocytosis in elderly patients.

Imaging techniques, like CT scans and ultrasounds play a crucial role in diagnosing appendicitis in older adults, as delayed or missed diagnoses can result in serious complications. While abdominal ultrasound (US) is often the preferred initial imaging option for various groups, such as children and pregnant women, its effectiveness is somewhat limited in older populations, with an overall sensitivity of 86% and specificity of 81% [24]. In elderly patients with acute abdominal pain, CT scans are recommended due to the wide range of potential conditions they can detect. CT findings can impact treatment decisions, influencing the course of medical management in 52% of cases and surgical intervention in 48%, with overall treatment plans being altered in up to 65% of patients with positive CT results [25]. In older adults, symptoms tend to be less typical, and the presence of previous abdominal surgeries or other abdominal disorders is more common. As a result, the differential diagnosis becomes more complex, making a detailed anatomical assessment, like a CT scan, increasingly important for accurate diagnosis [26]. For patients with inconclusive ultrasound (USG) results and suspected appendicitis, a low-dose contrast-enhanced CT scan is advised [27]. For patients who fall into high-risk categories determined by clinical scoring, it is recommended to proceed directly to surgery without conducting cross-sectional imaging [28].

Treatment

Surgical intervention, specifically appendectomy, remains the primary treatment for appendicitis in geriatric patients. Due to comorbidities and frailty, careful consideration is needed when assessing surgical risks and benefits.

Conservative treatment in certain publications, the use of antibiotic therapy as a conservative treatment for acute appendicitis is regarded as an alternative approach for the general population, rather than exclusively advocating for surgical options [29]. The authors sought to illustrate the advantages of utilizing this method among elderly patients [30].

In their study involving patients aged over 80, Park *et al.* describe this method as both safe and effective for a selected group, particularly those with elevated perioperative risk. The findings indicate that the treatment proved successful in over 70% of cases. One significant advantage for these patients, who frequently face multiple comorbidities, is the ability to avoid unnecessary surgeries and the associated procedural complications [31].

Another study concluded that antibiotic therapy, when used as a standalone treatment for acute appendicitis, cannot be

recommended for this age group at present due to insufficient evidence of its efficacy. It should only be considered for a very limited subset of patients with absolute contraindications to surgery [32]. Non-operative management is not recommended for older adults, obese individuals, patients with existing health conditions, and pregnant women because in these groups a higher likelihood of complications and increased mortality rates [28].

Surgical treatment, Surgery remains the primary treatment for acute appendicitis, with the choice between laparoscopic (LA) and open (OA) techniques. Some studies suggest that LA offers benefits such as reduced pain, shorter surgical duration, and quicker recovery times. However, other research has indicated a higher risk of intra-abdominal abscesses associated with the laparoscopic method [33]. Overall Postoperative complications, including wound infections, intra-abdominal abscesses, and ileus, occur at different rates between open appendectomy (11.1%) and laparoscopic appendectomy (8.7%) [34].

The benefits of laparoscopic appendectomy over open surgery in the general population are well established, including a lower incidence of postoperative wound infections, reduced postoperative pain, and shorter hospital stays. A recent meta-analysis from 2019 confirmed these findings. It also highlighted lower complication rates with laparoscopy, particularly in cases of complicated appendicitis [35]. However, there is an increased incidence of intraabdominal abscess formation. Although limited data exist for the elderly population, a 2012 meta-analysis focused on individuals over 60 found that the laparoscopic approach significantly reduced postoperative mortality, complications, and hospital stay length (LOS) compared to the open approach [36].

In elderly patients, the risk of converting from laparoscopic to open appendectomy is higher, ranging from 3% to 17% [37]. The most common reason for conversion is periappendicular infiltration/an inflammatory mass.

Following successful conservative treatment of an appendiceal abscess or inflammatory mass, planning an interval appendectomy is crucial, especially in patients over 65, due to the increased likelihood of appendiceal tumors (5.9-20%) [37-39].

Complications

In the elderly population, perforation rates are higher, which contributes to increased postoperative morbidity and mortality. While the overall morbidity rate stands at 9.3%, complications are observed more frequently in older patients than in their younger counterparts (46% vs. 8%; $P < .0001$) [24].

Postoperative complications, including wound infections and pneumonia, are more prevalent in older adults. The primary cause of morbidity is associated with surgical site infections, occurring in 9.0-15.4% of cases significantly higher than the 2.6-3.7% observed in younger patients [37,40].

Prognosis

Timely diagnosis and prompt surgical intervention are essential for ensuring positive outcomes in older patients. Mortality rates in this demographic are higher, ranging from 0.74% [41] to 6.1%, [37] increasing with age, whereas in the general population, they are between 0.04% and 0.21% [39,42] highlighting the significance of early detection and treatment in this age group to prevent morbidity and mortality.

Conclusion

Appendicitis in the geriatric population is a complex condition with distinct clinical characteristics and challenges compared to younger patients. Timely diagnosis, advanced imaging techniques, and

careful surgical decision-making are essential in optimizing outcomes for older adults with appendicitis. Further research is needed to refine diagnostic and treatment strategies specific to this age group.

Declarations

Ethics approval and consent to participate

Not applicable

Data Availability

Not applicable.

Conflicts of Interest

There is no conflict of interest regarding the publication of this paper."

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Authors' contributions

Inamullah: Analyzed and interpreted the patient data regarding appendicitis in geriatric patients in published articles and was a major contributor to writing the manuscript. TG: reviewed articles. BK: helped write the manuscript. SA: reviewed the whole manuscript. All authors read and approved the final manuscript.

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