

## Review Article

# Inguinal hernia and diverticulosis in octogenarians: the role of connective tissue and aging: a short narrative review

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## ABSTRACT

Inguinal hernia and diverticulosis are highly prevalent conditions in older adults that significantly affect health expenditures and complications. Increasing evidence suggests that both diseases may share common age-related pathophysiological mechanisms, particularly alterations in connective tissue and collagen metabolism. These associations appear especially relevant in octogenarians. A narrative literature review was conducted using PubMed to identify studies addressing inguinal hernia, diverticulosis, diverticulitis, connective tissue alterations, collagen metabolism, and aging, with a focus on patients aged 80 years and older. Relevant epidemiological, clinical, registry-based, and experimental studies were synthesized. The study reveals that diverticulosis affects roughly 70% of individuals aged 80 and older, with a concerning 20% recurrence rate of diverticulitis leading to high complication and mortality rates following surgery. As age increases, the risk for inguinal hernia also rises, especially for emergency repairs. Evidence suggests a common underlying connective tissue disorder linking the two conditions, with patients undergoing colectomy for diverticulitis at higher risk for incisional hernia. This calls for personalized management strategies, particularly preoperative assessments for patients with diverticulosis. Inguinal hernia and diverticulosis present significant challenges for octogenarians, necessitating informed, tailored management approaches. The study emphasizes the link between age-related connective tissue changes and adverse health outcomes, advocating for individualized care strategies. Ongoing research is essential to refine management pathways and improve outcomes for aging patients.

**Keywords:** Inguinal hernia, Octogenarian, Diverticulosis, Diverticulitis, Connective tissue, Collagen, Age, Recurrence, Complication

## INTRODUCTION

Inguinal hernia and diverticulosis are common conditions that affect health expenditures. Risk factors and complications have been evaluated separately for each disease. However, both diseases may share a similar etiology, be associated in their pathogenesis, and share age as a risk factor. Regarding octogenarians, we should understand the factors influencing outcomes after hernia

repair. The prevalence of diverticulosis rises steadily with age, affecting the majority of individuals aged 80 years and older.<sup>1</sup> Similarly, the incidence of inguinal hernia and the risk of emergency hernia repair increase markedly in advanced age.<sup>2</sup> These observations raise the question of whether inguinal hernia and diverticulosis represent distinct manifestations of a shared connective tissue disorder rather than independent disease entities. This narrative review aims to summarize current evidence on

the association between inguinal hernia and diverticulosis in octogenarians, with a particular focus on age-related connective tissue alterations and their implications for surgical decision-making.

## **METHODS**

A narrative literature search was conducted in PubMed to identify relevant publications addressing inguinal hernia, diverticulosis, diverticulitis, age-related connective tissue alterations, collagen metabolism, hernia recurrence, and outcomes in elderly patients, with particular emphasis on octogenarians. The search included original research articles, registry analyses, systematic reviews, and key experimental studies considered relevant to the scope of this review. Reference lists of selected articles were additionally screened to identify further pertinent publications. No formal inclusion or exclusion criteria were applied, as this work was intended as a narrative review rather than a systematic analysis.

## **AGE AND DIVERTICULOSIS, DIVERTICULITIS**

The prevalence of diverticulosis significantly increases with age, affecting most adults aged 65 years and older, including approximately 70% of those aged 80 and above. Gastrointestinal (GI), liver, and pancreatic diseases contribute substantially to morbidity, mortality, and healthcare costs in the United States, with hospitalizations for related conditions such as inflammatory bowel disease rising over the past two decades.<sup>1</sup>

Diverticulitis is a common GI disorder that can lead to serious health complications and increased healthcare expenses. About 20% of first-time diverticulitis patients experience at least one recurrence; however, the risk of complications, such as abdominal sepsis, is reduced in subsequent episodes. Identified modifiable risk factors include obesity, dietary habits, and physical inactivity, all of which may influence intestinal microbiome and inflammation levels.<sup>3,4</sup>

People aged 80 or older face higher complication and death rates from diverticulitis, especially when surgery is required. Frequent recurrences also increase the chance of emergency colectomy or colostomy after nonoperative management. Recommendations for elective colectomy may be more effective when based on individual patient factors rather than solely on established guidelines.<sup>5</sup>

## **AGE AND INGUINAL HERNIA**

Older age, particularly 80 years or older, is associated with higher complication rates and increased mortality from diverticulitis, especially when surgery is needed. Both age and recurrent episodes influence the risk of requiring emergency colectomy or colostomy after nonoperative management, suggesting that elective colectomy recommendations should be personalized.<sup>6</sup>

A systematic review of 40 studies on inguinal hernia surgery, involving 719,901 procedures, identified significant risk factors for recurrence: female gender (RR 1.38), direct inguinal hernias (RR 1.91), prior hernia surgery (RR 2.20), and smoking (OR 2.53). Emergency admissions and family history also play roles, while age and recovery time do not affect recurrence risk. The multifactorial nature of these recurrences highlights the importance of understanding both technical and non-technical factors.<sup>7</sup>

Octogenarians undergoing elective inguinal hernia repair face low morbidity and mortality, but emergency repairs have a higher death risk. Women also face a greater mortality risk post-repair due to a higher likelihood of emergencies or femoral hernias.<sup>8</sup> Additionally, endoscopic or laparoscopic hernia surgery shows increased complication rates for patients over 65, particularly after 80.<sup>9</sup>

## **AGE DIVERTICULOSIS AND INGUINAL HERNIA**

Diverticulosis is linked to abdominal wall hernias, such as inguinal hernias. This suggests a common age-related connective tissue disorder called “herniosis.” In a study of 13,855 patients, 3,685 (26.6%) had diverticulosis. The study found that diverticulosis was independently associated with direct inguinal hernia repair (odds ratio OR 1.33) and umbilical/epigastric hernia repair (OR 1.74). This suggests connective tissue changes may contribute to both conditions.<sup>10</sup>

## **AGE DIVERTICULITIS AND POSTOPERATIVE HERNIA RISK**

Patients undergoing colectomy for diverticulitis have a higher risk of developing incisional hernias than those undergoing the same surgery for colon cancer. Recent studies have linked mutations associated with diverticular disease and connective tissue disorders to abdominal wall hernias, but data on this shared etiology, particularly regarding laparoscopic surgery, are limited. Surgeons should follow evidence-based guidelines for fascial closure during resections for diverticulitis to minimize this complication.<sup>11</sup>

## **AGE AND INGUINAL HERNIA RECURRENCE**

Advanced age, even for octogenarians, is not always an independent risk factor for inguinal hernia recurrence. Instead, recurrence is more closely associated with hernia type, surgical technique, and connective tissue quality. A review of 40 studies and 378,824 procedures identified female sex, direct inguinal hernias in the first surgery, recurring hernia surgery, and smoking as key risk factors.<sup>12</sup> Another study showed more collagen III (immature) in skin and less collagen I (mature) in transversalis fascia in hernia patients. The collagen I to III ratio was also reduced in both tissues.<sup>13</sup>

Collagen breakdown may help cause inguinal hernias. This study evaluated biomarkers in patients with primary and recurrent hernias. The serum ratio of procollagen type I N-terminal propeptide (PINP) to type III N-terminal propeptide (PIIINP) was lower in patients with recurrent hernias. This suggests impaired collagen metabolism and may serve as a marker for recurrence.<sup>14</sup>

Direct and recurrent hernia repairs are linked to ventral hernia repairs. Matrix metalloproteinases (MMPs) are not effective. However, collagen turnover markers are altered in patients with hernias. These systemic markers might help tailor surgical strategies.<sup>15</sup> Moreover, changes in collagen metabolism, specifically in type V and IV collagen, have been observed post-surgery. Inguinal hernia patients showed higher postoperative type V collagen turnover compared to preoperative levels, though lower than in controls. In contrast, incisional hernia patients had similar levels pre- and post-operation. This suggests persistent alterations in collagen metabolism may contribute to hernia development.<sup>16</sup>

Inguinal and incisional hernias arise from weaknesses in the abdominal wall and connective tissue defects. The extracellular matrix, mainly collagen and MMPs, is significant in hernia pathophysiology. TIMPs inhibit MMPs and are essential for collagen metabolism. Research shows that TIMP1 levels are higher in hernia patients, while TIMP2 levels are elevated in controls, with no significant difference between incisional and inguinal hernias. Increased TIMP1 supports its role in hernia development, suggesting that measuring TIMP levels could have clinical implications. Further validation is needed.<sup>17</sup> Conditions like genital prolapse and hernias are linked to connective tissue dysfunction.<sup>18</sup> An inguinal hernia occurs when abdominal contents protrude through the inguinal canal, with collagen's integrity being crucial. Glycine, abundant in collagen, is linked to age, BMI, and the onset of inguinal hernias.<sup>19</sup> Hernia formation and recurrence are associated with altered collagen metabolism, shown by a decreased type I:III collagen ratio.<sup>20</sup>

A study underscores the importance of a biological approach in conjunction with technical considerations for understanding the pathogenesis of recurrent hernia formation. It highlights the disruption in the scarring process as a significant factor. Specifically, the composition of the scar tissue shows a reduced ratio of collagen type I to type III, resulting in reduced tensile strength. This decrease in strength may substantially contribute to the recurrence of hernias.<sup>21</sup> The alterations observed in the expression of collagen-interacting proteins suggest the presence of a fundamental connective tissue disorder that may underlie (recurrent) incisional hernias.<sup>22</sup> The findings of this research strongly indicate that recurrent inguinal hernias are associated with complications in the collagen matrix. This understanding enhances understanding of the underlying pathophysiology and may inform specific therapeutic

strategies in hernia surgery, including the use of surgical meshes.<sup>23</sup>

Aging has been shown to compromise collagen structure and increase cross-linking, leading to diminished tissue tensile strength, which is correlated with both diverticulosis and hernia development.<sup>24</sup> Furthermore, there is a statistical association between diverticulosis and hernias, likely attributable to shared connective tissue abnormalities termed herniosis rather than to mechanical factors.<sup>10</sup> Hernia tissue exhibits a lower ratio of type I to type III collagen, indicative of weaker connective tissue; a similar pattern is also present in diverticular tissue.<sup>20</sup>

Genetic factors influencing collagen and extracellular matrix remodeling contribute to the susceptibility to diverticulosis and may also heighten the risk of hernia formation.<sup>25</sup> Additionally, congenital collagen disorders significantly elevate the risk of hernias, illustrating the role of compromised collagen integrity in their development.<sup>26</sup>

### ***What does this mean for surgeons?***

Both diverticulosis and inguinal hernia prevalence increase significantly with age. Aging leads to collagen cross-linking, reduced elasticity, and altered ratios of collagen types I and III.<sup>10,20,24</sup>

Watchful waiting is acceptable for minimally symptomatic patients, even among older adults. However, emergency hernia surgery carries a considerably higher mortality rate in individuals aged 80 and older. For octogenarians, elective repair is safer than emergency repair, highlighting the importance of proactive decision-making when symptoms are present.<sup>8</sup>

In cases of active diverticulitis, elective hernia repair should be postponed. Emergency operations should generally be avoided in patients aged 80 years or older.<sup>9,27</sup>

Prehabilitation for older patients is crucial. Factors such as sarcopenia, malnutrition, frailty, reduced collagen quality, and being over 65 years old increase the risk of complications, particularly frailty.<sup>12,15</sup>

The surgical technique should be matched to the surgeon's expertise and the patient's overall fitness. Laparoscopic repair is safe for elderly patients, while open repair under local anesthesia is effective for frail individuals aged 80 and above.<sup>28</sup>

The choice of anesthesia becomes increasingly important with age. Local anesthesia reduces cardiopulmonary stress and is especially beneficial in octogenarians, whereas general anesthesia should be avoided.<sup>29,30</sup>

The risk of complications is higher in patients aged 80 and older. Elective surgery typically has a low mortality

rate, even in this age group. However, in emergency surgery, mortality rates increase sharply.<sup>8</sup>

## CONCLUSION

Inguinal hernia and diverticulosis pose significant challenges for octogenarians, requiring an informed, personalized approach to management. This study underscores the critical link between age, connective tissue changes, and health outcomes in these conditions. Given that diverticulosis affects the majority of older adults, tailored interventions, especially for those requiring inguinal hernia repair, are vital. Prioritizing individualized treatment strategies over rigid protocols can enhance care quality, reduce complications, and improve overall quality of life for this vulnerable population. Ongoing research is essential to refine management pathways and equip healthcare professionals to better address the specific needs of aging patients, ultimately leading to improved health outcomes and well-being.

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