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RISK FACTORS, DIAGNOSIS, AND CLINICAL OUTCOMES IN ABDOMINAL AORTIC ANEURYSM: AN INTEGRATIVE LITERATURE REVIEW

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ABSTRACT

Introduction: abdominal aortic aneurysm (AAA) is a multifactorial and often asymptomatic condition characterized by progressive and irreversible dilation of the aortic wall, with a high risk of rupture and sudden death. It is more prevalent in men over 65 years, especially smokers, and is usually diagnosed incidentally. OBJECTIVES: To synthesize scientific evidence on risk factors, diagnostic methods, and clinical outcomes related to AAA through an integrative literature review. **Methodology:** This is an integrative literature review with searches conducted in PubMed from 01/01/2020 to 06/30/2025, using MeSH/DeCS descriptors combined with Boolean operators. Eligible studies included observational studies, case series with n ≥ 50, clinical trials and systematic reviews with quantitative data. **Results and discussion:** AAA was associated with male sex, advanced age, smoking, hypertension, dyslipidemia, and family history. Ultrasound is the preferred screening method, while computed tomography is essential for surgical planning. Early intervention, preferably with endovascular repair (EVAR), reduces mortality, though it requires ongoing monitoring. Open surgery remains a valid option in selected cases. Controlling risk factors is crucial to prevent complications. **Conclusion:** Screening high-risk groups, early diagnosis, and appropriate surgical intervention are essential to reduce AAA-related mortality.

Keywords: Abdominal aortic aneurysm, Risk factors, Diagnosis, Clinical outcomes, Endovascular repair.

INTRODUCTION

Aortic aneurysm is a pathological condition characterized by a progressive and irreversible dilation of the aortic wall. The most common type is the abdominal aortic aneurysm (AAA), which is defined when the diameter of the affected segment reaches 3.0 cm or more, often representing an increase of more than 50% compared with the normal diameter of the vessel lumen. The main pathophysiological mechanisms involved include protein destabilization of the extracellular matrix, endothelial dysfunction, and chronic inflammation of the aortic wall, leading to the loss of vascular elasticity.[1]

Clinically, the progression of most cases of AAA is asymptomatic until rupture occurs. For this reason, the identification of risk factors is essential for the screening and clinical management of the disease. Among the main associated variables, the following stand out: male sex, advanced

age, smoking, family history of AAA, systemic arterial hypertension, dyslipidemia, coronary artery disease, and peripheral arterial disease.[2,3]

The diagnosis of AAA, given its silent nature, is often made incidentally during imaging examinations requested for other purposes. However, symptoms such as unexplained abdominal discomfort associated with low back pain, a palpable pulsatile mass, and hypotension may be suggestive of aneurysmal rupture, which requires immediate evaluation. Abdominal ultrasonography is the method of choice for investigation in at-risk individuals, as it has high sensitivity, is non-invasive, and is low cost.[4,3]

The main clinical outcomes of abdominal aortic aneurysm (AAA) include rupture, sudden death, the need for emergency surgical intervention, and postoperative complications. Rupture is the most critical outcome, with a mortality rate of over 80% in cases without hospital care and up to 50% even with immediate medical assistance. Sudden death, related to late-diagnosed rupture, is more common in individuals with large aortic protrusions (>5.5 cm) or with rapid aneurysm growth.[5,3,1] When identified early, AAA can be treated electively, usually through endovascular aneurysm repair (EVAR), a technique that reduces immediate morbidity and mortality. Postoperative complications include the occurrence of endoleaks, graft thrombosis, and endograft migration.[6,7]

OBJECTIVE

This study aims to synthesize, through an integrative review, the evidence available in the scientific literature regarding the risk factors, diagnostic methods, and clinical outcomes associated with abdominal aortic aneurysm.

METHODOLOGY

This This is an integrative literature review, aimed at synthesizing scientific evidence on risk factors, diagnostic methods, and clinical outcomes related to abdominal aortic aneurysm (aortic aneurysm, abdominal), as indexed in the controlled vocabularies MeSH (Medical Subject Headings) and DeCS (Health Sciences Descriptors). Studies published between January 1, 2020, and June 30, 2025, in Portuguese and English, were included.

Eligibility Criteria and Study Selection

Eligible studies included: observational studies (cohort and case-control), case series with n ≥ 50, randomized or non-randomized clinical trials, and systematic reviews with quantitative data.
The following were excluded: isolated case reports, narrative reviews, expert opinions not based on primary data, and letters to the editor.
Search Strategy: the search was conducted in the PubMed database, using combinations of MeSH/DeCS descriptors with Boolean operators, according to the objectives of the review. Below is an example of the strategy applied in the PubMed database: ("Aortic Aneurysm, Abdominal"[MeSH] OR "Aneurisma da aorta abdominal"[DeCS]) AND ("Risk Factors"[MeSH] OR "Fatores de risco"[DeCS]) AND ("Diagnosis"[MeSH] OR "Diagnóstico"[DeCS]) AND ("Treatment"[MeSH] OR "Terapêutica"[DeCS]) AND ("2020/01/01"[Date - Publication] : "2025/06/30"[Date - Publication])

Study Selection and Data Extraction Process

Screening was carried out in two stages by independent reviewers: (1) title and abstract screening and (2) full-text review. Any disagreements were resolved by consensus. The extracted

data included: methodological characteristics of the study, population, interventions or exposures, analyzed outcomes, main findings, and limitations reported by the authors.

RESULTS AND DISCUSSION

Abdominal aortic aneurysm (AAA) is a frequently asymptomatic condition, often being detected incidentally during imaging examinations requested for other reasons.[5,4,2] Despite its silent nature, the aneurysm is potentially lethal in the event of rupture - an event associated with high mortality rates, being responsible for approximately 170,000 deaths annually worldwide.[4,1,7]

The prevalence of AAA is related to demographic, behavioral, and genetic factors. Male sex, advanced age, and smoking stand out. It is more common in men, and its incidence increases significantly after 65 years of age.[4] In women, although less prevalent, AAA tends to grow more rapidly and rupture at smaller diameters, from 4.5 cm onward.[7,4] Smoking is the main modifiable risk factor, increasing incidence, accelerating aneurysm growth, and increasing the risk of rupture—its cessation being recommended with Class I level of evidence.[4,7,1] In addition, arterial hypertension, coronary artery disease, and peripheral arterial disease are frequently associated comorbidities and act as independent risk factors for the development of AAA.[4,7,2] Dyslipidemia - that is, elevated levels of LDL cholesterol and lipoprotein(a) - has a potentially causal role, and the use of statins may attenuate aneurysm growth.[7,4] Obesity, on the other hand, may be associated with slower AAA growth.[7] Chronic inflammatory diseases also contribute to its pathogenesis.[4,1,8] Furthermore, family history of AAA has a strong genetic component, with heritability reaching up to 70%, and the risk of development and rupture in first-degree relatives being substantially higher—by about 10 times.[4,7,1] Although physical inactivity and alcohol consumption are considered additional factors, the evidence regarding their association is still limited.[4]

The pathophysiology of AAA involves destruction of the extracellular matrix (ECM), chronic inflammation, and apoptosis of smooth muscle cells (SMCs).[4,7] The degradation of the ECM, including elastin and collagen, is mediated by matrix metalloproteinases (MMPs) released by inflammatory cells such as neutrophils and macrophages,[4] weakening the aortic wall and predisposing it to progressive dilation and, eventually, rupture.[4,7] Endothelial dysfunction is an early pathological event that contributes to oxidative stress and inflammation in the arterial wall.[1] Chronic inflammation also includes the transdifferentiation of SMCs into macrophage-like cells.[4] Studies of flow-mediated dilation (FMD) inversely correlate endothelial dysfunction with aneurysm diameter, with smoking contributing to this dysfunction.[1] DNA demethylation and oxidative stress also modulate gene expression and apoptosis of SMCs, increasing susceptibility to dilation and rupture.[4]

With regard to diagnosis, it is known that it is frequently incidental, being detected in imaging examinations for other clinical reasons, since it is generally asymptomatic until rupture.[3,5,4] Abdominal ultrasonography is the examination of choice for screening, and it is recommended for men aged 65 to 75 years who are smokers or former smokers.[3,4] Its choice is due to being cost-effective, non-invasive, and radiation-free, in addition to having high sensitivity (94–100%) and specificity (98–100%) in the detection of AAA.[3] It is also used for the initial diagnosis and periodic monitoring of small aneurysms.[5,4] Accuracy, however, may be limited by obesity or intestinal gas.[3,4] Computed tomography (CT) is the gold standard for diagnostic confirmation and surgical planning, providing detailed assessment of diameter, extension, and wall characteristics, in addition to mapping the aorta and adjacent arteries.[4] It is crucial for cases that require intervention, such as aneurysms larger than 5.5 cm in men or 5.0 cm in women,

or with rapid growth (>0.5 cm in 6 months or >1 cm in 1 year).[3,4] For greater precision, measurements should be taken from the outer edge of the vessel wall, in the true axial direction of the aorta, using multiplanar and three-dimensional reconstructions.[4] Magnetic resonance imaging (MRI), although less common and with limitations such as availability, claustrophobia, and presence of metallic devices, may be an option in specific cases, mainly because it does not require the use of iodinated contrast or radiation. Regardless of the imaging method, regular surveillance is essential to monitor aneurysm growth and determine the appropriate moment for intervention.[4,3]

According to clinical guidelines, AAA follow-up depends on the initial diameter.[4,2] Aneurysms below 3.0 cm do not require regular follow-up.[4] Those between 3.0 and 5.4 cm should be monitored every 6 to 12 months, depending on the growth rate.[4] Surgical intervention is generally indicated upon reaching 5.5 cm in men or 5.0 cm in women,[2] in cases of accelerated growth (>0.5 cm in 6 months or >1 cm in 1 year), or presence of symptoms.[7,4,2]

With regard to clinical outcomes, the prognosis of the aneurysm is intrinsically linked to its early diagnosis and adequate treatment.[5,4] AAA rupture is a serious medical emergency, frequently lethal in most cases when untreated.[4] Historically, in-hospital mortality for ruptured aneurysm reached 50%,[4] but the dissemination of endovascular treatment has led to a reduction to the 20% to 30% range.[4] In contrast, elective intervention, performed before rupture, is associated with significantly lower rates of mortality and complications.[5,4]

The two main surgical approaches for the treatment of abdominal aortic aneurysm are conventional open surgery and endovascular repair (EVAR).[6,4] EVAR has gained prominence in recent decades for being a less invasive procedure and has been the most common surgical approach for AAA due to patient preference.[6,4] When compared with open surgery, EVAR generally promotes faster recovery, presents lower rates of perioperative complications, and lower 30-day mortality.[6,4] In addition, patients undergoing EVAR typically have shorter surgical time, lower blood loss, shorter hospital stay, and shorter stay in intensive care units, with fewer immediate postoperative cardiac and respiratory complications.[4] However, EVAR requires continuous and rigorous follow-up with imaging examinations, such as annual CT angiographies.[6,4] This is due to the significantly higher risk of complications and need for reintervention over time, with endoleaks, endograft migration, and material failures being the most frequent.[6,4] Although mortality is lower, the rates of reinterventions and adverse events are generally more frequent in EVAR than in open surgery.[4]

On the other hand, open surgery remains an essential option, especially for patients with anatomy unfavorable to EVAR.[6,4] Although it may have greater perioperative morbidity and be less suitable for patients with severe comorbidities or advanced age, open surgery demonstrates excellent long-term results and lower need for reoperations compared with EVAR.[6,4] After open surgery, imaging follow-up is less intense, with CT of the aorta and iliac arteries being recommended every 5 years.[4]

In the management of AAA, preventive strategies and health education are crucial.[5] Targeted screening campaigns are fundamental for early detection.[4] In addition, strict control of risk factors, such as smoking and hypertension, is essential to reduce progression and avoid adverse outcomes.[4,7] Finally, postoperative surveillance is vital to detect complications early, such as endoleaks or recurrence of aortic dilation.[6,4] The frequency of imaging examinations depends on the intervention: CT angiography is recommended 30 days after endovascular repair (EVAR) and annually thereafter, or every 5 years after open repair.[4]

CONCLUSION

Finally, the present study states that abdominal aortic aneurysm (AAA) is a pathological condition associated with several factors, generally asymptomatic, and presents a high risk of death, especially in cases of rupture. Therefore, early diagnosis is essential to reduce mortality related to AAA, demonstrating the essentiality of screening in risk groups, such as male smokers aged 65 to 75 years and patients with a family history of aneurysm. However, screening is not sufficient to prevent aneurysmal rupture; lifestyle changes are also crucial to control disease progression, such as blood pressure control and smoking cessation. Although surgical techniques, such as open surgery and endovascular repair (EVAR), provide immediate benefits, especially when performed before vessel rupture, post-surgical follow-up is indispensable, since it allows anticipation of management in the face of possible complications.

It is therefore concluded that, although AAA, in most cases, does not present symptoms, its control and treatment are possible through early screening, identification, and intervention based on the most affected groups. It is also important to seek the improvement and innovation of the surgical procedures used for intervention in cases of abdominal aortic aneurysm, with the aim of reducing the deaths caused by this condition.

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