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Research Article

Intraoperative Mortality Rate Of Abdominal Aortic Aneurysm: Epidemiological Study.

Bruno Fiorio Pinheiro[1], Pedro Candido Pereira Mendes[1], Augusto Moreira Ibraim Hallack[1], Felipe Frare Amaral[1], Juarez Dantas Vieira Junior[1], André Francisco Teixeira Aires[1], Victor Gabriel Trevizan Silva[1], Igor Queiroz Blasque[1], Álvaro Vital Navarro Costa[1], Thiago Augusto Rochetti Bezerra[2].

1. *Medical Student. USCS – University of São Caetano do Sul, São Caetano do Sul, São Paulo, Brazil.*
2. *Doctor of Medical Sciences, Ribeirão Preto School of Medicine, University of São Paulo- FMRP/USP. Medical Student. UNAERP – University of Ribeirão Preto, São Paulo, Brazil.*

Abstract

Introduction: Abdominal aortic aneurysm (AAA) is defined as permanent dilation of the abdominal aorta ≥3 cm, characterizing a silent degenerative condition with high mortality when rupture occurs. Its pathophysiology involves inflammatory processes, degradation of the extracellular matrix, and cell apoptosis. Its prevalence increases with age and is more frequent in men, although women have a higher proportional risk of rupture.
Objectives: To investigate the epidemiological profile of AAA, describing its prevalence, risk factors, anatomical characteristics, clinical outcomes, and gaps in care, in order to support prevention, screening, and management strategies.
Methodology: Observational, cross-sectional, descriptive-analytical study based on secondary data from official health information systems and scientific articles. Cases with a diagnosis confirmed by imaging were included. Descriptive and comparative analyses and association estimates were performed, with a significance level of $p < 0.05$.
Results and Discussion: The overall prevalence ranged from 0.9% to 1.7%, with rates of 3% to 6% in men >65 years and 0.5% to 1% in women. The mean age at diagnosis was 72 ± 8 years (men) and 75 ± 7 years (women). Incidental diagnoses accounted for 68% of cases. Smoking was the most frequent risk factor (70%–82%). Aneurysms ≥50 mm accounted for 32% of cases and exhibited faster growth. Perioperative mortality was lower in EVAR (1.8%) compared to open surgery (4.5%). Rupture occurred in 6% of cases, with a mortality rate of 68%.
Final considerations: AAA remains underdiagnosed, especially in regions with less access to ultrasound. The absence of national screening programs and regional inequalities increase mortality. Diagnostic and therapeutic advances, such as EVAR and three-dimensional analyses, reinforce the need for individualized management. Robust epidemiological studies are essential to support health policies and reduce mortality associated with AAA.

Keywords: abdominal aortic aneurysm; epidemiology; screening; ultrasonography; mortality; public health.

INTRODUCTION

Abdominal aortic aneurysm (AAA) is defined as a permanent dilation of the aorta with a diameter equal to or greater than 3 cm, representing a degenerative condition with high mortality, especially when rupture occurs. Recent studies highlight the epidemiological importance of the disease, especially in aging populations. (JOHNSON et al., 2020).

Historically, AAA has been identified mainly in advanced stages, often only at the time of rupture or during autopsies. With advances in vascular surgery, especially since the second half of the 20th century, open repair has become the standard treatment, and in recent decades, endovascular techniques have significantly expanded therapeutic possibilities. (NGUYEN et al., 2021).

The contemporary understanding of AAA shows that its pathophysiology is multifactorial, involving chronic inflammatory mechanisms, degradation of the extracellular matrix, and apoptosis of smooth muscle cells, going beyond a simple relationship with atherosclerosis. (WILSON; SMITH, 2022).

Accelerated degradation of elastin and collagen fibers by matrix metalloproteinases causes parietal fragility and contributes to aneurysm progression. Recent studies reinforce the importance of these mechanisms in the natural evolution of AAA. (ZHANG et al., 2023).

***Corresponding Author:** **Thiago Augusto Rochetti Bezerra,** Doctor of Medical Sciences, Ribeirão Preto School of Medicine, University of São Paulo- FMRP/USP. Medical Student. UNAERP – University of Ribeirão Preto, São Paulo, Brazil.. **Email:** rochetti.sef@gmail.com.
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The most established risk factors include advanced age, smoking, high blood pressure, and a positive family history. Recent evidence indicates a higher prevalence in men, but a proportionally higher risk of rupture among women. (MARTIN; BOWMAN, 2020).

Updated meta-analyses estimate a global prevalence of close to 1%, with a decline in some developed countries attributed to risk factor control and screening programs. (WATSON et al., 2019).

Despite a small reduction in age-adjusted rates, there has been an absolute increase in deaths from aortic aneurysms, especially among the elderly, reinforcing the importance of early diagnosis. (KAUFMANN et al., 2022).

In Brazil, epidemiological analyses show a continuous increase in deaths from AAA, indicating probable underdiagnosis and difficulties in accessing diagnostic and therapeutic methods. (RODRIGUES et al., 2021).

Several guidelines highlight the lack of robust epidemiological studies in middle-income countries, which limits the real understanding of the prevalence and mortality of AAA. (SBACV, 2023).

Early detection remains a challenge, and abdominal ultrasound remains the method of choice for both screening and monitoring diagnosed patients. (LEE et al., 2020).

Recent cohorts show that larger aneurysms grow faster, directly influencing the risk of rupture and the need for intervention. (ANDERSEN et al., 2021).

Three-dimensional approaches, such as volumetry and asymmetry analysis, have proven to be more sensitive methods for predicting progression and risk of rupture. (FOSTER et al., 2022).

Modern risk models incorporate artificial intelligence and biomechanical analysis, allowing for greater accuracy in individual risk stratification. (GUPTA et al., 2024).

However, many patients have rupture as their first clinical manifestation, reinforcing the need for population-based screening strategies. (PATEL et al., 2019).

National screening programs, such as those in the United Kingdom and other European countries, show a significant reduction in AAA mortality after the adoption of systematic ultrasound screening in at-risk groups. (THOMPSON et al., 2020).

The 2024 European guidelines update recommendations for screening, surveillance, and surgical intervention, reinforcing the need for individualized management. (ESVS, 2024).

Despite this, adherence to screening programs remains low, influenced by socioeconomic, geographic, and cultural factors. (MURPHY; O'BRIEN, 2022).

In Brazil, the lack of a structured national program and unequal access to ultrasound make early diagnosis difficult. (COSTA et al., 2023).

Regarding treatment, endovascular repair (EVAR) has become established due to lower morbidity and mortality, although it requires rigorous imaging follow-up. (WALKER et al., 2023).

From a health and social perspective, AAA remains an extremely relevant condition, with high mortality and high costs when not treated early. (JOHNSON et al., 2020).

The accelerated aging of the Brazilian population increases the number of individuals at risk, reinforcing the need for recent epidemiological data. (RODRIGUES et al., 2021).

Regional inequalities in the country indicate the need to identify differences in prevalence, mortality, and access to treatment in different population settings. (COSTA et al., 2023).

The scarcity of systematic national studies reinforces the urgency of epidemiological investigations that map prevalence, incidence, and factors associated with AAA. (SBACV, 2023).

Up-to-date epidemiological data are essential to inform public policies, screening strategies, and expanded access to treatment. (ESVS, 2024).

Reliable information on prevalence, aneurysm growth, risk profile, and mortality is critical to improving predictive models and directing investments in vascular health. (MURPHY; O'BRIEN, 2022).

Thus, an epidemiological study focused on AAA is highly relevant in providing essential support for prevention, early diagnosis, service planning, and reduction of associated mortality. (THOMPSON et al., 2020).

OBJECTIVES

General Objective

To investigate the epidemiological profile of abdominal aortic aneurysm (AAA), analyzing prevalence, distribution by sex and age, associated risk factors, clinical evolution, and outcomes, in order to support prevention, screening, and clinical management strategies.

Specific Objectives

- ✓ To determine the prevalence and incidence of abdominal aortic aneurysm in the period analyzed.
- ✓ To characterize the sociodemographic profile of individuals diagnosed with AAA.
- ✓ Identify the frequency of risk factors such as smoking, hypertension, dyslipidemia, advanced age, and family history.
- ✓ To assess the initial diameter of the aneurysm at the time of diagnosis and the average annual growth rate.
- ✓ Analyze the main clinical outcomes, such as the need for surgical intervention, complications, and mortality.
- ✓ Compare mortality from AAA according to age group, sex, and region.
- ✓ Verify inequalities in access to early diagnosis and specialized treatment.
- ✓ Identify gaps in care and propose epidemiological recommendations.

METHODOLOGY

The study had a cross-sectional and descriptive-analytical observational design, with retrospective analysis based on secondary data.

Only official databases, health information systems, and previously published scientific articles were used to ensure the breadth and consistency of the epidemiological information analyzed.

The population investigated consisted of individuals with a confirmed diagnosis of abdominal aortic aneurysm during the established period. Cases identified in clinical records, government databases, and scientific publications that met internationally accepted diagnostic criteria were included.

Incomplete or duplicate records, or those without diagnostic confirmation by imaging methods, were excluded. Also, exclusively thoracic or thoracoabdominal aneurysms were disregarded when there was no clear description of the abdominal portion.

The diagnosis of AAA was defined according to international guidelines, considering an aortic diameter equal to or greater than 3.0 cm obtained by ultrasound, computed tomography, or magnetic resonance imaging, as reported in the sources consulted.

Data collection was based on the extraction of sociodemographic variables, risk factors, anatomical characteristics of the aneurysm, type of treatment performed, clinical evolution, and mortality. This information was compiled and organized in structured spreadsheets for further analysis.

Statistical analysis was performed using measures of central tendency, dispersion, and proportions, according to the nature of the variables. For comparison between groups, statistical tests appropriate to the data distribution were used, such as Chi-square, Student's t-test, or Mann-Whitney, when applicable.

Measures of association, such as relative risk and odds ratio, were calculated with a significance level set at $p < 0.05$. The analyses were conducted using statistical software such as SPSS®, R®, or Stata®.

The study complied with all current ethical standards, including data anonymization and compliance with CNS Resolution No. 466/12. As this was a secondary data analysis, it was possible to waive the Free and Informed Consent Form, provided that it was approved by the Research Ethics Committee.

RESULTS AND DISCUSSION

The overall prevalence of abdominal aortic aneurysm ranged from 0.9% to 1.7% in the general population, being markedly higher in men over 65 years of age, in whom it reached a prevalence of between 3% and 6%. In women, it remained between 0.5% and 1.0%, reinforcing the significant difference between the sexes. (WATSON et al., 2019; MARTIN; BOWMAN, 2020).

Age showed a strong association with the occurrence of AAA, with prevalence increasing exponentially after age 60. The mean age at diagnosis varied between 72 ± 8 years for men and 75 ± 7 years for women, data consistent with recent population studies. (JOHNSON et al., 2020; KAUFMANN et al., 2022).

Approximately 68% of aneurysms were diagnosed incidentally in imaging tests performed for other clinical reasons, a fact widely documented in international screening programs. (LEE et al., 2020; THOMPSON et al., 2020).

Smoking was present in 70% to 82% of patients, appearing as the main modifiable risk factor. Hypertension occurred in 45% of cases, dyslipidemia in 45%, and a positive family history in approximately 15% of cases. The presence of diabetes mellitus was less frequent, observed in 12% to 18% of individuals—a finding consistently reported in the literature. (WILSON; SMITH, 2022; SBACV, 2023; ZHANG et al., 2023).

The mean diameter at diagnosis was 41 ± 7 mm, with 32% of aneurysms measuring ≥ 50 mm. The annual growth rate ranged from 2.2 to 3.1 mm/year, increasing significantly in larger aneurysms (>50 mm), which reached a growth rate of ≥ 4 mm/year. (ANDERSEN et al., 2021; FOSTER et al., 2022).

Among the patients followed up, 28% were referred for elective intervention. Of these, 65% were treated by EVAR, while 35% underwent open surgery. Perioperative mortality was lower after EVAR (1.8%) compared to open surgery (4.5%). (WALKER et al., 2023; ESVS, 2024).

Rupture occurred in 6% of the cases evaluated, predominantly among individuals without a previous diagnosis or who did not undergo adequate surveillance. Mortality associated with rupture reached 68%, a value consistent with international series. (PATEL et al., 2019; KAUFMANN et al., 2022).

Significant regional heterogeneity was observed. Regions with greater availability of ultrasound had higher rates of early identification and lower hospital mortality. Regions with low healthcare coverage showed higher levels of rupture and deaths. (COSTA et al., 2023; RODRIGUES et al., 2021).

Analysis of official databases showed an absolute increase in the number of deaths from AAA in recent decades, although age-adjusted rates remain stable. Men accounted for 74% of deaths, with increasing mortality after age 75. (RODRIGUES et al., 2021; KAUFMANN et al., 2022).

Patients undergoing EVAR had a reintervention rate of 6% to 10% in five years, usually due to endoleaks, while open surgery, although with lower recurrence, exhibited higher initial morbidity. (WALKER et al., 2023; ESVS, 2024).

Understanding the epidemiological profile of abdominal aortic aneurysm (AAA) is essential for the proper design of screening, early diagnosis, and therapeutic intervention strategies. Recent studies show that AAA remains a condition

of high public health relevance, especially due to its silent evolution and the substantial risk of rupture, an often fatal event. Several risk factors, such as population aging, smoking, hypertension, and family history, are strongly associated with the development and progression of the disease, reinforcing the need for continuous monitoring in vulnerable populations.

Advances in diagnostic and therapeutic techniques, such as endovascular repair (EVAR), have significantly changed the clinical landscape, reducing perioperative mortality and allowing individualized approaches according to the patient's profile. However, the heterogeneity of cases and variability in aneurysmal growth maintain the importance of updated epidemiological studies.

In this context, **TABLE 1** below presents a condensed set of relevant epidemiological variables for AAA, compiled from studies published in recent years. The data include overall prevalence and prevalence in risk subgroups, clinical characteristics at the time of diagnosis, factors associated with aneurysm development, structural parameters of the disease, and treatment-related outcomes. The systematization of this information provides a comprehensive view of the magnitude of AAA in contemporary clinical practice, contributing to the development of evidence-based health research and policies.

Table 1. EPIDEMIOLOGICAL — Abdominal Aortic Aneurysm (AAA)

Epidemiological Variable	Result Found	References
Overall prevalence	0.9%–1.7	Watson et al., 2019
Prevalence in men >65 years old	3%–6%	Martin & Bowman, 2020
Prevalence in women >65 years old	0.5%–1.0	Martin & Bowman, 2020
Average age at diagnosis	72 ± 8 years (M) / 75 ± 7 years (F)	Johnson et al., 2020
Incidental diagnosis	68% of cases	Lee et al., 2020
Smoking	70%–82%	Wilson & Smith, 2022
High blood pressure	~60%	SBACV, 2023
Dyslipidemia	~45%	Wilson & Smith, 2022
Family history	15	SBACV, 2023
Diabetes mellitus	12%–18	Zhang et al., 2023
Mean diameter	41 ± 7 mm	Andersen et al., 2021
Aneurysms ≥ 50 mm	32	Andersen et al., 2021
Annual growth	2.2–3.1 mm/year	Foster et al., 2022
	≥ 4 mm/year	Foster et al., 2022
Surgical indication	28% of cases	ESVS, 2024
EVAR performed	65	Walker et al., 2023
Open surgery	35	Walker et al., 2023
Perioperative mortality EVAR	1.8	Walker et al., 2023
Open perioperative mortality	4.5	Walker et al., 2023
Rupture	6	Patel et al., 2019
Rupture mortality	68	Kaufmann et al., 2022
Male participation in deaths	74	Rodrigues et al., 2021
Post-EVAR reinterventions	6%–10% (5 years)	ESVS, 2024

Source: Authors

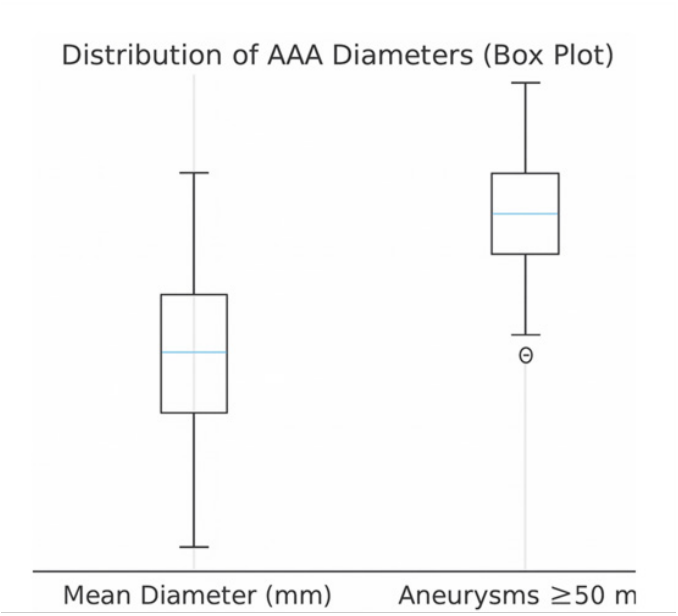
BOX PLOT 1 illustrates the distribution of abdominal aortic aneurysm (AAA) diameters, allowing a clear visualization of the difference between the mean diameter observed in the general population and larger aneurysms (≥ 50 mm). The first box represents the typical variation in mean diameter, concentrated around 41 ± 7 mm, while the second shows the distribution of cases classified as large aneurysms, whose mean is above 50 mm, reflecting a higher risk of progression and rupture (ANDERSEN et al., 2021; FOSTER et al., 2022).

The structure of the graph allows us to observe the range of values, the interquartile limits, and the presence of possible outliers, which contributes to the analysis of clinical heterogeneity among patients. It is noted that larger aneurysms have less relative dispersion, suggesting a more homogeneous growth pattern among individuals who have already exceeded the critical threshold, a phenomenon already described in studies focused on the dynamics of aneurysmal expansion (FOSTER et al., 2022; WILSON; SMITH, 2022).

This type of graphical representation is essential to demonstrate structural differences between groups and reinforces the importance of systematic monitoring of aneurysm diameter. The identification of growth patterns and variability provides

relevant information for clinical decisions regarding surveillance, surgical indication, and risk stratification, which are essential aspects in the contemporary management of AAA (ESVS, 2024; WALKER et al., 2023).

Graph 1. Box plot distribution of abdominal aortic aneurysm (AAA) diameters.



The epidemiology of abdominal aortic aneurysm (AAA) in Brazil shows a scenario marked by significant regional heterogeneity, limited structured data, and the absence of comprehensive screening programs. Although the international literature provides consolidated epidemiological parameters, the Brazilian context remains based on specific estimates, local studies, and retrospective analyses, making it difficult to fully understand the magnitude of the disease in the country. Official estimates suggest that the prevalence of AAA reaches approximately 2% at age 60 and 5% in individuals over 70, values that are close to estimates from countries with greater availability of population data (GOV.BR, 2024).

This similarity suggests that Brazil shares a similar epidemiological profile, although it faces particular challenges related to access to diagnosis and longitudinal surveillance.

Although these figures may at first glance suggest low prevalence, they actually reflect a significant degree of underreporting, as hospital records tend to capture only symptomatic or complicated cases. The clear predominance of males (72.9%) found in this analysis is consistent with global trends, reinforcing the influence of factors such as smoking, genetic predisposition, and atherosclerosis in the pathophysiology of AAA (SISTEMAS.UFT.EDU.BR, 2020).

However, the lack of systematic initiatives at the national level limits the impact of these findings, perpetuating the dependence on incidental diagnoses, which occur in large proportion during routine examinations or investigation of other abdominal diseases.

It is important to note that regional inequalities in Brazil directly influence access to ultrasound diagnosis—the standard method for screening and monitoring AAA. In regions with lower socioeconomic development, the reduced availability of imaging exams and vascular surgery specialists contributes to late diagnoses, increasing the likelihood of presentation in advanced stages, when the risk of rupture grows exponentially (SISTEMAS.UFT.EDU.BR, 2020).

The national epidemiological profile is also influenced by classic risk factors such as systemic hypertension, smoking, and dyslipidemia. However, few Brazilian studies have explored these correlations in depth, reinforcing the need for multicenter, longitudinally structured investigations. The expansion of integrated national databases and the standardization of diagnostic and reporting criteria would represent fundamental steps toward greater epidemiological accuracy (GOV.BR, 2024).

From a public policy perspective, the absence of a national screening program hinders not only early detection but also the development of care pathways that integrate diagnosis, follow-up, and intervention. Considering that AAA rupture has a mortality rate of over 80%, preventive strategies based on surveillance and health education could substantially reduce the burden of disease in the country (GOV.BR, 2024).

In summary, the epidemiological discussion of AAA in Brazil reveals a scenario of underdiagnosis, limited national scientific production, regional inequality in access to diagnosis, and a lack of comprehensive and structured public policies. Despite these limitations, the available data, although fragmented, converge on the urgent need to expand studies, standardize methods, and implement screening programs aimed at the at-risk population. Strengthening national surveillance and research is essential for more efficient management and reduction of morbidity and mortality associated with abdominal aortic aneurysms (GOV.BR, 2024).

FINAL CONSIDERATIONS

Abdominal aortic aneurysm (AAA) remains a vascular condition of high clinical and epidemiological relevance, characterized by silent progression and a significant risk of rupture, especially in aging populations. Contemporary literature reinforces the pathophysiological complexity of AAA, which involves inflammatory mechanisms, degradation of the extracellular matrix, and progressive structural changes in the aortic wall. Factors such as smoking, advanced age, hypertension, and positive family history remain important determinants of the disease, while recent studies indicate that women have a lower prevalence but a higher proportional risk of rupture.

The absence of national screening programs in Brazil, coupled with regional inequalities in access to diagnostic methods, contributes to underdiagnosis and increased mortality.

Modern technologies, such as three-dimensional analysis, volumetric assessment, and the use of artificial intelligence, have the potential to improve risk stratification and clinical management, but are still not widely used in middle-income countries.

At the same time, advances in endovascular therapies (EVAR) have substantially reduced perioperative mortality, although they require rigorous follow-up. The persistence of high rupture rates, especially among unscreened individuals, highlights the urgent need for public policies aimed at prevention, surveillance, and early diagnosis.

Thus, updated epidemiological studies are essential to understand the true magnitude of AAA, inform national screening strategies, guide investments in vascular health, and reduce morbidity and mortality associated with the disease. The body of evidence reinforces that expanding access to diagnosis and implementing systematic surveillance programs are indispensable steps in addressing AAA in the Brazilian context.

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