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Hypertension and Abdominal Aortic Aneurysms: Risk Factors, Diagnosis, and Endovascular Treatment

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LITERATURE REVIEW

RESUMO

Introdução: A hipertensão arterial é uma condição crônica caracterizada pela elevação persistente da pressão sanguínea, que contribui significativamente para a morbilidade e mortalidade cardiovascular. Quando não controlada adequadamente, ela pode levar a complicações graves, incluindo aneurismas da aorta abdominal, uma dilatação patológica da parede arterial que pode resultar em ruptura e morte súbita. A interação entre hipertensão e aneurismas da aorta abdominal tem sido amplamente estudada, evidenciando que a hipertensão é um fator de risco crucial para o desenvolvimento e crescimento desses aneurismas. A abordagem terapêutica para esses pacientes envolve estratégias de monitoramento e tratamento, onde o tratamento endovascular emergiu como uma opção minimamente invasiva eficaz. Objetivo: A revisão sistemática de literatura visou avaliar os fatores de risco associados à hipertensão arterial e aneurismas da aorta abdominal, além de examinar os métodos de diagnóstico e a eficácia do tratamento endovascular para essa condição. Metodologia: A metodologia foi baseada no checklist PRISMA e incluiu uma pesquisa extensiva nas bases de dados PubMed, Scielo e Web of Science. Utilizaram-se os descritores "hipertensão arterial", "aneurisma da aorta abdominal", "tratamento endovascular", "diagnóstico de aneurisma" e "fatores de risco cardiovascular" para a busca de artigos relevantes. Foram incluídos estudos publicados nos últimos 10 anos que abordaram aspectos clínicos, diagnósticos e terapêuticos relacionados ao tema. Os critérios de inclusão foram: artigos de estudos clínicos, revisões sistemáticas e ensaios clínicos randomizados; publicações em periódicos revisados por pares; e estudos que incluíam pacientes adultos com diagnóstico de hipertensão arterial e aneurisma da aorta abdominal. Os critérios de exclusão foram: estudos que não abordavam especificamente aneurismas da aorta abdominal; artigos fora do escopo de tratamento endovascular; e publicações anteriores a uma década. Resultados: Os resultados mostraram que a hipertensão arterial é um fator de risco predominante para o desenvolvimento e crescimento de aneurismas da aorta abdominal. O diagnóstico precoce através de imagens, como ultrassonografia e tomografia computadorizada, foi fundamental para a gestão da condição. O tratamento endovascular foi destacado como uma abordagem eficaz, oferecendo vantagens sobre a cirurgia aberta, como menor tempo de recuperação e menos complicações. Estudos indicaram que a monitorização regular e a intervenção precoce são essenciais para a redução da mortalidade associada a aneurismas da aorta abdominal. Conclusão: Em conclusão, a hipertensão arterial desempenha um papel significativo no desenvolvimento e progressão de aneurismas da

aorta abdominal. O diagnóstico precoce e a escolha do tratamento endovascular têm mostrado melhorar os resultados clínicos e reduzir a mortalidade. O tratamento endovascular representa uma alternativa viável e menos invasiva comparada à cirurgia tradicional, destacando-se como uma abordagem importante na gestão de pacientes com aneurismas da aorta abdominal associados à hipertensão.

Palavras-chaves: "hipertensão arterial", "aneurisma da aorta abdominal", "tratamento endovascular", "diagnóstico de aneurisma" e "fatores de risco cardiovascular"

ABSTRACT

Introduction: Hypertension is a chronic condition characterized by persistently elevated blood pressure, which significantly contributes to cardiovascular morbidity and mortality. When not properly controlled, it can lead to severe complications, including abdominal aortic aneurysms, a pathological dilation of the arterial wall that may result in rupture and sudden death. The interaction between hypertension and abdominal aortic aneurysms has been extensively studied, highlighting that hypertension is a crucial risk factor for the development and growth of these aneurysms. The therapeutic approach for these patients involves monitoring and treatment strategies, with endovascular treatment emerging as an effective minimally invasive option. Objective: The systematic literature review aimed to assess the risk factors associated with hypertension and abdominal aortic aneurysms, as well as to examine the diagnostic methods and the effectiveness of endovascular treatment for this condition. Methodology: The methodology was based on the PRISMA checklist and included an extensive search in the databases PubMed, Scielo, and Web of Science. The descriptors used were "hypertension," "abdominal aortic aneurysm," "endovascular treatment," "aneurysm diagnosis," and "cardiovascular risk factors" to find relevant articles. Studies published in the last 10 years that addressed clinical, diagnostic, and therapeutic aspects related to the topic were included. The inclusion criteria were: clinical studies, systematic reviews, and randomized controlled trials; publications in peer-reviewed journals; and studies involving adult patients with a diagnosis of hypertension and abdominal aortic aneurysm. The exclusion criteria were: studies that did not specifically address abdominal aortic aneurysms; articles outside the scope of endovascular treatment; and publications older than a decade. Results: The results showed that hypertension is a predominant risk factor for the development and growth of abdominal aortic aneurysms. Early diagnosis through imaging techniques, such as ultrasound and computed tomography, was crucial for managing the condition. Endovascular treatment was highlighted as an effective approach, offering advantages over open surgery, such as shorter recovery time and fewer complications. Studies indicated that regular monitoring and early intervention are essential for reducing mortality associated with abdominal aortic aneurysms. Conclusion: In conclusion, hypertension plays a significant role in the development and progression of abdominal aortic aneurysms. Early diagnosis and the choice of endovascular treatment have been shown to improve clinical outcomes and reduce mortality. Endovascular treatment represents a viable and less invasive alternative compared to traditional surgery, proving to be an important approach in managing patients with abdominal aortic aneurysms associated with hypertension.

Keywords: "Hypertension", “Abdominal aortic aneurysm”, “Endovascular treatment”,

"Aneurysm diagnosis" and "Cardiovascular risk factors".

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INTRODUCTION:

Hypertension, characterized by chronic elevation of blood pressure, represents a significant risk factor for a range of cardiovascular complications, including the development of abdominal aortic aneurysms. This condition arises when elevated blood pressure exerts additional stress on the arterial walls, leading to their degeneration and weakening. The progressive weakening of the arterial wall can result in the formation of an aneurysm, an abnormal dilation that may expand and eventually rupture, causing severe health consequences.

Early and accurate diagnosis of abdominal aortic aneurysms is crucial for effective management of the condition. Imaging techniques play a fundamental role in the identification and monitoring of aneurysms. Ultrasonography, often used as an initial examination, is effective in assessing the size and shape of the aneurysm due to its ability to produce detailed images of the aorta without invasive procedures. Complementary modalities, such as computed tomography (CT) and magnetic resonance imaging (MRI), offer a more detailed view of the aortic structure and the characteristics of the aneurysm, facilitating the assessment of rupture risk and aiding in treatment decisions. These diagnostic modalities enable early detection of aneurysms and continuous monitoring, which is essential for preventing severe complications associated with the condition.

Endovascular treatment emerges as an innovative and effective alternative in managing abdominal aortic aneurysms, offering a minimally invasive approach that significantly reduces recovery time and complications compared to traditional open surgery. This procedure involves the insertion of a stent or endograft through a catheter, usually introduced via the femoral artery. The stent, a tubular mesh structure, is placed within the aneurysm to reinforce the aortic wall and prevent rupture. This technique provides a lower impact on the patient's body and a quicker recovery, as well as being less invasive with a reduced risk of infections and other postoperative complications.

Controlling risk factors, such as hypertension, plays a crucial role in the prevention and management of abdominal aortic aneurysms. Continuous monitoring of blood pressure is essential to prevent accelerated growth and rupture of the aneurysm.

In addition to hypertension, other risk factors, such as advanced age, family history, and the presence of atherosclerosis, require proactive management. Adopting strategies to control blood pressure and modifying risk behaviors are fundamental for the effective prevention and treatment of aneurysms.

The effectiveness of endovascular treatment is continually enhanced by technological advancements and innovation in the devices used. New stents and techniques are developed to improve clinical outcomes and reduce associated risks. Recent studies highlight the importance of these advancements in improving procedure success rates and reducing complications, providing better outcomes for patients. The combination of endovascular treatment with rigorous management of risk factors offers a comprehensive approach to controlling abdominal aortic aneurysms, promoting safer and more efficient treatment.

METHODOLOGY

The methodology adopted for the systematic review strictly followed the PRISMA checklist to ensure transparency and reproducibility of the process. The search was conducted in the databases PubMed, Scielo, and Web of Science, using five descriptors: "hypertension," "abdominal aortic aneurysm," "endovascular treatment," "aneurysm diagnosis," and "cardiovascular risk factors." The inclusion period was restricted to articles published in the last ten years to ensure the relevance and timeliness of the information.

The inclusion criteria were established to ensure the relevance and quality of the selected studies. Only peer-reviewed articles were included, ensuring the scientific validity of the information. Furthermore, only studies that directly addressed hypertension and/or abdominal aortic aneurysms were considered, ensuring pertinence to the topic. Publications that detailed diagnostic methodologies or endovascular treatment were selected to allow a focused and comprehensive analysis of methods and results. Studies presenting empirical data, such as clinical trials and observational studies, were included to provide a solid evidence base. Finally, articles written in Portuguese and English were considered to maximize the inclusion of relevant literature.

The exclusion criteria were equally stringent. Studies that did not specifically

address abdominal aortic aneurysms or hypertension were excluded, ensuring the relevance of the material. Articles published before the last ten years were disregarded to ensure the information's timeliness. Studies that did not present empirical data or were solely theoretical reviews were excluded to maintain data quality and applicability. Additionally, studies that had not undergone peer review were excluded, minimizing the risk of including unverified information. Finally, articles in languages other than Portuguese and English were disregarded to ensure accessibility and complete understanding of the texts.

Based on the established criteria, a systematic process of screening and selecting articles was carried out. Initially, references were extracted and assessed for compliance with the inclusion and exclusion criteria. The selected articles were then analyzed in detail to extract and synthesize relevant evidence, resulting in a comprehensive and updated review on the impact of hypertension on the development of abdominal aortic aneurysms and the effectiveness of endovascular treatment.

RESULTS

Hypertension is a primary risk factor for the development and progression of abdominal aortic aneurysms. Elevated blood pressure exerts excessive force on the walls of the aorta, leading to the degeneration of elastic fibers and weakening of the arterial tissue. Over time, this continuous stress results in abnormal dilation of the aorta, leading to the formation of an aneurysm. This phenomenon occurs because hypertension increases intraluminal pressure, overloading the arterial wall's ability to maintain its structural integrity. Thus, hypertension not only contributes to the initial formation of the aneurysm but also accelerates its growth and can elevate the risk of rupture.

Moreover, chronic hypertension causes vascular changes that perpetuate the cycle of damage and weakening of the arterial wall. The repetitive stretching of the aortic layers due to elevated blood pressure results in progressive dilation of the aneurysm. Studies show that uncontrolled hypertension is associated with a higher rate of aneurysm growth, increasing the likelihood of serious complications, such as rupture. Therefore, effective blood pressure control is crucial to minimize risks associated with

abdominal aortic aneurysms and to improve clinical outcomes for affected patients.

Early diagnosis of abdominal aortic aneurysms is crucial for effective management of the condition and prevention of adverse events. Imaging techniques, such as ultrasonography, computed tomography (CT), and magnetic resonance imaging (MRI), play a fundamental role in identifying and monitoring aneurysms. For instance, ultrasonography is frequently used as an initial examination due to its ability to provide detailed images of the aorta in a non-invasive manner. This examination allows for early detection of aneurysms, facilitating monitoring and assessment of rupture risk. The precision and speed of ultrasonography are critical for early diagnosis and intervention.

Simultaneously, CT and MRI provide more detailed information about the aortic structure and aneurysm characteristics. CT is particularly useful for measuring the exact size of the aneurysm and assessing the presence of complications, while MRI provides high-resolution images of soft tissues and can help visualize the extent of aortic dilation and the presence of thrombi. The combined use of these imaging modalities allows for a comprehensive evaluation of the aneurysm condition, promoting informed and timely therapeutic decisions. Therefore, precise and early diagnosis is essential for effective management of abdominal aortic aneurysms and optimizing clinical outcomes.

Endovascular treatment represents a widely used minimally invasive approach for managing abdominal aortic aneurysms. This method involves the insertion of a stent or endograft through a catheter, usually inserted into the femoral artery. The endograft, a mesh tubular structure, is placed within the aorta to reinforce the weakened arterial wall and prevent aneurysm expansion. The goal of endovascular treatment is to reduce the risk of aneurysm rupture, providing a less invasive solution compared to traditional open surgery. The minimally invasive approach reduces surgical impact and improves patient recovery time, allowing a quicker return to normal activities.

Additionally, endovascular treatment offers significant advantages over traditional surgical techniques, including a lower complication rate and faster recovery. Studies show that patients undergoing this technique experience less postoperative pain and a lower risk of infections, as well as a reduced need for blood transfusions. The efficacy of this approach is supported by clinical evidence demonstrating the effectiveness of stents in preventing aneurysm progression and improving survival.

Thus, endovascular treatment remains a preferred option for many patients with abdominal aortic aneurysms, especially those with elevated risks for more invasive surgical procedures.

Managing hypertension is crucial in preventing and treating abdominal aortic aneurysms. Elevated blood pressure not only contributes to aneurysm development but also accelerates its growth and increases the risk of rupture. To mitigate these risks, it is essential to maintain blood pressure within controlled levels through pharmacological interventions and lifestyle changes. Medications often include antihypertensive drugs such as angiotensin-converting enzyme (ACE) inhibitors, angiotensin II receptor blockers (ARBs), and beta-blockers, which help reduce blood pressure and relieve the burden on arterial walls.

Moreover, lifestyle modifications play a significant role in controlling hypertension. Changes such as adopting a healthy diet, regular physical exercise, and smoking cessation are fundamental to achieving and maintaining healthy blood pressure levels. Continuous monitoring and strict adherence to prescribed treatments are essential to ensure the effectiveness of interventions and reduce the risk of complications associated with aneurysms. Integrating these methods into hypertension management significantly contributes to the effective prevention and treatment of abdominal aortic aneurysms, promoting better patient outcomes and reducing the likelihood of adverse events.

Considering additional risk factors is fundamental for a comprehensive approach in managing abdominal aortic aneurysms. While hypertension is a predominant risk factor, other aspects also play critical roles in the development and progression of this condition. Advanced age is one of the main additional factors, as the elasticity of arterial walls decreases with aging, increasing vulnerability to aneurysm formation. Studies show that the prevalence of abdominal aortic aneurysms is significantly higher in individuals over 65 years of age, reflecting the impact of aging on vascular health.

Furthermore, family history and the presence of atherosclerosis are relevant risk factors that interact with hypertension to increase the likelihood of aneurysms. Individuals with a family history of aneurysms have a higher genetic predisposition to develop the condition, which may be attributed to hereditary factors affecting arterial

wall integrity. Atherosclerosis, characterized by the buildup of cholesterol plaques and other substances in the arteries, contributes to the rigidity and weakening of arterial walls, facilitating the formation and expansion of aneurysms. Therefore, identifying and managing these additional risk factors is essential for an effective and personalized approach to treating and preventing abdominal aortic aneurysms.

Regular monitoring of patients with abdominal aortic aneurysms is an essential practice for ensuring effective management of the condition and preventing serious complications. Periodic follow-ups allow continuous observation of aneurysm evolution and early detection of any changes that may indicate an increased risk of rupture. Evaluations are typically conducted using imaging tests such as ultrasonography or CT scans, which provide detailed information about the size and shape of the aneurysm. These tests are crucial for adjusting treatment strategies and deciding the need for additional interventions.

Additionally, regular monitoring enables the identification of changes in the aneurysm's growth pattern, which is crucial for determining the appropriate timing for surgical or endovascular intervention. Follow-up protocols vary based on aneurysm size and patient risk, with more frequent evaluations recommended for larger aneurysms or patients with additional risk factors. Adhering strictly to the monitoring plan establishes a proactive approach, ensuring that any adverse developments are addressed efficiently and promptly, thereby minimizing the risk of severe complications such as aneurysm rupture.

The effectiveness of endovascular treatment has been extensively documented in recent studies, highlighting its advantages over traditional surgical methods. This treatment, which involves the insertion of an endovascular stent, is recognized for its minimally invasive approach, significantly reducing hospital stay and recovery time. The technique allows for aneurysm correction without large incisions, minimizing surgical trauma and postoperative pain. Studies show that endovascular treatment provides a high success rate in preventing ruptures and improving patients' quality of life.

Furthermore, the efficacy of endovascular treatment is often associated with a lower complication rate compared to open surgery. With advancements in technology and innovation in device design, endovascular stents have become more sophisticated

and adaptable, resulting in better clinical outcomes. The ability to perform the procedure with minimal impact on the patient's body contributes to faster recovery and a lower incidence of complications, such as infections or vascular access issues. Therefore, choosing endovascular treatment represents a significant advancement in managing abdominal aortic aneurysms, reflecting a safer and more effective approach for many patients.

Technological advancements have a significant impact on the effectiveness of treating abdominal aortic aneurysms, especially in the context of endovascular techniques. Continuous innovation in the development of devices, such as stents and endografts, provides substantial improvements in clinical outcomes and procedure safety. Currently, stents are designed with more durable and flexible materials that better adapt to the aortic anatomy and offer greater resistance to aneurysm growth. These advanced devices are engineered to optimize blood flow and minimize the risk of complications, such as stent migration or endoleaks, which can compromise treatment success.

Additionally, imaging methods and navigation systems used during endovascular procedures have also evolved significantly. The integration of advanced technologies, such as three-dimensional imaging and fluoroscopy-guided navigation, allows for more precise placement of stents and endografts. These innovations enhance real-time visualization and monitoring, resulting in greater accuracy and reduced error rates. Thus, technological advancements contribute to a more efficient and safe approach to treating abdominal aortic aneurysms, reflecting ongoing progress in endovascular medicine.

However, despite the significant advantages of endovascular treatment, it is essential to be aware of potential complications associated with this approach. Although the technique is minimally invasive, it is not without risks. Common complications include infections at the vascular access site, stent migration, and endoleaks, which occur when blood leaks into the space between the stent and the arterial wall. These issues may require additional procedures or adjustments in treatment to ensure long-term effectiveness.

Furthermore, the need for long-term follow-up is an important consideration, as

some complications may not manifest immediately after the procedure. Continuous monitoring through imaging tests is crucial for early detection and management of these complications. Despite technological innovations reducing complication rates, rigorous surveillance remains an essential part of endovascular treatment, ensuring treatment effectiveness and long-term patient health protection.

The impact of effective treatment of abdominal aortic aneurysms on patients' quality of life is notable and multifaceted. When the condition is diagnosed early and treated appropriately, patients generally experience significant improvements in their overall health and well-being. Effective intervention, whether through endovascular methods or other therapeutic means, can substantially reduce the risk of severe adverse events, such as aneurysm rupture, which can be fatal. Thus, proper management of the condition not only improves survival but also contributes to faster recovery and a more effective return to daily activities.

Additionally, improvements in quality of life are often observed through the reduction of symptoms associated with aneurysms, such as abdominal pain

CONCLUSION

A detailed analysis of the topic "Hypertension and Abdominal Aortic Aneurysms: Risk Factors, Diagnosis, and Endovascular Treatment" has revealed several important conclusions that highlight the complexity and relevance of these cardiovascular conditions. The reviewed studies demonstrated that hypertension is a primary risk factor for the development and progression of abdominal aortic aneurysms. Elevated blood pressure directly contributes to the weakening of the aortic walls, facilitating the formation and expansion of aneurysms. Furthermore, chronic hypertension is associated with a significant increase in the growth rate of aneurysms, underscoring the need for stringent blood pressure control to mitigate the risks of severe complications.

Early diagnosis of abdominal aortic aneurysms, achieved through imaging technologies such as ultrasonography, computed tomography (CT), and magnetic resonance imaging (MRI), is essential for effective management. These imaging modalities allow for detailed evaluation of the aneurysm's anatomy and facilitate continuous monitoring of its progression. Early detection enables timely and

appropriate interventions, preventing the progression of the condition and the occurrence of adverse events, such as aneurysm rupture.

Endovascular treatment has emerged as an effective and minimally invasive approach for managing abdominal aortic aneurysms. Scientific studies support that the use of endovascular stents and grafts offers a safe alternative with lower morbidity compared to traditional open surgery. Technological advancements in endovascular devices have contributed to significant improvements in clinical outcomes, including reduced recovery time and lower complication rates. However, continuous vigilance and regular follow-up remain crucial to monitor for potential complications such as endoleaks or stent migration.

Additionally, additional risk factors such as advanced age, atherosclerosis, and family history play significant roles in the development and progression of abdominal aortic aneurysms. Recognizing these factors allows for a more personalized and effective approach to managing the condition and emphasizes the importance of regular monitoring and early interventions.

In conclusion, proper management of abdominal aortic aneurysms, coupled with effective control of hypertension, results in substantial improvements in patients' quality of life. Successful intervention not only prolongs survival but also reduces symptoms and functional limitations, allowing patients to resume their daily activities with greater comfort and safety. Overall, the combination of early diagnosis, innovative treatment, and risk factor management is crucial for optimizing clinical outcomes and the quality of life for patients affected by these cardiovascular conditions.

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