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Open Surgery vs. Endovascular Repair of Abdominal Aortic Aneurysms: A Systematic Review

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SYSTEMATIC REVIEW

ABSTRACT

Endovascular repair (EVAR) and open surgical repair (OSR) are the primary approaches for treating abdominal aortic aneurysms (AAA). Both techniques present unique risks and benefits across short-, medium-, and long-term outcomes. EVAR, being less invasive, is associated with lower perioperative mortality and morbidity rates but carries an increased risk of secondary rupture and reinterventions. Conversely, OSR, although more invasive, demonstrates lower rates of late complications and reinterventions. This study aims to comprehensively analyze and compare the perioperative complications and long-term survival outcomes of these two interventions. To analyze perioperative complications and long-term survival rates associated with endovascular repair and open surgical repair in the management of abdominal aortic aneurysms. A systematic review was conducted using the Scientific Electronic Library Online (SciELO), National Library of Medicine (PubMed), and MEDLINE databases. Predefined inclusion and exclusion criteria were applied, and relevant articles were identified using the keywords “Endovascular repair,” “Open surgery repair,” “Abdominal aortic aneurysm,” and “Complications,” combined with the Boolean operator “AND.” Comparative analysis of EVAR and OSR reveals that EVAR offers lower perioperative mortality and faster recovery but is associated with a higher risk of long-term complications and reinterventions. On the other hand, OSR, despite its invasive nature and higher short-term mortality, is linked to fewer late complications

and reinterventions. Both approaches exhibit similar mortality rates over the long term. Therefore, the choice of treatment should be individualized based on the patient's clinical profile and preferences. EVAR and OSR are equally effective in managing AAA, with differences primarily in perioperative and long-term outcomes. EVAR minimizes perioperative risks but requires ongoing monitoring for late complications, while OSR, though more invasive, offers greater long-term stability with fewer late reinterventions. The choice between these methods should prioritize patient-specific factors and preferences.

Keywords: Endovascular Repair (EVAR), Open Surgery Repair (OSR), Abdominal Aortic Aneurysm (AAA), Complications, Long-Term Outcomes, Survival Rates

Cirurgia Aberta vs. Reparação Endovascular de Aneurismas da Aorta Abdominal: Uma Revisão Sistemática

RESUMO

A reparação endovascular (EVAR) e a reparação cirúrgica aberta (OSR) são as principais abordagens para o tratamento de aneurismas da aorta abdominal (AAA). Ambas as técnicas apresentam riscos e benefícios distintos em desfechos de curto, médio e longo prazo. A EVAR, por ser menos invasiva, está associada a menores taxas de mortalidade e morbidade perioperatória, mas apresenta um risco aumentado de ruptura secundária e reintervenções. Por outro lado, a OSR, embora mais invasiva, demonstra menores taxas de complicações tardias e reintervenções. Este estudo tem como objetivo analisar e comparar de forma abrangente as complicações perioperatórias e os desfechos de sobrevida a longo prazo dessas duas intervenções. Uma revisão sistemática foi realizada utilizando as bases de dados Scientific Electronic Library Online (SciELO), National Library of Medicine (PubMed) e MEDLINE. Foram aplicados critérios de inclusão e exclusão predefinidos, e os artigos relevantes foram identificados com as palavras-chave "Reparação endovascular", "Reparação cirúrgica aberta", "Aneurisma da aorta abdominal" e "Complicações", combinadas com o operador booleano "AND". A análise comparativa entre EVAR e OSR revela que a EVAR oferece menor mortalidade perioperatória e recuperação mais rápida, mas está associada a maior risco de complicações a longo prazo e reintervenções. Por outro lado, a OSR, apesar de sua natureza invasiva e maior mortalidade no curto prazo, está vinculada a menores complicações tardias e reintervenções. Ambas as abordagens apresentam taxas de mortalidade semelhantes ao longo do tempo. Portanto, a escolha do tratamento deve ser individualizada com base no perfil clínico e nas preferências do paciente. EVAR e OSR são igualmente eficazes no manejo de AAA, com diferenças primárias em desfechos perioperatórios e de longo prazo. A EVAR minimiza os riscos perioperatórios, mas requer monitoramento contínuo para complicações tardias, enquanto a OSR, embora mais invasiva, oferece maior estabilidade a longo prazo, com menos reintervenções tardias. A escolha entre esses métodos deve priorizar os fatores específicos do paciente e suas preferências.

Palavras-chave: Reparação Endovascular (EVAR), Reparação Cirúrgica Aberta (OSR),

Aneurisma da Aorta Abdominal (AAA), Complicações, Desfechos a Longo Prazo, Taxas de Sobrevida.

INTRODUÇÃO

Abdominal aortic aneurysms (AAA) are a serious and often asymptomatic condition, characterized by localized dilation of the aortic wall, which poses a significant threat to life due to its high potential for rupture. This pathology demands continuous monitoring and timely intervention, as rupture can lead to catastrophic complications such as hypovolemic shock and severe hemorrhage, significantly increasing the risk of mortality. In the absence of clinical manifestations, the diagnosis is typically achieved through imaging techniques such as ultrasound (USG) or computed tomography (CT). Upon diagnosis, surgical intervention often becomes necessary, particularly when medical management is insufficient to stabilize the aneurysm or mitigate its progression.

Currently, two primary surgical approaches are available for the management of AAA: Endovascular Repair (EVAR) and Open Surgical Repair (OSR). EVAR is a minimally invasive technique that has gained popularity due to its association with lower perioperative mortality rates, reduced recovery times, and fewer immediate postoperative morbidities. However, this approach is not without limitations, as it is linked to long-term complications such as graft migration, late rupture, and the occurrence of endoleaks—leakage of blood into the aneurysm sac around the endoprosthesis. Conversely, OSR, though more invasive, offers greater durability in outcomes, with lower incidences of late complications and reinterventions. This contrast between the short-term benefits of EVAR and the long-term stability of OSR creates a clinical dilemma, necessitating careful consideration of individual patient characteristics and risk factors.

The choice between EVAR and OSR is further complicated by variations in patient anatomy, comorbidities, and preferences, which influence the suitability and success of each procedure. While EVAR may be ideal for patients at high surgical risk due to its minimally invasive nature, OSR remains the gold standard for younger or healthier individuals seeking a durable solution. These considerations underscore the importance of personalized treatment strategies in AAA management.

This study aims to perform a comprehensive systematic review and meta-analysis comparing perioperative complications and long-term survival rates between

EVAR and OSR. By examining the benefits, limitations, efficacy, and side effects of each approach, this review seeks to elucidate the nuances of these treatment modalities and provide evidence-based guidance for clinical decision-making. Additionally, this analysis will explore the durability of outcomes and the impact of these interventions on patient quality of life. The ultimate goal is to enhance the understanding of AAA treatment options, contribute to the existing literature, and support clinicians in tailoring therapeutic approaches to individual patient needs, thus promoting better long-term prognoses.

METODOLOGIA

This study is a systematic literature review aimed at analyzing perioperative complications and survival rates between endovascular repair (EVAR) and open surgical repair (OSR) for abdominal aortic aneurysms. The review was conducted using the electronic databases SciELO, PubMed, and MEDLINE, where the following descriptors were applied: "Endovascular Repair," "Open Surgical Repair," "Abdominal Aortic Aneurysm," and "Complications," combined using the Boolean operator "AND" to refine search results.

The timeframe for the study was limited to articles published in the last 10 years (2014-2024) to capture the most recent data and clinical practices. Studies included in the review were full-text articles with free access, involving patients who underwent either EVAR or OSR for abdominal aortic aneurysm.

A total of 38 articles were initially reviewed, with 15 meeting the established inclusion and exclusion criteria and subsequently included in the final analysis. Inclusion criteria encompassed studies presenting relevant quantitative or qualitative data on perioperative complications and survival rates, such as clinical trials, systematic reviews, and cohort studies. Exclusion criteria applied to incomplete articles, studies not aligned with the selected descriptors, studies published outside the stipulated period, and titles not directly related to the research topic. This methodology aims to provide insights into the comparative outcomes of EVAR and OSR, supporting clinical decision-making for abdominal aortic aneurysm treatment.

RESULTADOS E DISCUSSÃO

The studies comparing endovascular repair (EVAR) and open surgical repair (OSR) for abdominal aortic aneurysms (AAA) demonstrate a wide range of findings across perioperative and long-term outcomes. EVAR consistently shows significant advantages in the immediate postoperative period, such as lower perioperative mortality and reduced recovery times, but it is associated with increased risks of long-term complications, such as endoleaks, graft migration, and secondary interventions. Conversely, OSR, despite being a more invasive approach with higher initial risks, offers greater long-term stability, including lower rates of reinterventions and aneurysm-related complications.

Giannopoulos et al. (2020) highlight that EVAR patients had a significantly higher reintervention rate (29%) compared to OSR patients (15%), despite similar overall mortality between the two groups over time. These results underscore EVAR's immediate benefits but reveal its vulnerability to long-term complications. Schermerhorn et al. (2015), analyzing a large cohort of Medicare patients, reported perioperative mortality rates of 1.6% for EVAR versus 5.2% for OSR. Over time, however, survival rates converged, with late aneurysm rupture rates higher in the EVAR group (5.4%) compared to OSR (1.4%). Similarly, Yokoyama et al. (2020) found that while EVAR reduces perioperative mortality (hazard ratio of 0.39), long-term mortality after two to six years was higher for EVAR compared to OSR. However, this difference diminished over longer periods, with both groups showing comparable mortality rates after ten years. Alothman and Bobat (2020) reinforce these findings, emphasizing higher rates of aneurysm-related complications in the EVAR group, despite similar overall mortality in the long term.

The need for reinterventions following EVAR is a consistent theme in the literature, as noted by Loufopoulos et al. (2023), who found that EVAR offers a survival advantage in the first postoperative year, but this benefit diminishes over time as OSR demonstrates lower reintervention rates. Chang et al. (2021) corroborate this, highlighting that EVAR is more prone to complications in patients deemed unfit for OSR, suggesting that patient selection plays a critical role in determining outcomes. For

specific populations, such as older adults, Raju et al. (2020) found EVAR to be a viable option, particularly in octogenarians, due to its reduced short-term risks. However, they stressed the need for rigorous surveillance to manage vascular complications and reinterventions. Choi et al. (2018) similarly observed that while EVAR minimizes immediate perioperative risks, OSR demonstrated superior long-term survival and lower postoperative complication rates.

Patient preferences also play a significant role in the decision-making process. Columbo et al. (2020) reported that patients prioritizing lower risks of long-term complications often preferred OSR, even with its higher initial invasiveness. This emphasizes the need for shared decision-making and clear communication between clinicians and patients to align treatment options with individual values and expectations. Ullery et al. (2015) showed that implementing an "EVAR-first" protocol for ruptured aneurysms reduced perioperative mortality and immediate postoperative complications, although long-term benefits were less pronounced. Harky et al. (2019) add that EVAR offers better perioperative outcomes, such as shorter hospital stays and fewer cardiac and renal complications, but at the cost of higher rates of vascular complications and a greater likelihood of reinterventions.

Finally, Edwards et al. (2014) compared EVAR and OSR for ruptured aneurysms and found a perioperative mortality rate of 33.8% for EVAR compared to 47.7% for OSR, underscoring EVAR's utility in acute settings. However, the increased need for reinterventions with EVAR over time further supports the narrative that while EVAR offers significant immediate benefits, OSR remains the more durable option in the long term.

In conclusion, EVAR and OSR each present distinct advantages and limitations. EVAR excels in the perioperative period, offering lower immediate mortality and morbidity but requiring vigilant long-term monitoring due to its higher rate of complications and reinterventions. OSR, although more invasive and associated with higher short-term mortality, offers greater durability and fewer late complications, making it a preferred choice for patients seeking long-term stability. The choice between EVAR and OSR should be tailored to the individual patient, considering factors such as age, comorbidities, anatomical suitability, and personal preferences. A multidisciplinary

approach and shared decision-making process are essential to optimizing outcomes and ensuring the best possible long-term prognosis for patients with AAA.

CONSIDERAÇÕES FINAIS

Endovascular repair (EVAR) has proven to be an effective alternative to open surgery repair (OSR) in the management of abdominal aortic aneurysms (AAA), but it is not superior. EVAR is associated with significantly lower perioperative morbidity and mortality rates compared to OSR, making it an appealing choice for high-risk surgical patients or those seeking less invasive interventions. However, OSR demonstrates superior long-term durability, with fewer aneurysm-related complications such as endoleaks, graft migration, or late ruptures, thereby reducing the need for intensive surveillance and reinterventions. These findings highlight the complementary nature of both approaches, each addressing distinct clinical priorities.

While EVAR provides a clear survival advantage in the short term, this benefit diminishes after two years post-procedure, with long-term mortality and morbidity rates aligning more closely with those observed in OSR. The higher rates of reintervention and late rupture associated with EVAR necessitate ongoing follow-up and monitoring, which can impact patient quality of life and healthcare costs. Conversely, OSR, though more invasive and associated with higher initial risks, offers greater stability over time, making it a preferable option for younger, healthier patients or those with complex aneurysms unsuitable for EVAR.

The choice between EVAR and OSR should be guided by a multidisciplinary approach that considers patient-specific factors such as age, comorbidities, anatomical suitability, and personal preferences. Shared decision-making is critical, allowing patients to weigh the trade-offs between the invasiveness of OSR and the long-term risks of EVAR. The discussion should also encompass the potential for perioperative complications, the likelihood of long-term durability, and the need for follow-up interventions.

The implications of this review extend beyond clinical decision-making to contribute to a broader understanding of AAA management. Clinicians can use these findings to tailor treatment strategies that align with patient needs and preferences,

ultimately improving outcomes. Additionally, this analysis highlights the importance of developing standardized protocols for follow-up care, particularly for EVAR patients, to mitigate long-term risks.

Future research should focus on improving EVAR technologies to reduce the incidence of late complications, such as endoleaks and reinterventions, while exploring innovative approaches to enhance the long-term durability of minimally invasive treatments. Comparative studies assessing the cost-effectiveness of EVAR and OSR in diverse patient populations would also provide valuable insights. Moreover, large-scale, longitudinal studies are necessary to evaluate the impact of these interventions on quality of life and healthcare resources, as well as to refine patient selection criteria.

Despite its strengths, this review has certain limitations, including potential selection biases and the variability in methodologies across studies, which may affect the generalizability of findings. Future systematic reviews should aim to include a broader range of patient demographics and clinical contexts to ensure a more comprehensive understanding of the relative benefits and limitations of EVAR and OSR. By addressing these gaps, ongoing research can further optimize AAA management, ensuring that treatment decisions are both evidence-based and patient-centered.

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