

Ruptured aneurysm of abdominal aorta: is surgery the best treatment?

Aneurisma roto de aorta abdominal: a cirurgia é o melhor tratamento?

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ABSTRACT

Objective: The aim of this article is to compare the procedures used in the treatment of ruptured abdominal aortic aneurysm, in order to determine the best approach to this urgency. **Methods:** The rupture of abdominal aortic aneurysm is a serious complication, with high mortality rate. Early surgery is related to great survival of these patients. However, there are two methods of treatment (open and endovascular surgery). The present study is a review of the literature in PubMed, UpToDate, Scopus and Scielo databases, using the key words "aneurysm, aortic aneurysm, abdominal aorta", "rupture", "aortic surgery", "endovascular procedure", "angioplasty", "endoluminal repair", "percutaneous transluminal angioplasty". We included English and Portuguese language articles, published between 2006 and 2015, addressing the treatment of the ruptured aneurysm of abdominal aorta. **Conclusion:** Significant differences in the mortality rates of open surgery compared to the endovascular treatment of ruptured aneurysm definitely have not been demonstrated. There is some evidence that perioperative (30 days) results after endovascular aneurysm correction of ruptured aneurism can be better than open repair.

Key words: Abdominal aortic aneurysm. Rupture, Surgery, Endovascular repair. Angioplasty. Percutaneous transluminal angioplasty.

RESUMO

Objetivo: O objetivo deste artigo é comparar os procedimentos utilizados no tratamento de aneurisma roto da aorta abdominal, a fim de determinar a melhor abordagem para esta urgência. **Métodos:** A ruptura do aneurisma da aorta

abdominal é uma complicação grave, com alta taxa de mortalidade. Cirurgia precoce está relacionada com altas taxas de sobrevivência. No entanto, existem dois métodos de tratamento (a cirurgia aberta e a endovascular). O presente estudo é uma revisão da literatura realizada nas bases de dados PubMed, UpToDate, Scopus e Scielo, usando as palavras-chave "aneurisma, aneurisma da aorta, Aorta Abdominal", "ruptura" "cirurgia da aorta", "procedimento endovascular", "angioplastia", "endovascular", "angioplastia transluminal percutânea". Foram incluídos artigos em inglês e português, publicados entre 2006 e 2015, abordando o tratamento do aneurisma da aorta abdominal. **Conclusão:** Não foram demonstradas diferenças significativas nas taxas de mortalidade pós cirurgia aberta, em comparação com o tratamento endovascular de aneurisma roto. Há evidência de que resultados perioperatórios (30 dias) após correção de aneurisma endovascular pode ser melhor do que a cirurgia aberta.

Descritores: Aneurisma da aorta abdominal. Ruptura de aneurisma aórtico. Cirurgia. Procedimento endovascular. Angioplastia percutânea.

INTRODUCTION

The rupture is a fatal complication of abdominal aortic aneurysm (rAAA). Elective correction of aneurysm is associated with low rates of morbidity and mortality in selected patients, but, despite advances in intensive care unit and repair techniques, mortality after correction of ruptured abdominal aortic aneurysm remains high¹. The surgical results are better, by using the endovascular aneurysm endoprosthesis in emergency circumstances, than using open surgery. A growing number of institutions have initiated protocols for endovascular repair of rAAA with promising results in small series, but not all institutions are equipped to treat rAAA using minimally invasive technology. The transfer of patients with rAAA can be associated with a high mortality (17 to 19%) in comparison with those undergoing repair at the institution in which minimally invasive technology is available^{2,3-5}.

METHODOLOGY

The present study is a review of the literature in PubMed database, UpToDate, Scopus and Scielo, using the key words "Aneurysm, Aortic Aneurysm, Abdominal Aorta", "Rupture", "Aortic Surgery", "Endovascular Procedure", "Angioplasty", "Endoluminal Repair", "Percutaneous Transluminal

Angioplasty". We included English and Portuguese language articles, published between 2006 and 2015, addressing the treatment of the ruptured aneurysm of abdominal aorta.

ANATOMY

The aorta is the largest artery in the human body, and this when surpasses the diaphragm muscle receives the name of abdominal aorta, where it emits several branches, forking more distally in the common iliac arteries⁴.

DEFINITION

Aneurysm means irreversible dilatation limited to a vessel or heart wall⁵. Thus, the aneurysm is a localized dilatation of a blood vessel by more than 50% of its normal assumed diameter^{6, 7}.

TREATMENT

The treatment of rAAA is a medical urgency, because of bleeding and its high mortality^{8,9}. Due to developments in surgical technique and critical care, the mortality rate of elective abdominal aortic aneurysm repair has been greatly improved. However, Cooley and DeBakey's early presentation of surgical treatments for ruptured abdominal aortic aneurysms (rAAA) noted a 50% survival rate¹⁰, which has proven difficult to improve over six decades of subsequent effort^{1,11,12}. Endovascular aneurysm repair (EVAR) has the advantage of having relatively low perioperative mortality and morbidity compared to open surgical repair (OSR)¹³⁻¹⁵, and consequently, patients increasingly undergo EVAR for rAAA¹⁶. Nevertheless, OSR still plays an important role in the treatment of rAAA due to the anatomical and institutional limitations of EVAR. In this article, we review strategies for the management of rAAA in order to reduce perioperative mortality and morbidity and discuss features, pros and cons of OSR and EVAR.

ENDOVASCULAR OR CONVENTIONAL SURGERY?

In observational studies, the endovascular repair of rAAA has been associated with lower rates of mortality in comparison with the open repair of ruptured rAAA (EVAR: of the 16.31%; open the 44.34%), which may be due to

decreased blood loss and reduction of ischemia¹⁷⁻²¹. The main criticism of these studies is that hemodynamically stable patients with rAAA are most often selected for EVAR, and hemodynamically unstable patients tend to be treated with open repair²². Some authors have suggested that such patient selection influence the comparison, and that the mortality rate for EVAR and open repair for ruptured rAAA are really similar.

A few randomized clinical trials comparing open repair versus EVAR in patients with ruptured rAAA were published^{23,24}. The first was a small study, pilot, that reported a high rate of mortality of 53% for both groups, which led to widespread criticism of the study design²³. An other research, a randomized clinical trial of 132 patients who were suited anatomically, concluded that no difference was found in the perioperative mortality (30 days) among those who were treated with open repair versus EVAR (25 versus 21%)²⁴. It has been suggested that long-necked aneurysms can provide a survival advantage, even in patients treated with open repair²⁵.

Concerning to immediate treatment of the patients with rupture, a multicenter study (IMPROVE) held in the United Kingdom and Canada, sought to determine the optimal management of rAAA using a drawing of "reality"²⁵. The study randomly distributed 613 patients for which there was a suspected rAAA based on history or clinical examination, and image diagnosis. No difference in perioperative (30 day) of mortality was observed among the assigned groups. In a pre-specified subgroup analysis, the perioperative mortality was significantly lower for women assigned to the EVAR compared to women assigned to open repair (37% versus 57%), but this difference was not observed for men. Patients referred for EVAR were significantly more likely to go home soon, compared to those designated for open repair (94% against 77%). After treatment, the mortality for patients who underwent EVAR was of 25% compared to 38% for those who underwent open correction²⁵. IMPROVE study showed that, for patients with suspected, but no evidence of rAAA, makes the open surgery and endovascular strategy equally valid²⁵.

Although the mortality rates associated with the correction of the rAAA with open surgery versus endovascular correction can be challenging, perioperative

morbidity rates have been consistently and significantly lower for EVAR in comparison with the open repair in randomized trials of elective AAA^{8,26,27}.

. Extrapolating from these findings, it appears that EVAR would be highly desirable in patients with rAAA who have poor prognosis factors for the open repair. The apparent advantage of EVAR probably relates to its minimally invasive nature, which minimizes the physiological stress and decreases the risk of cardiovascular disease, pulmonary and renal disease²⁸.

Although attempts have been made to quantify the risk of mortality with rAAA, no variable or sorting proved reliable to predict mortality²⁹.

The complications of surgery to repair rAAA are similar to those of the elective procedure, but there is a higher incidence of complications such as myocardial infarction, respiratory failure and acute kidney injury compared to the elective AAA repair³⁰.

Extended operating time, increased blood loss, increased fluid administration, and intraoperative hypotension are predictive of postoperative intestinal ischemia, which has a mortality rate of almost 60% in patients undergoing open repair of rAAA³¹. In a small review of patients it was described some degree of colonic ischemia after repair of rAAA³².

Conversion of EVAR for open repair is unusual for elective AAA repair and is, as yet, undefined for rAAA. Conversion of EVAR for open repair is generally associated with higher rates of mortality in comparison with the open repair. There are no comparable studies for rAAA. In a study of elective, early conversion of EVAR to open surgery was associated with a mortality rate of 12.4%³³, which contrasts with the mortality of approximately 3% to the initial repair AAA¹.

MORTALITY

Despite improvements in pre-hospital care, anesthesia, and cardiovascular intensive care, postoperative mortality after correction of rAAA remains about 40 to 50%³⁴.

Factors that worsen survival during the open surgical repair of the supraceliac rAAA include procedure delayed for more than 30 minutes, administration of more than 3,500 ml of blood volume, the intraoperative urine

output less than 200mL, thrombosis of other vascular beds, and intraoperative hypotension³⁵. The EVAR has the potential to minimize these variables and complications, can improve survival after rupture of AAA, but this has not been definitely established. In a review, it was stated that the open surgery was a higher risk for perioperative independent of death (30 days), compared to the endovascular treatment for hemodynamically unstable patients and patients hemodynamically stable [Mohan PP, Hamblin MH. Comparison of endovascular repair of ruptured and open aortic abdominal aneurysm in the United States in the past decade. *Cardiovasc Intervent Radiol.* 2014 Apr;37(2):337-42.]⁴⁰.

In the long term (5 years), survival after emergency repair of rAAA is 53 to 64%, in contrast to survival rates after elective repair, 69-74%³⁹. Factors associated with lower long-term survival include advanced age, renal dysfunction, respiratory failure and myocardial infarction^{35,36}.

INITIAL MANAGEMENT

Finally, let's take a look on the pre-treatment management. Preoperative hemodynamic stability is directly associated with the patient's mortality^{37,38}, and preoperative shock is the most serious risk factor affecting survival after rAAA. It is important to stabilize the patient's blood pressure. However, aggressive fluid resuscitation before achieving control of the proximal aorta can lead to further bleeding, which may result in an increased risk of mortality³⁹. Thus, the primary goal in the initial management of patients with rAAA is achieving hemodynamic stability to allow perfusion of the vital organs. This usually involves maintaining a systolic blood pressure of 70 to 80 mmHg, and avoiding aggressive resuscitation to pressures higher than 100 mmHg. Aggressive volume resuscitation of patients with rAAA before proximal aortic control resulted in an increased perioperative risk of death independent of systolic blood pressure. Therefore, volume resuscitation should be delayed until surgical control of bleeding is achieved⁴⁰.

The treatment of a patient with rAAA requires a cooperative relationship between multidisciplinary specialties to ensure a timely diagnosis, appropriate preoperative and perioperative support, efficient aneurysm repair, and excellent postoperative care. Thus, specific protocols for patients with rAAA are useful, such as the fast-track algorithm for the care of patients with rAAA^{41,42}.

CONCLUSION

Significant differences in the mortality rates of open surgery compared to the endovascular treatment of ruptured aneurysm definitely have not been demonstrated. There is some evidence to suggest that perioperative (30 days) results after of endovascular aneurysm (EVAR) correction of ruptured rAAA can be better than to open repair. So, for patients with multiple risk factors and a poor prognosis after open surgical repair and anatomy suitable for endovascular approach, we suggest an attempt to EVAR, provided that there is proper equipment and available experienced personnel.

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