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Indication of endovascular treatment of type B aortic dissection - Literature review

Indicação do tratamento endovascular na dissecção de aorta do tipo B - Revisão da literatura

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Abstract

Aortic dissection is a cardiovascular event of high mortality if not early diagnosed and properly treated. In Stanford type A aortic dissection, there is the involvement of the ascending aorta, whereas in type B the ascending aorta is not affected. The treatment of type A aortic dissection is mainly surgical. The hospital mortality of type B aortic dissection surgical treatment is approximately 20%, while medical therapy is 10%. However, half the patients who are discharged from hospital after medical treatment, progress to aortic complications in the following years, and the mortality in three to five years may reach 25-50%. In addition, the surgical treatment of aortic complications after medical treatment, has also a significant mortality. This way, the endovascular treatment comes up as an interesting alternative of a less invasive treatment for this disease. They presented a mortality rate lower than 10% with more than 80% success rate of occlusion and thrombosis of the false lumen. The INSTEAD TRIAL, which randomized patients with uncomplicated type B aortic dissection for optimal medical therapy and endovascular treatment in addition to optimal medical therapy, showed that after three years of follow up, patients who underwent endovascular treatment had lower mortality and aorta-related complications. Therefore, there is a current tendency to recommend the endovascular treatment as a standard for the treatment of type B aortic dissection

Descriptors: **Endovascular Procedures. Aortic Diseases. Aneurysm, Dissecting.**

Resumo

A dissecção da aorta é um evento cardiovascular de alta mortalidade quando não diagnosticado precocemente e tratado adequadamente. Na dissecção de aorta do tipo A de Stanford há o envolvimento da aorta ascendente enquanto na do tipo B este a aorta ascendente não está acometida. O tratamento da dissecção de aorta do tipo A é predominantemente cirúrgico. A mortalidade hospitalar do tratamento cirúrgico da dissecção da aorta do tipo B é de aproximadamente 20%, enquanto a do tratamento clínico é de 10%. Entretanto, metade dos pacientes que recebem alta hospitalar após o tratamento clínico, evoluem com complicações aórticas nos anos subsequentes, sendo que a mortalidade em três a cinco anos pode atingir 25 a 50%. Além disto, o tratamento

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cirúrgico das complicações aórticas, após o tratamento clínico, também apresenta alta mortalidade. Desta forma, o tratamento endovascular surge como interessante alternativa para o tratamento menos invasivo desta doença. Inicialmente indicado apenas para os casos complicados, apresentavam mortalidade hospitalar menor que 10% com mais de 80% de sucesso de oclusão e trombose da falsa luz. O INSTEAD TRIAL, que randomizou pacientes com dissecção de aorta do tipo B não complicada para o tratamento médico otimizado e para o tratamento endovascular em adição ao tratamento médico otimizado, demonstrou que após três anos de acompanhamento, aqueles pacientes submetidos ao tratamento endovascular apresentaram menor mortalidade e complicações relacionados a aorta. Portanto, atualmente há uma tendência em se indicar o tratamento endovascular como padrão para o tratamento da dissecção de aorta do tipo B.

Descritores: **Procedimentos Endovasculares. Doenças da Aorta. Aneurisma Dissecante.**

INTRODUCTION

Aortic dissection is a cardiovascular event of high mortality if not early diagnosed and properly treated. In Stanford type A aortic dissection there is the involvement of the ascending aorta, whereas in type B, the dissection is restricted to the descending aorta.

The treatment of Type A aortic dissection is mainly surgical. The hospital mortality of surgical treatment of Type B aortic dissection is about 20%, while medical therapy is 10%, therefore the recommendation for intervention in these cases shall be reserved for complicated cases, that are characterized by persistent pain, presence of ischemic complications, uncontrolled hypertension and aortic dilatation[1]. However, half of patients who are discharged after medical treatment, evolves with aortic complications in the following years, and the mortality in three to five years can reach 20% to 50%[2]. Furthermore, the surgical treatment of aortic complications after medical treatment, has also a significant mortality.

Endovascular Treatment

The endovascular approach in aortic diseases was introduced by Volodos et al.[3] in 1986 and Parodi et al.[4], in 1991, it is the correction of aortic diseases with self expandable prosthesis implantation inside the aorta, starting from catheters introduced through the femoral artery.

The endovascular treatment of descending aortic dissections was first described by Dake et al.[5] in 1994.

In 1997, the group of the Paulista School of Medicine led by Dr. Honorio Palma and Dr. Ernie Buffolo described, in a series of seventy patients with aortic dissection type B treated with the elephant trunk technique, two cases where the tube Dacron was replaced by anterograde released stent graft during total circulatory arrest of five minutes[6].

In 1999 Dake et al.[7] in 19 patients with complicated type b aortic dissection who underwent endovascular treatment, reported hospital mortality of 16% for aortic rupture and 79% for false lumen thrombosis. Nienaber et al.[8], in 1999, comparing patients with chronic or subacute dissection endovascular treated with patients who underwent conventional surgery, reported technical success in 100% of cases, with 83.3% of immediate thrombosis of the false lumen.

The EUROSTAR registry[9], described in 2004, introduced the first wider case series of patients treated with thoracic aortic stent graft. This registry included patients with aortic dissection, aortic aneurysm, pseudoaneurysm and traumatic aortic lesions. Despite the heterogeneity of the patients, it demonstrated primary technical success of 89%, with 30-day mortality of 6.5%, the one-year survival was 90% in cases of aortic dissection type B, and paraplegia occurred in 0 8%.

In Brazil, Fonseca et al.[10], in 1998, present the endovascular treatment of 4 cases of acute type B dissection with stent graft interposition, obtaining success in all the cases with total occlusion of the slot with thrombosis of the false lumen.

The premature occlusion of the false lumen entrance seems to improve the prognosis of patients in long-term. Atsuku et al.[11] followed the late evolution (ten years) of patients with type B aortic dissection medically treated. These authors showed that in the group of patients that had thrombosis of the false lumen during medical treatment, the mortality associated with the dissection was 5.6 times lower than in the group of patients in whom the false lumen remained patent, concluding that the patency the false lumen was an independent risk factor for dissection, death or events related to the dissection.

Tsai et al.[12] have shown that after discharge from hospital, patients who presented partial thrombosis of the false lumen had higher mortality than patients with complete patency of the false lumen. This happens with the higher incidence of rupture of the aneurysm sac expansion for not having distal reentry and end up in "dead end", leading to greater subsequent pressurization of the false lumen.

In the initial evaluation of acute type B aortic dissection, prognostic indicators of severity as the patency of the false

lumen and aortic diameter greater than 40 mm as it should be considered in the choice of the appropriate therapy[13]. Loewe et al.[14] demonstrated a higher incidence of complications in acute type B aortic dissection in which the location of the entrance hole is in the small aortic curvature and recommended that these patients should be considered as high risk and with indication of premature endovascular treatment.

Eggebrecht et al.[15], in a meta-analysis of 39 published studies from 1999 to 2005, which involved 609 patients, proved the technical success in 98.2% of patients; hospital mortality of 5.3%, presence of neurological complications of 3.1 %, 1% of paraplegia and 2.1% of ischemic stroke. During follow-up, there was 2.3% of aortic rupture. Xiong et al.[16], also from meta-analysis of 39 studies published from 2001 to 2007 in China, involving 1304 patients, showed a hospital mortality of 2.6±0.1%, and a 5-year survival of 95.2%. The low mortality rate for endovascular treatment in a significant number of patients with type B aortic dissection complicated[15,16] allowed to question the indication of medical treatment as an approach to uncomplicated type B aortic dissections.

The INSTEAD[17] was the first prospective, randomized, multicenter trial that compared endovascular treatment added to optimal medical treatment exclusively in uncomplicated type B aortic dissections in the subacute and chronic stage.

After two years of follow up, there was no difference in mortality from all causes and events related to the aorta between the two groups, although the aortic remodeling, defined as an increase of the true lumen and false lumen thrombosis was higher in patients undergoing endovascular treatment, 91.3% versus 19.4% in the group of medical treatment[18].

At late follow-up of these patients, between 2-5 years, the group of patients randomized to endovascular and optimized medical treatment showed lower mortality due to events related to the aorta, 6.9% versus 19.3% in the group that was selected for exclusive optimized medical treatment[19]. Furthermore, patients of the endovascular treatment also presented reduced disease progression of 27% against 46.1% in the medical treatment[19].

The efficacy of endovascular treatment of type B aortic dissections is conditioned to occlusion of the entrance and complete thrombosis of the false lumen.

The literature describes a variation in the rate of complete thrombosis of the false lumen in the descending thoracic aorta, between 22.2% and 100%[7,8,20-24]. This wide variation is related to the stage of the disease presentation in which it was proposed the treatment as well as the studied segment of the descending thoracic aorta.

Shimono et al.[22], in a late follow-up of 24.5 months after endovascular repair, reported that the complete thrombosis of the false lumen was more frequent in patients treated in the acute phase 66.7% than those treated during the chronic phase 38.5%. According to these authors the persistent false lumen perfusion was correlated with late complications such as aortic dilation and rupture with subsequent death.

Kusagawa et al.[25] reported that after two years of follow-up after endovascular repair of type B aortic dissection, the false lumen thrombosis occurred in 76% of patients undergoing repair in the acute phase of the disease and in 36% of those who have corrected in the chronic phase. They also reported that after treatment of acute cases, the average diameter of the false lumen in the descending aorta early reduced, between one and six months. In the cases treated in the chronic phase, this reduction occurred later, between six and twelve months, confirming that the false lumen thrombosis is more likely when treatment is instituted in the acute phase.

Fioranelli et al.[26] reported that the presence of reentry thoracic aorta was correlated with the patency of the false lumen in the postoperative follow-up and agreed with the findings of Kato et al.[23]; Shimono et al.[22] and Kusagawa et al.[25] who stated that the delamination, sometimes fragile in the acute phase, becomes more fibrotic and stable in the chronic phase thereby decreasing the potential for aortic remodeling in this stage. Lopera et al.[27], also reported that the presence of reentry at the level of the descending thoracic aorta associated with fibrosis in chronic cases, contribute to the reduced chance of sealing the intimal-middle layer and consequent reduction of thrombosis of the thoracic false lumen. Dias et al.[28], despite the small number of patients studied, concluded that the endovascular treatment of type B aortic dissection, in the chronic phase, did not decrease the diameter of the descending aorta and showed persistence of the false lumen in the descending segment of the thoracic aorta in 27.3% and abdominal aorta of 81.8%.

Kusagawa et al.[25], in a 6-year experience with endovascular treatment for acute and chronic dissection, reported that the presence of reentry in the thoracic and abdominal aorta were correlated with the maintenance of the false lumen diameter in the thoracic aorta. The presence of abdominal visceral level reentry allowed the reduction or thrombosis of the false lumen of the thoracic aorta, demonstrating that the presence of reentry into the descending thoracic aorta is the limiting factor in this segment of the aortic remodeling.

Schoder et al.[29] demonstrated that endovascular treatment determined the false lumen thrombosis at the level of the stent graft in 90% of cases, 60% in the most distal segment of the stent graft and 22% in the segment of the abdominal aorta. It was justified by the presence of distal reentries.

Eggebrecht et al.[24], in 38 patients with complicated type B dissection underwent endovascular treatment, 10 patients in the acute phase and 28 in the chronic phase, reported early mortality of 11%, all of them occurring in patients treated in the acute phase.

Böckler et al.[30], studying 37 patients with complicated dissection, also demonstrated a 19% incidence of early mortality in patients treated during the acute phase of dissection and no deaths in patients treated in the chronic phase. These authors considered that this high mortality rate is due to the selection of patients, the severity of the case that requires immediate intervention. Given that these patients, despite the technical success of the occlusion of the false lumen by the stent graft, evolve with systemic complications from previous clinical condition. Thus, the cause of early death in the present study was mostly due to multiple organ failure and mesenteric ischemia, and other causes not related to the aorta. Therefore, in relation to the developmental stage of the disease in which the endovascular treatment is indicated, it seems that the incidence of false lumen thrombosis is higher in acute cases, despite early mortality also being higher in these patients, although it is determined by the previous clinical severity of these patients.

The retrograde dissection has also been described in the literature in up to 8% of cases[31].

According to Rubin et al.[32], this complication can take place early or even at a later period of the treatment.

The possible causes for retrograde dissection are inherent to the technical procedure, and as with intimal injury of the aortic wall by the tip of super-hard guide wires, or the ends of the stent delivery systems. It has also been linked to retrograde dissection. The proximal balloon inflating for accommodation can also lead to intimal injury[26]. The choice of prosthesis with much larger diameters than the lap anchor, which presented higher radial force against the aortic wall, is also an important cause of retrograde dissection or even rupture of the aortic wall[33].

According to Pamler et al.[34], Kasirajan et al.[33] and Rubin et al.[32] The presence of free proximal stent, *"Free Flo",* in close and direct contact with the weakened aortic wall, may also cause intimal injury. Bortone et al.[35], in 43 studied cases, reported 7.0% of early mortality because of retrograde dissection due to the use of stent graft with proximal free stent.

Dialetto et al.[36], in 28 patients treated with complicated Stanford type B dissection, presented 10.7% (03 patients) of early mortality, and the causes of death were retrograde dissection and rupture of the false lumen in two cases.

Recently, Fattori et al.[37] published data from 1995 to 2012 from the international registry of aortic dissection. 1129 consecutive patients with type B acute aortic dissection were monitored. Uncomplicated patients were medically treated (75.6%) and those with complicated dissection were indicated for the endovascular procedure (24.4%). The hospital mortality between the two groups was similar, but at a 5 year follow-up, the group that underwent endovascular treatment had a lower mortality of 15.5% compared to 29% of death in patients who were medically treated.

As a conclusion, we can say that the best current scientific evidence suggests that in complicated cases, endovascular therapy is the best treatment option, in the subacute and chronic uncomplicated cases, the endovascular treatment and the clinical treatment have similar short-term results, however in the long-term evaluation, the endovascular treatment has lower mortality rate, lower incidence of complications related to the aorta and lower disease progression. Regarding the treatment of this disease in its acute phase, future comparative and randomized studies are needed to define the best treatment to be indicated.

Authors' roles & responsibilities	
JJD	Final approval of the manuscript, drafting the manuscript; review it critically
JCDVP	Drafting of the manuscript; review it critically
RAB	Final approval of the manuscript, drafting the manuscript; review it critically
ALF	Drafting of the manuscript; review it critically
WKK	Drafting of the manuscript; review it critically
ARF	Final approval of the manuscript

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