The Results of Thoracic Endovascular Aortic Repair for High-risk Type B Aortic Dissection

Lam Dac Huy[1], Tran Minh Bao Luan[1,], Lam Van Nut[2], Nguyen Huu Tuong[1], Nguyen Hung Truong[1]*

ABSTRACT

Overview: Evaluating the efficacy of endovascular intervention in treatment of high-risk type B aortic dissection

Methods: Review a series case of high-risk type B aortic dissection cases treated with endovascular intervention at Cho Ray Hospital from January 2020 to December 2022.

Results: The study included a total of 30 patients with high-risk type B aortic dissection who underwent endovascular intervention meeting all sampling criteria. The average age was 53 years (26-73 years), with males accounting for 86.7%. The most common risk factor was hypertension (86.7%). Pain was the primary reason for hospital admission, with chest pain being the most frequent (80%). The most prevalent high-risk factors were false lumen diameter > 22mm (66.7%), followed by aortic diameter > 40mm (36.7%), and entry tear diameter > 10mm (33.3%). Regarding intervention characteristics, the average stent graft length was 207.3mm, with proximal landing zones predominantly in zone 1 (23.3%), zone 2 (40%), and zone 3 (36.7%). Twenty-nine patients were continuously monitored for an average of 4.3 months, with a complication rate of 10% including endoleak type Ia (6.9%) and retrograde dissection (3.4%). Aortic remodeling was evidenced by a significant reduction in false lumen size ($p<0.001$)

Conclusion: Follow-up results show a low rate of complications and a high rate of aortic reconstruction post-intervention.

Keywords: *type B aortic dissection, endovascular intervention.*

INTRODUCTION

Aortic dissection is a life-threatening condition where the layers of aorta are separated by blood entering through a tear in the intima. This results in the formation of a false lumen (FL) running parallel to the true lumen (TL), disrupting normal aortic architecture and function. Generally, pathogenesis involves intimal tearing that permits high-pressure blood into the middle layer (media) of the aortic wall with subsequent dissection.[1-3] Aortic dissection was associated with a high incidence of life-threatening complications such as acute cardiac tamponade, myocardial infarction, aortic insufficiency, ischemic stroke and visceral ischemia.[2] Aortic dissection carries a crude incidence of about 3 per 100,000 annually[3-6] and such severe consequences that urgent, meticulous clinical attention is clinically necessary if not mandatory.

The 2022 guidelines from the American College of Cardiology (ACC) and the American Heart Association (AHA)[2] recommend on the

[1] *University of Medicine and Pharmacy at Ho Chi Minh City, Ho Chi Minh City, Vietnam*
[2] *Vascular Surgery Department of Cho Ray Hospital, Ho Chi Minh City, Vietnam*
[*] *Corresponding author: Tran Minh Bao Luan,*
Tel: 0988990059 - Email: tranminhbaoluan@ump.edu.vn
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basis of moderate-quality evidence that for high-risk patients endovascular intervention may be reasonable (Class IIb recommendation). The criteria for high-risk status were: aortic diameter > 40 mm, false lumen diameter > 22 mm, entry tear location at the minor curvature of the aortic arch or >10 mm in length, aneurysmal dilatation >5 mm of any diameter per year, imaging-based signs of malperfusion (pleural effusion or organ ischemia). If patients have clinical indicators such as persistent pain or hypertension unresponsive to medical management (other specific conditions are outlined in the current statement), this categorizes the patient as high-risk.

Endovascular intervention remains open in current therapeutic guidelines for high-risk Stanford type B a aortic dissection. Moreover, at the moment, domestic research conducted in the field is characterized by the fact that it is limited to generalized assessment of the results of endovascular intervention in patients with Stanford type B aortic dissection, with particular attention of professionals not being paid to the study of high-level risk over long periods of follow-up. For this reason, it becomes critical to discuss such an issue in the research and find out more specific information concerning high-risk patients.

MATERIALS AND METHODS:

Sample:

The study included patients diagnosed with high-risk Stanford type B aortic dissection who underwent endovascular treatment at Cho Ray Hospital from January 2020 to December 2022.

Method:

Using a retrospective descriptive case series approach, the study aimed to evaluate clinical outcomes and treatment efficacy. Statistical analysis utilized Excel for data management, Epidata version 3.1 for data quality assurance, and Stata version 14.2 for robust statistical testing. Fisher's Exact Test assessed categorical variables, and the Student's t-test evaluated continuous variables, with significance set at $p \leq 0.05$.

RESULTS:

Among the 30 patients included in the study, 26 were male (86.7%) and 4 were female (13.3%). The predominance of male patients underscores a notable demographic trend within our cohort, reflecting the condition's potentially higher prevalence in males. The average age was 53.0 ± 10.8 years, with the majority falling within the 40 - 50 age range.

Cardiovascular risk factors:

Hypertension emerged as the predominant risk factor among the study participants.

Table 1. Cardiovascular Risk Factors in the Study Cohort

Risk Factor	Number of patients	Percentage (%)
Hypertension	26	86.7
Diabetes mellitus	3	10.0
Dyslipidemia	13	43.3
Smoking	16	53.3
Lung disease	2	6.8
Coronary artery disease	5	16.7

Reasons for hospital admission:

Chest pain was the most prevalent symptom, reported by 80.0% of patients, followed by abdominal pain in 56.7% of cases. Some patients presented with concurrent chest and abdominal pain. No admissions were due to syncope, with only 1 case (3.3%) admitted for hypertensive crisis.

Pre-intervention imaging characteristics:

The mean maximum diameter of the thoracic aorta was 39.3 mm, with nearly all cases exhibiting a larger false lumen diameter compared to the true lumen. Entry tears were identified in 23 patients, averaging 11.6 mm in diameter. Dissection extending into the abdominal aorta was observed in 24 patients. Imaging indicated organ ischemia in 2 patients (6.7%), primarily affecting renal perfusion, while 8 patients (26.7%) exhibited visceral ischemia.

High-risk Stanford Type B dissection rate:

The presence of a false lumen diameter > 22 mm was identified as the most prevalent high-risk factor, affecting 66.7% of patients. Nearly half of the cohort (46.7%) exhibited two or more high-risk factors (Figure 1).

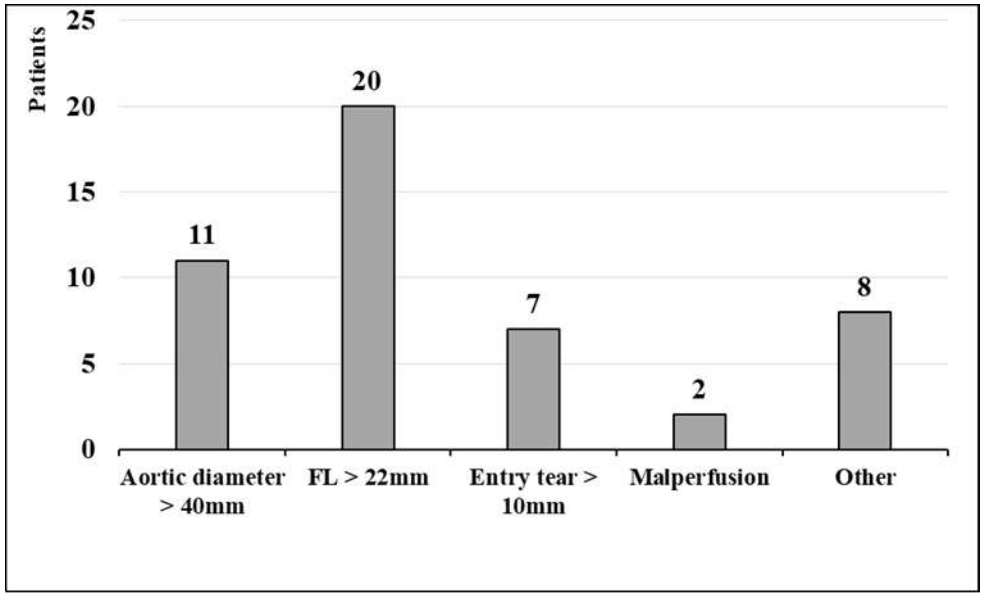

Figure 1. Proportion of high-risk factors

Intervention Characteristics:

Stent graft placement location was determined based on the entry tear site. Four patients (13.3%) required unilateral stent graft placement, while seven patients (23.3%) underwent bilateral stent graft deployment. Eight patients (26.7%) underwent left subclavian artery coverage without repositioning. The mean proximal stent graft diameter was 35.8 mm, distal stent graft diameter was 31.4 mm, and the average covered stent graft length was 207.3 mm. The mean surgical duration was 246 minutes, with an average of 1.4 stent grafts used per patient, with a maximum of 2 grafts utilized.

Outcomes:

Among the 30 patients who underwent endovascular stent graft placement, one mortality occurred within 24 hours due to post-operative

thoracic aortic dissection rupture. The remaining patients were hospitalized for an average of 7.3 ± 3.4 days (range: 4-14 days).

Follow-up evaluations from 30 days to 6 months post-intervention, based on Fillinger's criteria (2010)[7], assessed the effectiveness and safety of endovascular intervention.

Safety:

During follow-up, two fatalities were recorded: one due to thoracic aortic dissection with type Ia endoleak and another due to retrograde progression to Stanford type A dissection. One patient experienced a stroke. Additionally, two cases of type I endoleak were managed, and one case of retrograde dissection was treated. The overall complication rate was approximately 10%.

Effectiveness:

Out of 26 patients without complications, significant reductions in false lumen diameter were observed post-intervention ($p < 0.001$) *(Figure 2).*

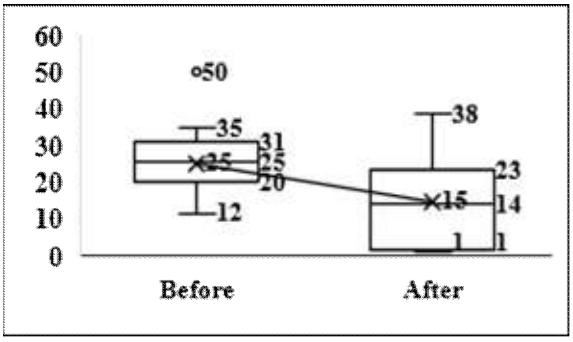

Figure 2. Changes in thoracic false lumen diameter post-intervention

Moreover, there was a statistically significant decrease in false lumen thrombus presence following intervention ($p < 0.001$) *(Figure 3).*

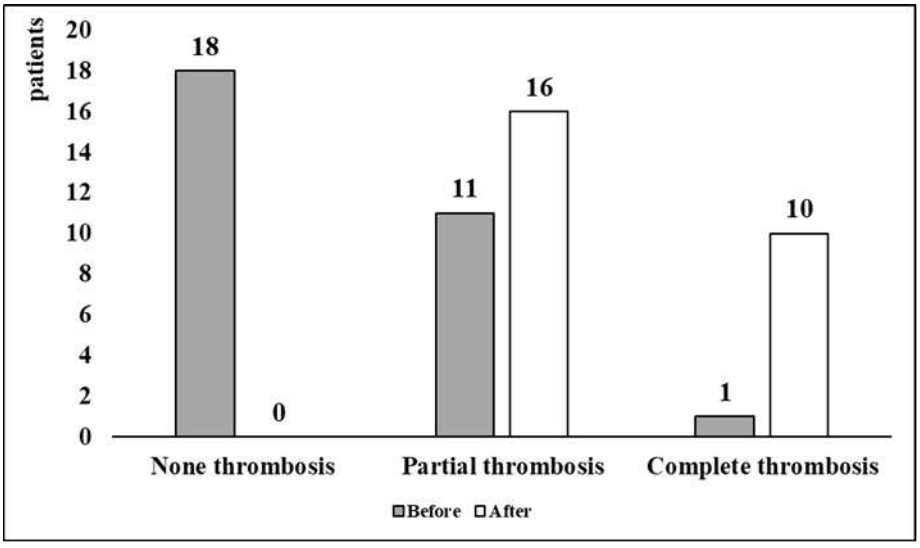

Figure 3. Changes in false lumen thrombus presence pre- and post-intervention

These findings highlight both the challenges and successes in managing high-risk Stanford type B aortic dissection through meticulous endovascular intervention, underscoring the need for continued vigilance and innovative treatment strategies in clinical practice.

DISCUSSION:

The approach to managing Stanford type B aortic dissection (TBAD) has markedly advanced since the inception of endovascular intervention in the early 21st century. Despite ongoing debates surrounding the optimal treatment for uncomplicated TBAD, current guidelines[2] recommend endovascular intervention for high-risk cases due to its demonstrated superiority over conservative medical management.

Significant studies by Enmin Xie (2021)[4] and Bavaria et al. (2015)[8] reported post-intervention mortality rates of 6.3% and 6.5%, respectively. Similarly, Lombardi et al. (2019)[9] documented a mortality rate of 6.1%. Lombardi's study [9] notably found no cases of myocardial infarction over a 12-month follow-up, contrasting with Bavaria's report[8] of a 4.3% incidence. Neurological complications, such as stroke, were observed at a rate of 1.2% in Lombardi's cohort[9].

In our study involving 30 patients treated with endovascular stent graft placement for TBAD, one perioperative mortality was recorded. During subsequent follow-up, two additional deaths occurred, resulting in an overall mortality rate of 6.9%. Specifically, one patient succumbed to retrograde progression to Stanford type A dissection, while another experienced complications including type Ia endoleak, aneurysm formation, and subsequent rupture of the descending thoracic aorta. Cardiovascular complications were absent, and neurological complications were noted in 3.4% of cases.

The efficacy of endovascular intervention in treating Stanford type B aortic dissection (TBAD) is well-established. However, the crucial question remains whether combining endovascular treatment with optimized medical therapy offers different outcomes compared to medical therapy alone, and whether its benefits outweigh the associated risks. International studies have highlighted that endovascular reconstruction plays a significant role in reducing late complications of TBAD, such as false lumen expansion.

In a study by Lombardi et al. (2019)[9], patients were followed for 12 months, showing a significant reduction in the maximum aortic diameter in over 78.8% of cases, with minimal changes observed in 1.5% of cases. Diameter enlargement was seen in 19.7% of patients, with a mean reduction in false lumen diameter of 10.1mm ($p < 0.001$), and complete thrombosis of the false lumen in over 100% of cases. Similarly, Bavaria et al. (2015)[8] reported reductions in maximum aortic diameter in 18.2% of patients over a 9-month follow-up, with insignificant changes in 63.6% of cases and enlargement in 18.2% of cases, alongside a high incidence of complete false lumen thrombosis (97%).

For patients at high risk managed solely with medical therapy, there is a higher incidence of late complications such as aortic rupture, false lumen expansion, and retrograde dissection. In our study, significant reductions in false lumen diameter were observed post-intervention. On average, there was a reduction of 15.1mm in false lumen diameter, which was statistically significant ($p < 0.001$) *(Figure 2).* Regarding false lumen thrombosis, complete thrombosis was noted in 38.5% of cases, with partial thrombosis in 61.5%, and no cases without thrombosis *(Figure 3).*

The analysis and comparison of these findings underscore the critical role of endovascular intervention in effectively mitigating late complications associated with Stanford type B aortic dissection.

CONCLUSION:

Treating high-risk Stanford type B aortic dissection (TBAD) with a combination of endovascular intervention and optimized medical therapy is both safe and effective in reducing post-intervention complications. Furthermore, this approach demonstrates significant efficacy in aortic remodeling following endovascular intervention.

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