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OUTCOMES OF ENDOVASCULAR TREATMENT FOR ACUTE AORTIC SYNDROME AT THONG NHAT HOSPITAL

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ABSTRACT

Introduction: Acute aortic syndrome (AAS) is a life-threatening emergency encompassing aortic dissection, intramural hematoma (IMH), penetrating aortic ulcer (PAU), and aortic rupture/pseudoaneurysm. Mortality reaches 50–90% without timely intervention. Endovascular stent-grafting has become the preferred approach for descending aortic lesions.

Objective: To evaluate clinical characteristics, lesion morphology, and early outcomes of endovascular treatment for AAS at Thong Nhat Hospital.

Methods: A retrospective descriptive study of 22 patients diagnosed with AAS and treated by endovascular stent-grafting from June 2020 to January 2024. Lesion classification followed the Svensson system and the 2014 ESC Guidelines. Categorical variables were analyzed using Fisher's exact test; continuous variables using the independent samples t-test.

Results: 22 patients (male 72.7%; mean age 58.5 ± 14.2 years). Lesion types: aortic dissection 45.5%, aortic rupture/pseudoaneurysm 27.3%, PAU 22.7%, IMH 4.5%. Most common proximal landing zones: zone 0 (22.7%) and zone 2 (36.4%). Supra-aortic vessel transposition was required in 68.2% of cases. Technical success rate was 77.3%. Complications (each 4.5%): endoleak, retrograde type A dissection, aortic/iliac rupture, cerebral embolism, and acute limb ischemia. In-hospital mortality was 9.1% (2/22).

Conclusion: Endovascular stent-grafting is a feasible, safe and effective treatment for AAS with acceptable in-hospital mortality. Larger cohorts and longer follow-up are needed to evaluate mid- and long-term outcomes.

Keywords: *Acute aortic syndrome; endovascular treatment; stent-graft; aortic dissection; aortic aneurysm.*

1. INTRODUCTION

Acute aortic syndrome (AAS) is an umbrella concept encompassing several life-threatening acute aortic wall pathologies, including aortic dissection (AD), intramural hematoma (IMH), penetrating aortic ulcer (PAU), aortic rupture/pseudoaneurysm, and traumatic or iatrogenic aortic injury[1]. The syndrome is increasingly recognized in clinical practice, largely owing to the widespread availability of multi-detector computed tomography (MDCT).

According to data from the International Registry of Acute Aortic Dissection (IRAD), the incidence of AAS is approximately 2.6–3.5 cases per 100,000 population per year, predominantly in males (two-thirds of cases) with a mean age of 60–63 years[2]. In Vietnam, the disease tends to present at a younger age, with a mean of 51–55 years and a clear male predominance[4].

Without timely treatment, AAS carries an extremely high mortality: untreated type A dissection is associated with a mortality increase of approximately 1% per hour in the first 24 hours, reaching up to 90% at 30 days[3]. Conventional open surgery improves prognosis but still carries significant early mortality (22–30%) and high rates of neurological complications[3,4]. The landmark INSTEAD randomized trial by Nienaber et al. (2009) was the first to demonstrate the superiority of TEVAR over optimal medical therapy alone for uncomplicated type B aortic dissection in terms of aortic remodeling at two years[5].

The 2022 ACC/AHA Guidelines recommend TEVAR as the preferred treatment for complicated acute descending AAS, including cases complicated by pericardial or pleural effusion, visceral malperfusion, impending rupture, or persistent pain refractory to optimal medical therapy[7]. However, domestic data on TEVAR outcomes in the context of AAS remain limited. We therefore conducted this study to evaluate the clinical characteristics, lesion morphology, and early outcomes of endovascular treatment for AAS at Thong Nhat Hospital.

2. PATIENTS AND METHODS

2.1. Study Population

The study included patients diagnosed with AAS according to the 2014 ESC criteria[1] and treated with endovascular stent-graft placement at the Department of Cardiovascular and Thoracic Surgery, Thong Nhat Hospital, Ho Chi Minh City, from June 2020 to January 2024.

Inclusion criteria: (1) age ≥ 18 years; (2) MDCT aortic imaging confirming at least one of the following: aortic dissection, IMH, PAU, or aortic rupture/pseudoaneurysm; (3) indication for endovascular intervention per 2014 ESC and 2022 ACC/AHA guidelines; (4) written informed consent.

Exclusion criteria: (1) Stanford type A aortic dissection requiring emergency open surgery; (2) contraindication to endovascular repair (inadequate vascular access or unfavorable anatomy); (3) patient refusal.

2.2. Study Design

A retrospective descriptive study design was used. Categorical variables were analyzed using Fisher's exact test. Continuous variables were compared using the independent samples t-test. Statistical significance was set at $p < 0.05$.

2.3. Diagnostic and Treatment Protocol

Patients presented with acute chest pain,

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interscapular back pain, epigastric pain, or incidental CT findings. Comprehensive evaluation included clinical examination, 12-lead ECG, biochemical investigations (high-sensitivity troponin, D-dimer, renal function, electrolytes), Doppler echocardiography, vascular duplex ultrasonography, and contrast-enhanced MDCT of the aorta from the neck to the groins with three-dimensional reconstruction.

Initial medical management consisted of strict bed rest, systolic blood pressure control below 120 mmHg (intravenous Nicardipine), heart rate control below 80 bpm (beta-blockers), optimized analgesia (intravenous Morphine), and continuous monitoring of vital signs and symptoms.

Endovascular procedures were performed in the DSA suite under fluoroscopic guidance via transfemoral access. When the lesion involved the aortic arch, supra-aortic vessel transposition — either total arch branch debranching or left common carotid-to-left subclavian artery bypass — was performed prior to stent-graft deployment. All transposition procedures and stent-graft deployments were performed in a single stage under general anesthesia with endotracheal intubation.

3. RESULTS

3.1. General Characteristics

Between June 2020 and January 2024, 22 patients met the study criteria. General characteristics are presented in Table 1. Males constituted 72.7% of the cohort, with a mean age of 58.5 ± 14.2 years (range 18–82 years). The most prevalent risk factors were hypertension (90.9%) and dyslipidemia (81.8%). Mean time from symptom onset to hospital admission was 7.0 ± 5.3 days. Chest pain occurred in 19 of 22 patients (86.4%); the remaining three were detected incidentally, though detailed history-taking revealed prior thoracic discomfort in each case.

Table 1. Clinical characteristics and risk factors of the study population (n = 22)

Characteristic	n (= 22)	%
Male sex	16	72.7
Mean age (years)	58.5 ± 14.2	—
Hypertension	20	90.9
Type 2 diabetes mellitus	4	18.2
Dyslipidemia	18	81.8
Current smoking	6	27.3
Time from onset to admission (days)	7.0 ± 5.3	—

3.2. Lesion Morphology

The distribution of lesion types is presented in Table 2. Aortic dissection was the most common morphology (45.5%), with Stanford type B accounting for 70% and arch-involving dissection for 30%. Aortic rupture/pseudoaneurysm ranked second (27.3%), followed by PAU (22.7%) and IMH (4.5%). Mean aortic diameter at the lesion site on CT was 48 ± 12 mm.

Table 2. Distribution of aortic lesion morphology (n = 22)

Lesion Morphology	n	%
Aortic dissection	10	45.5
– Stanford type B	7	70.0
– Arch-involving dissection	3	30.0
Intramural hematoma (IMH)	1	4.5
Penetrating aortic ulcer (PAU)	5	22.7
Aortic rupture / pseudoaneurysm	6	27.3

3.3. Technical Characteristics of the Intervention

Technical details are presented in Table 3. The most common proximal stent-graft landing zone was zone 2 (36.4%), followed by zones 0 and 3 (22.7% each). Supra-aortic vessel transposition was performed in 68.2% of patients: 36.4% underwent left common carotid-to-left subclavian

artery bypass, 9.1% carotid-to-carotid-to-left subclavian bypass, and 22.7% complete total arch branch debranching. All procedures were performed under general anesthesia with endotracheal intubation. Mean procedural time was 142 ± 38 minutes.

Table 3. Technical characteristics of endovascular intervention (n = 22)

Intervention Characteristic		n	%
Proximal stent-graft landing zone	Zone 0	5	22.7
	Zone 1	2	9.1
	Zone 2	8	36.4
	Zone 3	5	22.7
	Zone 4–5 (abdominal aorta)	2	9.1
Supra-aortic vessel transposition	None required	7	31.8
	Left carotid-to-subclavian bypass	8	36.4
	Carotid-to-carotid-to-subclavian bypass	2	9.1
	Total arch branch debranching	5	22.7
Mean procedural time (min)		142 ± 38	—
Mean hospital stay (days)		8 ± 4.2	—

3.4. Complications and Early Outcomes

Early outcomes and complications are presented in Table 4. The technical success rate was 77.3% (17/22). Complications occurred in five patients (22.7%), one patient each (4.5%): endoleak, retrograde type A dissection, aortic/iliac rupture, cerebral embolism, and acute limb ischemia. In-hospital mortality was 9.1% (2/22): one patient died from retrograde type A dissection following stent-graft deployment, and one from ruptured type B aortic dissection. Mean hospital stay was 8 ± 4.2 days.

Table 4. Complications and early outcomes following endovascular repair (n = 22).

Complication	n	%
No complication	17	77.3
Endoleak	1	4.5
Retrograde type A dissection	1	4.5
Aortic/iliac rupture	1	4.5
Cerebral embolism	1	4.5
Acute limb ischemia	1	4.5
In-hospital mortality	2	9.1

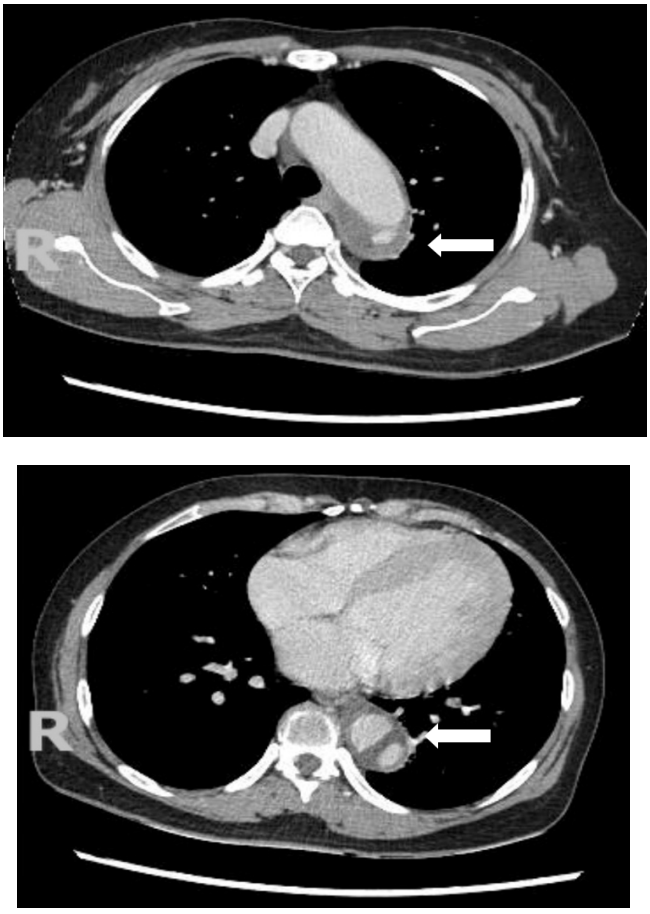

Figure 1. Preoperative CT scan demonstrating two penetrating aortic ulcers involving the aortic arch and descending thoracic aorta (blue arrows)

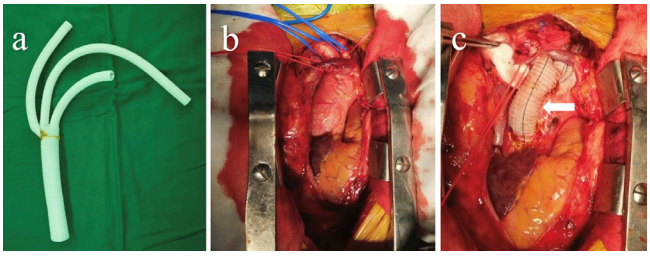

Figure 2. Intraoperative images of total arch branch debranching procedure. (a): Design of a trifurcated prosthetic graft; (b): Exposure of the ascending thoracic aorta with selection of the proximal anastomosis site; (c): Bypass graft from the ascending thoracic aorta to three branches: the innominate artery, left common carotid artery, and left subclavian artery (blue arrows).

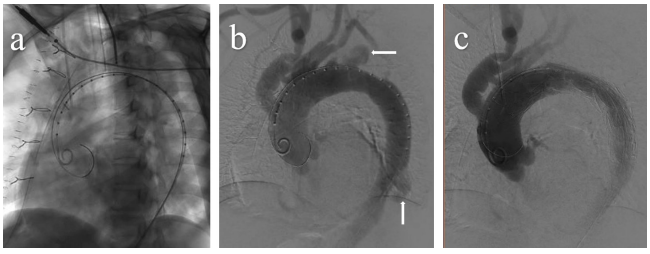

Figure 3. Endovascular intervention images. (a): Advancement of guidewire and catheter to the ascending thoracic aorta; (b): Angiography demonstrating two penetrating aortic ulcer sites (blue arrows); (c): Completion angiography following stent-graft deployment.

4. DISCUSSION

4.1. General Characteristics

AAS in this series predominantly affected males (72.7%), consistent with IRAD data in which males account for two-thirds of all cases[2]. The mean age of 58.5 years was younger than reported in European centers (60–71 years)[29], but comparable to domestic Vietnamese studies. Nong Huu Tho et al. (2022), in a surgical series of 101 AAS patients at Cho Ray Hospital, reported a mean age of 54.1 ± 14.9 years with a male-to-female ratio of 3.4:1, reflecting the tendency for acute aortic pathology to present at younger ages in Vietnamese patients compared with Western populations[4].

Hypertension was the most prominent risk factor (90.9%), consistent with IRAD data in which 77% of aortic dissection patients have systemic hypertension.[2] Rigorous blood pressure control during the initial medical phase is essential to minimize the risk of lesion propagation and pre-procedural complications.

4.2. Lesion Morphology

Aortic dissection remained the most prevalent lesion type (45.5%), consistent with international literature (45–80% depending on the series)[9]. The proportion in our study is lower than some reports, as type A dissections requiring open repair and chronic dissections were excluded. The relatively high rate of aortic rupture/pseudoaneurysm (27.3%) reflects the severity of the clinical presentations and the genuine need for emergency intervention. IMH was identified in only one case (4.5%), lower than European literature (10–25%),[1] which may be attributable to the fact that IMH is easily missed on non-contrast CT — as also noted in domestic surgical series[4].

4.3. Technical Considerations and Landing Zone Selection

Zone 2 was the most common proximal landing zone (36.4%), followed by zones 0 and 3 (22.7% each), reflecting the high proportion of arch-involving and proximal descending aortic lesions. Stent-graft deployment in zones 0–2 requires supra-aortic vessel transposition to preserve cerebral and upper limb perfusion; 68.2% of patients in this series underwent combined transposition procedures, a substantially higher rate than in purely infra-subclavian series. Shu et al. (2011) reported a technical success rate of 92% with a 30-day mortality of 8% for TEVAR in complicated type B aortic dissection, affirming the

efficacy of this approach[8].

All procedures in this series were performed in a single stage under general anesthesia with endotracheal intubation, which allowed simultaneous hybrid repair and precise hemodynamic control throughout complex arch interventions. This unified approach is increasingly preferred at high-volume centers for arch-involving lesions requiring transposition.

4.4. Complications and Mortality

The in-hospital mortality of 9.1% in this study was significantly lower than the 22.7% early post-operative mortality reported for open surgical repair of AAS in the domestic series by Nong Huu Tho et al[4]. This is consistent with the international trend toward TEVAR replacing open repair for descending aortic lesions[6,7].

Retrograde type A dissection (4.5%) was the most serious complication and was responsible for one in-hospital death. Dong et al. (2009) reported this complication in 1.3–4% of TEVAR cases and recommended preventive measures including avoidance of oversizing beyond 10%, use of a stent-graft with a soft proximal end, and gentle wire handling in the ascending aorta[10]. The endoleak rate of 4.5% falls within the commonly reported range of 3–5% in large series[8].

Compared with open surgical data in Cho Ray Hospital, the rates of irreversible neurological deficit (25.7%) and pneumonia (37.6%) reported in the open surgical group by Nong Huu Tho et al were substantially higher than those observed in the endovascular group in this study[4]. This advantage derives from avoidance of cardiopulmonary bypass, the absence of systemic hypothermia, and markedly reduced procedural time.

5. CONCLUSION

Endovascular stent-graft repair is a feasible, safe, and effective treatment for acute aortic syndrome at Thong Nhat Hospital, achieving a technical success rate of 77.3% and an in-hospital mortality of 9.1% — significantly lower than that of conventional open surgery. A high proportion of patients (68.2%) required combined supra-aortic vessel transposition, reflecting the predominance of arch-involving lesions in this cohort, and all cases were managed successfully in a single-stage procedure under general anesthesia. AAS in Vietnam tends to present at a younger age than in Western populations, with hypertension as the predominant risk factor. Larger prospective cohorts with extended follow-up are needed to comprehensively evaluate mid- and long-term outcomes.

DECLARATIONS

Conflicts of interest: The authors declare no conflicts of interest.

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Ethics approval: The study was approved by the Institutional Ethics Committee of Thong Nhat Hospital. All patients provided written informed consent prior to participation.

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