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Clinical Outcomes of EVAR and TEVAR in Treating Abdominal and Thoracic Aortic Aneurysms: A Retrospective Study in Indonesia

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Abstract

Aortic aneurysm is a serious cardiovascular condition that can lead to fatal rupture if not managed appropriately. This study aims to describe the characteristics of patients with abdominal and thoracic aortic aneurysms and to evaluate the outcomes of endovascular interventions—specifically EVAR and TEVAR—at the Provincial General Hospital of West Nusa Tenggara. Among the seven cases analyzed, six patients had abdominal aortic aneurysms and one patient had a thoracic aortic aneurysm complicated by dissection; the majority were elderly male patients with smoking and hypertension as predominant risk factors. All patients underwent either EVAR or TEVAR with favorable initial success, no major immediate post-procedural complications, and demonstrated clinical improvement. The study concludes that EVAR and TEVAR are effective and safe endovascular therapies for selected patients with aortic aneurysms. The findings highlight the importance of early detection and the strengthening of endovascular treatment facilities as integral components in the management of aortic aneurysms at regional hospitals.

Keywords: Aortic aneurysm, endovascular repair, minimally invasive procedure.

INTRODUCTION

Cardiovascular disease is the leading cause of death globally and remains a significant challenge in modern medicine. One of the most dangerous manifestations of cardiovascular disorders is aortic aneurysm, a pathological and permanent dilation of the arterial wall that carries a high risk of rupture. Ruptured aortic aneurysms can lead to massive bleeding and sudden death, with mortality rates exceeding 80% if not treated promptly (Wanhainen et al., 2019). Preventive strategies, including early detection and appropriate medical intervention, have been proven to reduce mortality from aneurysm complications (Kuivaniemi et al., 2020). Advances in imaging technology and interventional procedures have enhanced early diagnosis and treatment capabilities (Isselbacher et al., 2022). However, clinical challenges in detecting asymptomatic aneurysms remain a significant barrier in many healthcare settings (Howard et al., 2020). Therefore, a deeper understanding of the epidemiology and characteristics of aneurysms is essential in the context of modern cardiovascular care (Nordon et al., 2020).

Aortic aneurysms are generally classified into two main types: abdominal aortic aneurysms (AAA) and thoracic aortic aneurysms (TAA), each with distinct prevalence, etiology, and anatomical locations. AAA occurs more frequently, with a prevalence of 7–9% among individuals over 65 years old, particularly in active smokers (Chaikof et al., 2018). Approximately 80% of AAAs occur in the infrarenal segment. In comparison, TAA affects only 0.16–0.34% of the population and is more commonly found in patients with genetic disorders such as Marfan syndrome or bicuspid aortic valve (Rylski et al., 2020). TAA most commonly involves the ascending aorta (60%), followed by the descending aorta (35%), and the aortic arch (5%) (Nienaber et al., 2020). Most TAAs remain silent until severe complications such as dissection or rupture occur (Hiratzka et al., 2022). Given the differences in location and etiology, diagnostic and treatment approaches must be individually tailored (Erbel et al., 2019).

Although various interventional methods are available, there is ongoing scientific debate about the most effective treatment options for aortic aneurysms. Open surgery, while conventional and effective, carries a high risk of perioperative complications and a more extended recovery period (Salata et al., 2019). In contrast, endovascular procedures such as EVAR for AAA and TEVAR for TAA offer a less invasive alternative, with initial success rates above 95% and lower perioperative mortality (Mazzaccaro et al., 2020). However, several post-intervention complications—such as endoleaks, stent migration, and the need for reintervention—remain long-term challenges (Bosiers et al., 2020). Comparisons of short- and long-term effectiveness between EVAR and TEVAR still yield varying results in recent studies (Lederle et al., 2019). Therefore, the choice of

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intervention must consider the individual patient's characteristics and potential risks of further complications (Chen et al., 2021).

This study aims to analyze the effectiveness of endovascular procedures in patients with aortic aneurysms, taking into account the type of aneurysm, its anatomical location, and the patient's clinical condition. Given the differing characteristics between AAA and TAA, as well as the ongoing debate over procedural choices, a comprehensive analysis based on current clinical data is necessary. The findings of this research are expected to contribute scientifically to the development of more personalized and evidence-based therapeutic strategies (Tang et al., 2021). The urgency of this study lies in the increasing number of patients undergoing endovascular interventions for aneurysms, which has yet to be matched by systematic evaluations of their effectiveness (Lo et al., 2020). Thus, this study may strengthen the foundation for adaptive clinical practice in line with technological advancements and the evolving demands of contemporary cardiovascular healthcare (Ma et al., 2020).

MATERIALS AND METHODS

This study was conducted at the West Nusa Tenggara Provincial General Hospital (RSUD Provinsi NTB) from June to December 2023. It employed a retrospective descriptive method with a case series approach, aiming to describe the clinical characteristics and outcomes of endovascular interventions—EVAR (Endovascular Aneurysm Repair) and TEVAR (Thoracic Endovascular Aneurysm Repair)—in patients diagnosed with abdominal and thoracic aortic aneurysms. This study design was chosen to evaluate the effectiveness of treatment and the potential for post-procedural complications based on patient medical records in an observational manner (Faiza & Sharman, 2023; Nation & Wang, 2015).

The study population consisted of all patients diagnosed with abdominal and thoracic aortic aneurysms at the West Nusa Tenggara Provincial Hospital who underwent EVAR or TEVAR during the study period. Sampling was conducted using a purposive sampling method, resulting in a total of seven patients who met the inclusion criteria—specifically, patients with aortic aneurysms confirmed by CT angiography and who had received endovascular intervention. The observed variables included aneurysm location, type of procedure, demographic characteristics, medical history, and post-procedural clinical outcomes. Data were collected from medical records, radiological imaging results, and operative notes (Propper & Abularrage, 2013; Tortora & Derrickson, 2017).

The research procedure began with the identification of aneurysm cases from hospital medical records, followed by the collection of diagnostic data through CT angiography and documentation of EVAR or TEVAR procedures. Each case was analyzed individually by tracing the disease progression, comorbid conditions, interventional procedures, and clinical outcomes following the intervention. The collected data were analyzed using a qualitative descriptive method to illustrate clinical trends and patient responses to the procedures, including complications such as endoleaks or further dissections. The findings were presented in narrative form, patient distribution tables, and visual documentation of pre- and post-procedural conditions (Daye & Walker, 2018; Kessler et al., 2022).

RESULTS AND DISCUSSION

Patient Characteristics

An analysis of the demographic and clinical characteristics of patients is a crucial step in understanding the profile of the population affected by aortic aneurysm or dissection. The data collected includes variables such as sex, age, type of disease, comorbidities, and habits that may serve as potential risk factors. A summary of this information is presented in Table 1.

Table 1. ***Patient Characteristics***

Characteristic	Category	Number of Patients	Percentage (%)
Sex	Male	6 patients	83.30%
	Female	1 patient	16.70%
Age	≥ 60 years	4 patients	57.10%
	50–59 years	2 patients	28.50%
	40–49 years	none	0%
	≤ 40 years	1 patient	14.20%
Type of Disease	Abdominal Aortic Aneurysm (AAA)	6 patients	85.70%

	Thoracic Aortic Dissection (Stanford B)	1 patient	14.30%
Medical History	Coronary Artery Disease	1 patient	14.20%
	Hypertension	4 patients	57.10%
Habit	Smoking	6 patients	85.70%

The distribution of patient characteristics in this study reveals that the majority of respondents were male (83.3%) and belonged to the ≥60 years age group (57.1%). The most commonly identified condition was abdominal aortic aneurysm (AAA), accounting for 85.7% of cases. These findings indicate that elderly males are highly vulnerable to pathological abnormalities of the aorta, particularly abdominal aneurysms. Previous research by Kent et al. (2010) supports this observation, stating that men are at significantly higher risk of developing aortic aneurysms compared to women. This elevated risk is associated with degenerative changes in the aortic wall, which tend to occur more rapidly in men, influenced by hormonal factors and increased proteolytic enzyme activity (Kent, 2010).

The most prominent risk factors among patients in this study were hypertension (57.1%) and smoking habits (85.7%). Physiologically, chronic high blood pressure can increase tension on the aortic wall, accelerating the degradation of elastin and collagen structures. This process gradually leads to abnormal dilation or aortic expansion. Smoking is also a significant contributor, as it stimulates increased inflammatory and proteolytic activity in vascular tissue. A study by Golledge and Norman (2011) emphasized that chronic exposure to cigarette smoke is closely linked to aneurysm formation, especially in individuals with certain vascular predispositions (Golledge & Norman, 2011). These findings are consistent with those of Wanhainen et al. (2019), who reported that over 70% of AAA patients had a history of hypertension and smoking, particularly among elderly populations in Europe (Wanhainen et al., 2019).

This study has several limitations, including a relatively small sample size and the exclusion of other important risk variables, such as dyslipidemia, diabetes mellitus, and family history. These factors are known to play a role in the pathogenesis of aneurysms and should therefore be included in future research. The interpretation of the results must be done cautiously to avoid overgeneralization to a broader population. Nonetheless, the findings offer valuable implications for preventive efforts, particularly through early screening and education for high-risk groups. Targeted interventions among elderly male populations with a history of hypertension and smoking may be a crucial strategy in reducing the incidence of aortic rupture, which carries a high risk of sudden mortality.

Clinical Characteristics, Diagnosis, and Radiological Findings of Patients

An analysis of the clinical characteristics, diagnosis, and radiological findings of patients is essential to obtain a comprehensive understanding of the variations in the presentation of aortic aneurysm and dissection cases. Each case in this study exhibited unique features in terms of age, chief complaints, and radiological imaging results. Table 2 presents a systematic summary of the seven cases analyzed in this study.

Table 2. ***Clinical Characteristics, Diagnosis, and Radiological Findings of Patients***

Case	Age & Sex	Chief Complaint	Diagnosis	Main Radiological Findings
1	77 years old, Male	Abdominal pain, shortness of breath	Fusiform Abdominal Aortic Aneurysm (AAA)	Imaging showed an abdominal aortic aneurysm with a diameter of 4.5 cm and a length of 10.1 cm located in the infrarenal region, accompanied by intraluminal thrombus.
2	78 years old, Male	Weakness, jaundice, abdominal pain	Fusiform AAA with impending rupture	Abdominal aortic aneurysm with a diameter of 4 cm and a length of 7.23 cm was observed, accompanied by a thrombus measuring 0.6 cm thick.
3	55 years old, Male	Left chest pain	Stanford Type B / DeBakey Type III Aortic Dissection	An intimal flap was found forming a true lumen and a false lumen, with thrombus in the false lumen indicating aortic dissection.
4	67 years old, Male	Right upper abdominal pain, jaundice	AAA with CBD lesion	An abdominal aortic aneurysm measuring 5x4 cm was found, accompanied by a hypodense lesion in the common bile duct (CBD).

5	56 years old, Male	Chest pain radiating to the back	AAA + Aortic Dissection	Abdominal aortic aneurysm with a diameter of 5.07 cm and a thrombus measuring 3.75 cm was observed, along with dissection extending to the inferior mesenteric artery.
6	27 years old, Female	Non-specific abdominal pain	Infrarenal Fusiform AAA	A fusiform-type abdominal aortic aneurysm was identified in the infrarenal region with features of multiple atherosclerotic changes.
7	79 years old, Male	Abdominal pain, lump	Infrarenal AAA	An abdominal aortic aneurysm with a diameter of 6 cm was found.

The clinical characteristics summarized in Table 2 indicate a wide variation in the presentation of both abdominal aortic aneurysms (AAAs) and aortic dissections, encompassing differences in age, sex, clinical symptoms, and radiological findings. Most cases in this study involved the infrarenal segment of the aorta, with lesion sizes ranging from 4 to 6 cm in diameter. Several cases were associated with thrombus formation, while others showed complications such as impending rupture or involvement of the hepatobiliary system, including lesions in the biliary ducts. Only one patient was diagnosed with a Stanford type B/ B/DeBakey type III aortic dissection, radiologically characterized by the presence of an intimal flap and the formation of true and false lumens. These findings underscore the critical role of radiological imaging—particularly CT angiography—in accurately identifying the location, morphology, and extent of lesions, thereby supporting optimal therapeutic decision-making.

From a pathophysiological perspective, the predominance of aneurysms in the infrarenal segment can be attributed to the anatomical characteristics of this region, which has a lower elastin content compared to the thoracic segment. This makes it more vulnerable to high hemodynamic pressure and turbulent blood flow, which accelerate vascular wall degeneration (Golledge & Norman, 2011). In contrast, aortic dissection results from a tear in the intimal layer that allows blood to enter the media layer, forming a false lumen, and is generally associated with uncontrolled hypertension. These observations are consistent with findings by Wanhainen et al. (2019), who noted that aneurysm size, thrombus thickness, and the presence of systemic symptoms are key determinants of prognosis and the urgency of endovascular intervention.

This study has limitations, including a small sample size and the absence of long-term post-intervention evaluations. Nevertheless, the findings highlight the importance of enhancing early detection through routine radiological screening, particularly among high-risk populations such as older men with uncontrolled hypertension and nonspecific abdominal symptoms.

EVAR/TEVAR Interventions and Vascular Access

An analysis of the types of vascular access and intraoperative findings is essential for evaluating the success of endovascular approaches to aortic aneurysm and dissection. All patients in this study underwent either EVAR (Endovascular Aneurysm Repair) or TEVAR (Thoracic Endovascular Aortic Repair), with varying vascular access routes employed. Table 3 provides a summary of the access methods used and the findings observed during the intervention procedures (intraoperative/during).

Table 3. ***EVAR/TEVAR Interventions and Vascular Access***

Case	Access	Intraoperative Findings (Durante)
1	Right and left renal arteries	An abdominal aortic aneurysm extending from the infrarenal region to the common iliac arteries was identified, followed by stent endograft placement.
2	Right femoral artery	Abdominal aortic aneurysm was detected extending to the aortic bifurcation, and a stent endograft was placed.
3	Left femoral artery	Thoracic aortic dissection was identified, and a stent graft was placed.
4	Femoral artery	An abdominal aortic aneurysm measuring 5x4 cm was found, and a stent endograft was placed.
5	Right femoral artery	A fusiform-type abdominal aortic aneurysm located in the infrarenal region with thrombus was observed, and a stent endograft was placed.
6	Right femoral artery	A fusiform-type abdominal aortic aneurysm in the infrarenal region was identified, and a stent endograft was placed.
7	Right femoral artery	Abdominal aortic aneurysm with a diameter of 6 cm in the infrarenal region was identified, and a stent endograft was placed.

Table 3 demonstrates that the endovascular approach via the femoral artery was the most commonly utilized method for performing EVAR and TEVAR procedures in patients with aortic aneurysms or dissections. Six out of seven cases employed access through either the right or left femoral artery, while one case utilized bilateral access through the right and left renal arteries. The choice of access route depended on the lesion's location, vascular anatomical morphology, and technical considerations during the procedure. The successful deployment of endograft stents in all patients confirms the effectiveness of this minimally invasive approach in managing both abdominal and thoracic aortic lesions.

From a technical standpoint, femoral access is often preferred due to its proximity to the abdominal aorta and its adequate lumen diameter, which allows for the accommodation of endovascular devices. This approach has been proven to be safe and effective, as highlighted by Chaikof et al. (2018), who reported that femoral access minimizes complications compared to traditional open surgical techniques (Chaikof et al., 2018). Moreover, the successful TEVAR procedure via left femoral access in the patient with thoracic aortic dissection in this study aligns with findings from Riambau et al. (2017), which demonstrated favorable short-term outcomes and lower complication rates with endovascular treatment compared to open surgery for Stanford type B dissections (Riambau et al., 2017).

Nonetheless, the lack of long-term data and post-procedural monitoring remains a critical concern. Further evaluation is necessary to assess graft patency, the risk of endoleaks, and post-intervention mortality, ensuring the sustained efficacy of the procedure. This study suggests that the endovascular approach—particularly through femoral access—holds significant potential as a first-line therapy for aortic aneurysms, primarily when performed with proper indications and techniques.

CONCLUSION

Endovascular procedures such as EVAR and TEVAR have demonstrated high effectiveness, minimal invasiveness, and relative safety in treating abdominal and thoracic aortic aneurysms among selected patients at RSUD Provinsi NTB, with favorable short-term clinical outcomes and no significant postoperative complications reported. These findings support the growing body of evidence that endovascular repair can serve as a reliable and less invasive alternative to open surgery, especially in regional healthcare settings where access to advanced surgical facilities may be limited. From a scientific standpoint, this study underscores the vital importance of early diagnosis, precise anatomical assessment, targeted patient selection, and multidisciplinary collaboration in achieving optimal treatment outcomes. The clinical implications suggest a need to strengthen endovascular capabilities in district and provincial hospitals. Future studies should be directed toward multicenter, prospective designs with extended follow-up to assess long-term outcomes, cost-effectiveness, complication rates such as endoleaks or graft migration, and to establish evidence-based guidelines for patient selection and procedural standardization.

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