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Case report

INTERVENTION FOR ABDOMINAL AORTIC ARTERY STENOSIS WITH DISSECTED, ANEURYSMAL LESIONS

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ABSTRACT

Severe abdominal aortic stenosis with dissection and aneurysm is a complex and rare condition. Previously, traditional open abdominal aortic replacement surgery was often used to treat aorta lesions. Endovascular intervention has recently proven to be a treatment method with many advantages as a feasible and safe alternative to open surgery, providing high recanalization efficiency, with attractive long-term results, The rate of re-intervention and complications is low, and shorter hospital stay, especially for infrarenal abdominal aortic artery lesion. Many great advances in improving cardiovascular interventional devices over the past decade, endovascular intervention with aortic stent placement in patients with severe abdominal aortic stenosis with aneurysm lesions and complex dissections achieved a high success rate. We respectfully share our treatment experiences in 2 cases of severe complicated abdominal aortic stenosis with aneurysm and dissection that were successfully treated with stent placement.

I. INTRODUCTION

Abdominal aortic stenosis with dissection and aneurysm is a complex and rare condition. Previously, open abdominal aortic replacement surgery was often used to treat aorta damage [1]. Endovascular intervention has recently proven to be a treatment method with many advantages as a feasible and safe alternative to open surgery, providing high recanalization efficiency, with attractive long - term results, The rate of re - intervention and complications is low, and shorter hospital stay, especially for infrarenal abdominal aortic artery lesion [2, 3]. The advent of the aortic stent graft has proven to effectively treat aneurysms and dissections, thereby making endovascular intervention (EVAR) the "first line" in treating aneurysms and dissections of the abdominal aortic artery. However, there are still limited research data and treatment guidelines for infrarenal aortic stenosis [4]. Furthermore, not many devices are developed to intervene in aortic stenosis, especially in combination with dissections and aneurysms. We would like to introduce two cases of abdominal aortic stenosis patients with aneurysm and dissection who underwent successful endovascular intervention with Covered Stent at Hue Central Hospital.

II. CASE REPORTS

Case 1

A 56 - year - old female patient was admitted to the hospital due to intermittent claudication in both legs for several months and difficulty walking. The patient has a history of smoking, hypertension, diabetes, dyslipidemia, heart failure, and TIA. The ABI measurement shows 0.6 on the left and 0.5 on the right. The results of CT angiography showed a narrowing lesion of > 50% of the aorta just below the renal artery, extending a segment of 50 mm, quite angulated, combining widespread severe calcified atherosclerosis; in addition, right behind the stenosis, there was also an image of a 21x20mm aneurysm (Figure 1). The patient was diagnosed with severe infrarenal abdominal aortic stenosis with an aneurysm.

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After multidisciplinary consultation, carefully explain the situation to the patient and family. We performed an endovascular intervention to place a covered balloon expandable stent for narrow lesions with an aortic aneurysm below the kidney artery.

Under general anaesthesia, access to the percutaneous right radial artery was obtained with a 6F sheath and the right femoral artery with a 14F sheath. The pressure gradient across the aortic stenosis measured > 20mmHg (130/80mmHg in the right radial and 90/60mmHg in the femoral artery). It is planned to determine the aortic stenosis by angiogram using the pigtail catheter, but the right brachial artery is narrowed so it cannot be accessed. Therefore, switch to the left femoral artery, insert a Sheath 6F, and angiography confirm aortic stenosis (Figure 2A). Aortic predilection with NC Tadpole balloon 4.5 x 15 mm, 5.0 x 20 mm, and peripheral vascular balloon 6 x 40 mm. A 14 x 59mm BeGraft stent with size 14 x 59mm was deployed by Stiffwire in the aorta just below the left renal artery (due to severe aortic stenosis, we could not enter Pigtail to determine the location; we relied on the anatomical landmark right at the L3 lumbar pedicle of the first angiogram) (Figure 2B). Postoperative angiography showed that the stent was in the right position, residual stenosis < 10%, no dissection, no perforation of the blood vessels, no endoleak in the aneurysm, no thrombus in the stent, flow through the iliac arteries on both sides after placement (Figure 2C). The pressure gradient across the stenosis is 0 mmHg. Remove the device, close the blood vessel with a Perclose blood vessel closure device, and bandage the bilateral femoral artery puncture site. After the procedure, the patient received additional antiplatelet agents, including Aspirin 81mg and Clopidogrel 75mg. Symptoms of intermittent claudication decreased, blood pressure was 120/80mmHg and antihypertensive medication gradually decreased. The ABI index for the right leg is 1.05, and that for the left leg is 1.0. The patient was discharged and had regular follow - up examinations.

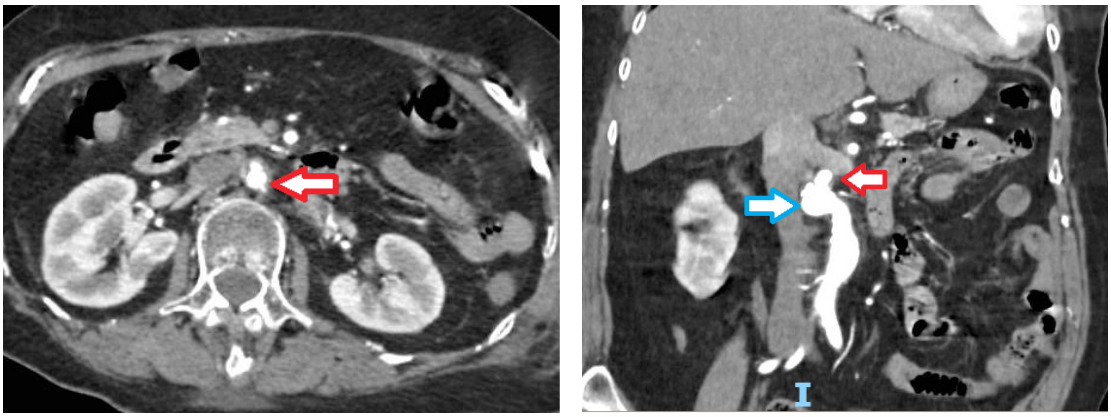

Figure 1: Location of infrarenal aortic stenosis with aneurysm

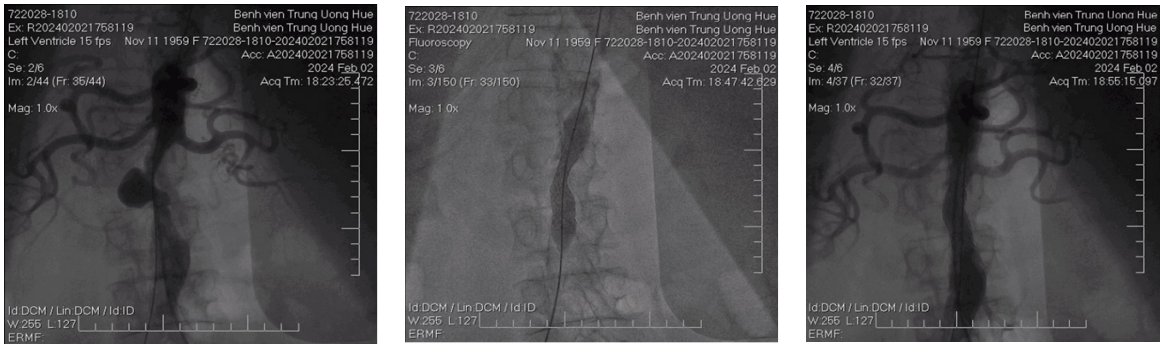

Figure 2: A: Angiography determined the aortic stenosis with aneurysm. B: Placement of Covered balloon-expanded stent below the left renal artery based on the anatomical landmark of the lumbar 3 vertebral pedicle. C: Imaging results after Cover Stent BeGraft placement

Case 2

A male patient, 62 years old, with a history of smoking and hypertension, and irregular treatment of COPD, was admitted to the hospital for bilateral leg pain for several months, which increased when walking. Recently, dry necrosis appeared on the big toe of the right foot. Measure the ABI index of the left leg to 0.6 and the right leg to 0.5. The results of the Doppler ultrasound of the iliac artery showed bilateral iliac artery stenosis. The patient was diagnosed with peripheral arterial disease and had angiography of the lower extremities. Surprisingly, the results showed stenosis with dissection of the end of the abdominal aorta and iliac arteries on both sides (Figure 3A). The patient was indicated for endovascular intervention with a balloon-expanded covered stent for these lesions. Access through bilateral femoral arteries. Passing the Pigtail for an angiogram to determine the location of aortic-iliac stenosis and dissection (Figure 3B). We put an aortic begraft of 16 x 48mm in size (Figures 3C and 4A). Followed by a 9 x 57mm Peripheral - BeGraft stent in the left iliac artery and an 8 x 57mm Peripheral - BeGraft stent in the right iliac artery. After determining the correct position, the 2 stents expand at the same time in a kissing balloon inflation (Figure 4A). After that, we continued to use these two balloons for extended kissing on the inside of the abdominal aortic stent (Figure 3B). Re-imaging to check that the stent is in the right position, no leakage, dissection, thrombus, and residual stenosis < 10% (Figure 3G and H). The patient's vessels were closed with a Perclose vascular access closure device and bilateral compression bandages of the femoral artery. The patient had reduced pain symptoms in both lower extremities and was discharged from the hospital 3 days later. Medicines included Aspirin, Clopidogrel, Statin. The patient's ability to walk improved on regular follow - up examinations, and both ABI indices were good.

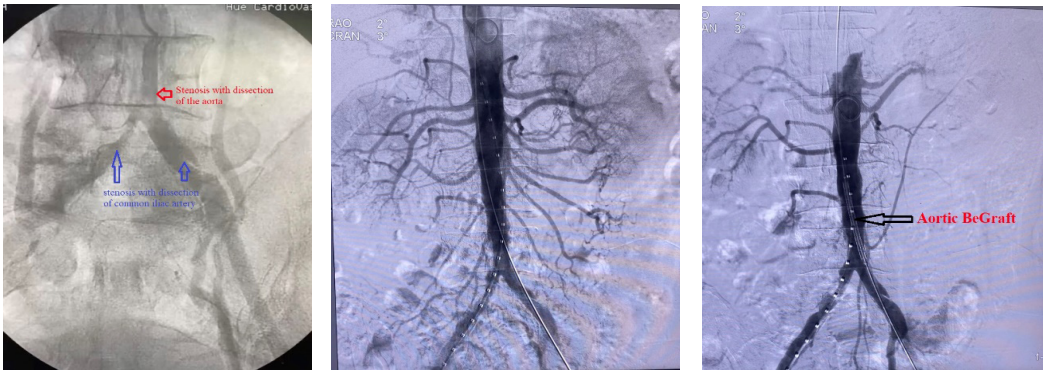

Figure 3: A, B: Angiography confirmed stenosis with aortic - iliac dissection.
C: A Covered Stent placed in Abdominal Aorta below the kidney atery

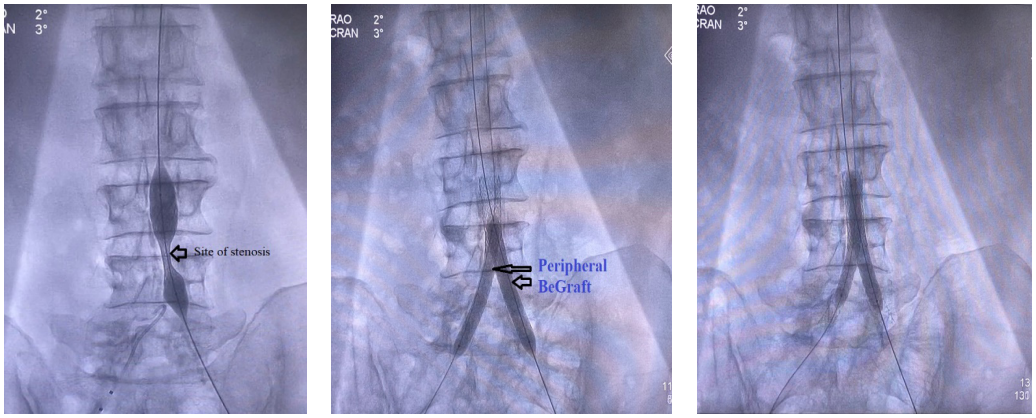

Figure 4: A: The site of stenosis is clearly visible when the balloon is inflated into the stent.
B: Put two Covered peripheral stents in Kissing Balloon inflation.
C: Expanding 2 peripheral stents within the abdominal aortic stent using a Kissing Balloon

Figure 5: Covered Stent placement was successful without residual stenosis

IV. DISCUSSION

Progressive abdominal aortic atherosclerosis causes aortic stenosis, aneurysm, or dissection lesions. Infrarenal aortic stenosis combined with aneurysm and dissection are complex and rare lesions [1]. Most of the data and evidence from studies focus on treating aortic aneurysms and dissections, while only a few report the treatment of infrarenal aortic stenosis.

The clinical manifestations of aneurysm and dissection aortic stenosis are very diverse, from mild to severe, including abdominal pain, intermittent claudication are the most common symptoms (in 81% of reported cases), followed by pain at rest (25%) and ischemic necrosis of the limbs (15%). The location of intermittent claudication is usually present in the buttocks in half of the cases and one quarter have calf pain [5].

Associated risk factors include heavy smoking (in 98% of reported cases), hypertension (58%), and hypercholesterolemia (8%) [6]. Pathogenesis is mainly due to exposure of vascular endothelial cells to these risk factors; this process often begins very young (about 20 years of age or earlier), progressing slowly over many years; thereby causing physical damage and/or cell dysfunction, progressing to atherosclerotic plaque formation and complications of atherosclerotic plaque. This atherosclerotic plaque can occupy part of the artery's lumen, causing the blood vessel's lumen to narrow, and the endothelial surface of the fibrous cap easily peels off and possibly forms a thrombus that can occlude the artery [7].

Diagnosis includes applying non-invasive, inexpensive methods for initial assessment such as measuring the ankle-brachial index (ABI) and vascular Doppler ultrasound. However, computed tomography angiography (CTA) is still the optimal means of providing detailed information about the location of the stenosis, the degree of stenosis, accompanying lesions such as aneurysm or dissection, the degree of calcification and downstream perfusion atherosclerosis. , collateral circulation... Diagnostic angiography further defines aortic stenosis when Diameter stenosis > 50% of the lumen of the reference vessel or pressure gradient > 10 mm Hg is considered significant [8].

Regarding treatment options, for aneurysms or dissection, two repair methods are currently available by open aneurysm replacement (OR) and endovascular aneurysm repair (EVAR), which recommends prioritising endovascular intervention if the anatomy is suitable [9]. For abdominal aortic stenosis, traditional open surgery with aortic endarterectomy or bypass has historically been the most common treatment for these lesions. However, open surgery is associated with mortality and complication rates as high as 3% and 5 - 10%,

respectively [1]. With more recent attention to the endovascular intervention approach with or without stent placement as a viable and safe alternative to open surgery that offers high technical success with attractive long-term results, reintervention and complication rates are low and hospital stays are shorter [2, 3]. Therefore, these groups of diseases can all be treated through endovascular intervention, however the characteristics of the stents used for each stenosis, aneurysm and dissection lesion are different. The choice of interventional equipment with the appropriate characteristics is extremely important in patients with this combination of these lesions.

Balloon angioplasty alone is rarely used as a final modality given the superior results with stents. There is less embolization, less risk of rupture, reduced overall complication, and higher long - term patency when stenting. Endovascular treatment with bare metal stents for infrarenal aorta disease has been reported to be apparently as successful as open surgery, with a primary patency in the range of 80%-100% at 3-10 years [10]. However, Kim et al. reported that the rate of vascular complications after bare metal stent treatment was 14.3% and may be related to vessel wall rupture, dissection, and distal embolisation [11]. The use of a polytetrafluoroethylene-covered stent is expected to reduce these risks, especially in severely calcified aortic lesions [1]. In 2020, the Society for Cardiovascular Angiography and Interventions-SCAI issued recommendations for the selection of interventional devices for aortic iliac injuries. It can be seen that Covered Stent is a strong choice in most pelvic floor disorde, including infrarenal aortic lesions [12].

	PTA	Specialty balloons	DCB	BMS (Self-expanding)	BMS (Balloon expandable)	Covered stents (Self-expanding)	Covered stents (Balloon expandable)	DES	Atherectomy
Aorto-iliac bifurcation	IIb [weak] B-R	III (no benefit] C-EO	III (no benefit] C-EO	IIa (moderate] B-R	I (strong] B-R	IIb (weak] C-LD	I (strong] B-R	III (no benefit] C-EO	**III (harm) C-EO**
Focal CIA lesion	IIa (moderate] B-R	III (no benefit] C-EO	III (no benefit] C-EO	IIa (moderate] B-R	I (strong] B-R	IIb (weak] C-LD	I (strong] B-R	III (no benefit] C-EO	**III (harm) C-EO**
Diffuse CIA lesion	IIb (weak] B-NR	III (no benefit] C-EO	III (no benefit] C-EO	I (strong] B-NR	I (strong] B-NR	IIb (weak] C-LD	1 (strong] B-NR	III (no benefit] C-EO	**III (harm) C-EO**
Focal EIA lesion	IIa (moderate] B-R	III (no benefit] C-EO	III (no benefit] C-EO	I (strong] B-R	IIa (moderate] B-R	IIb (weak] C-LD	IIa (moderate] B-NR	III (no benefit] C-EO	**III (harm) C-EO**
Diffuse EIA lesion	IIb (weak] B-NR	III (no benefit] C-EO	III (no benefit] C-EO	I (strong] B-NR	IIa (moderate] B-NR	IIa (moderate] C-LD	IIa (moderate] C-LD	III (no benefit] C-EO	**III (harm) C-EO**
Moderate to severe calcified, focal lesion	IIb (weak] B-NR	III (no benefit] C-LD	III (no benefit] C-EO	IIa (moderate] C-LD	IIa (moderate] C-LD	IIa (moderate] C-LD	I (strong] B-R	III (no benefit] C-EO	III (no benefit) C-EO
Moderate toseverecalcified,diffuselesion	IIb (weak] B-NR	III (no benefit] C-LD	III (no benefit] C-EO	IIa (moderate] B-NR	IIa (moderate] B-NR	IIa (moderate] C-LD	I (strong] C-LD	III (no benefit] C-EO	III (no benefit) C-EO
Chronic total occlusion, focal lesion	IIb (weak] C-LD	III (no benefit] C-EO	III (no benefit] C-EO	IIa (moderate] B-R	IIa (moderate] B-R	IIa (moderate] C-LD	IIa (moderate] B-R	III (no benefit] C-EO	**III (harm) C-EO**
Chronic total occlusion, diffuse lesion	IIb (weak] C-LD	III (no benefit] C-EO	III (no benefit] C-EO	IIa (moderate] B-R	IIa (moderate] B-NR	IIa (moderate] C-EO	IIa (moderate] B-R	III (no benefit] C-EO	**III (harm) C-EO**
ISR, focal lesion	IIa (moderate] C-LD	III (no benefit] C-EO	IIb (weak] C-EO	IIb (weak] C-LD	IIb (weak] C-LD	IIa (moderate] C-LD	IIa (moderate] C-LD	III (no benefit] C-EO	III (no benefit) C-EO
ISR, diffuse lesion	IIa (moderate] C-LD	III (no benefit] C-EO	IIb (weak] C-EO	IIb (weak] C-LD	IIb (weak] C-LD	IIa (moderate] C-LD	IIa (moderate] C-LD	III (no benefit] C-EO	III (no benefit) C-EO

Figure 6: BỔ SUNG CHÚ THÍCH……..
Abdominal aortic artery stenosis and indications for intervention.

Aortoiliac lesions treated with a covered stent required fewer re-interventions than those treated with a bare metal stent (BMS) (pooled odds ratio or OR: 0.19; 95% CI: 0.09 to 0.42,p<0.001). The primary patency rates for aortoiliac disease covered in this analysis and the BMS groups were 85.9% and 80.4%, respectively. The primary patency rate of the Covered stent achieved in the study by Wiesinger

et al. was even higher (92.0% after 6 months and 89.8% after 12 months)] [8].

Therefore, although the success of treatment depends on the lesion, location, and size of the aorta, a balloon expandable covered stent has the advantage of increased radial strength and the ability to minimise embolism, restenosis, and abdominal aortic wall rupture. The use of Covered Stent with polytetrafluoroethylene is expected to reduce these risks, especially in severely calcified aortic lesions. Furthermore, the polytetrafluoroethylene layer also helps treat accompanying aneurysms or dissection lesions simultaneously [1, 13]. This same aortic StentGraft with polytetrafluoroethylene coating has proven to be effective in treatment and has become the "first line" in the treatment of aneurysms and dissections] [9]. Thus, cases of stenosis with aortic dissection can be treated reasonably and safely with Covered stents [13]. Technical success was defined as residual stenosis of less than 30% or a resting trans-systolic pressure gradient of less than 10 mm Hg after stent placement. Clinical patency was defined as the absence or improvement of symptoms after the placement of the stent. Hemodynamic patency was defined as a normal triphasic Doppler waveform in the common femoral artery, an ankle-brachial index greater than 0.90, or the absence of a thigh-brachial pressure gradient at rest in either limb [14].

In the first patient, there were symptoms of intermittent claudication, A CT scan of the aorta showed a narrowing lesion of > 50% just below the renal artery, extending a segment of 50 mm, with very angulation, accompanied by widespread severe calcified atherosclerosis, in addition, right behind the stenosis, there was also an image of a 21 x 20mm aneurysm. Pressure measurements before and after stenosis differ by > 20mmHg (130/80mmHg and 90/60mmHg). Patients with multiple comorbidities including diabetes, atrial fibrillation, heart failure, and TIA should be referred for endovascular intervention after multidisciplinary consultation, considering and incorporating patient and family perspectives. In this case, choosing a balloon-expanded covered stent is considered optimal to help resolve the stenosis (placed exactly behind the renal artery, covering the aneurysm and avoiding the risk of aortic rupture due to heavy calcification). We chose BeGraft Stent 14 x 49mm over Sheath 14F. However, getting the stent through the narrowed position is still difficult. We use coronary artery NC balloons with dimensions of 4.5 x 15 mm; 4.5 x 20 mm; and peripheral artery balloons with size of 5.0 x 20mm. Finally, the stent was successfully pushed through the lesion. However, the right brachial artery was chronically occluded, and moreover, it was not possible to insert the Pigtail via the right femoral artery through the stenosis to re-angiogram the aorta before developing the stent. We rely on the anatomical landmark of the left renal artery just above the 3rd lumbar vertebral pedicle and the image of aortic calcification to accurately estimate the position below the left renal artery (located lower than the right renal artery). After releasing the stent, we took the Pigtail for a repeat aortogram and showed that the stent was in the right position, it did not cover the left renal artery, the aneurysm disappeared, the aorta had good flow and high speed, residual stenosis was < 10%, measured gradient pressure before and after the stenosis reduced to 0 mmHg.

The second patient was admitted to the hospital due to dry gangrene on the big toe of the right foot. An aortogram showed stenosis with dissection at the end of the aorta - iliac bifurcation. In this case, the use of Covered Stent not only helps place it accurately in the appropriate position, but also dilates the balloon to help treat the narrow position. The graft will reduce the risk of aortic rupture and address the dissection site by covering its entrance hole. We used an aortic Aortic - BeGraft size of 16 x 48mm and a peripheral - BeGraft stent size of 9 x 57mm in the left iliac artery and the other peripheral - BeGraft Stent size of 8 x 57mm in the right iliac artery. After that with the final angiogram, the stent was in the right position, there was no residual stenosis, it covered the dissection lesion and the pressure measured before and after the stenosis was 0 mmHg.

IV. CONCLUSIONS

Endovascular intervention with a stent is a safe, effective and low-complication method for treating complex infrarenal aortic stenosis with aneurysm and dissection.

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