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CASE REPORT

Acute Type B Aortic Dissection One Month After Fenestrated EVAR Procedure

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Introduction: Acute aortic dissection after endovascular repair of an aortic aneurysm is a rare but serious condition, with potential complications that can result in the death of the patient.

Report: This is the case of a patient diagnosed with a type IV thoraco-abdominal aneurysm with involvement of both iliac arteries who underwent endovascular repair with a four fenestration device and a left iliac branch. One month after the procedure, the patient presented with a type B acute aortic dissection that extended from the left subclavian artery to the proximal stent of the fenestrated graft. This dissection was treated by thoracic endovascular aortic repair, and after a problematic post-operative period, the patient was discharged after 30 days.

Discussion: Occurrence of an acute aortic dissection after endovascular repair of an aortic aneurysm has rarely been reported in the literature. Development of these dissections has been related to factors such as excessive oversizing, use of devices with active fixation systems, or injuries during the procedure, although it is believed that the late onset would indicate that it was a de novo dissection. The presence of an aortic dissection can lead to the collapse and occlusion of the previous endograft and even to aortic rupture, and mortality in reported cases reaches 30%. The authors suggest that endovascular treatment should be considered in these patients.

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INTRODUCTION

Endovascular repair of thoracic and abdominal aortic aneurysms is now well established as the first choice procedure in many patients, and the European Society for Vascular Surgery (ESVS) guidelines published in 2019 recommend endovascular treatment as the first option in most patients with suitable anatomy and reasonable life expectancy.[1] Although short term morbidity and mortality are low, these procedures are not exempt from complications such as altered renal function, endoleaks, migration of the devices, and even rupture of the aneurysm sac. Development of an aortic dissection in a patient who previously underwent an endovascular abdominal aortic aneurysm (AAA) repair is a rare complication, with few reports in the literature, but it can have serious consequences or even result in the death of the patient. Currently, it is not clearly established which is the best treatment in these cases.

CASE REPORT

A 74 year old male patient, with history of arterial hypertension, tobacco use, bradycardia, chronic obstructive pulmonary disease, and prostate neoplasm treated by radiotherapy and hormone therapy, was diagnosed with type IV thoraco-abdominal aortic aneurysm (TAA). The TAA had a maximum diameter of 37 mm in the descending thoracic aorta and 73 mm at the level of visceral trunks, with involvement of both iliac arteries, reaching 30 mm in the left common iliac artery (Fig. 1).

A fenestrated endovascular aneurysm repair (FEVAR) procedure was performed with a custom made four fenestration endograft (Zenith Fenestrated, Cook Medical, Bloomington, IN, USA), with coated balloon expandable stents (BeGraft, Bentley Innomed, Hechingen, Germany) as bridging stents. An iliac branch endograft (Zenith Iliac Branch, Cook Medical, Bloomington, IN, USA) was also implanted in the left iliac axis (Fig. 2A). This procedure was complicated because all the visceral branches originated from the aneurysm sac and had severe angulations, making cannulation difficult. In the computed tomography (CT) scan done before discharge, correct placement of all the

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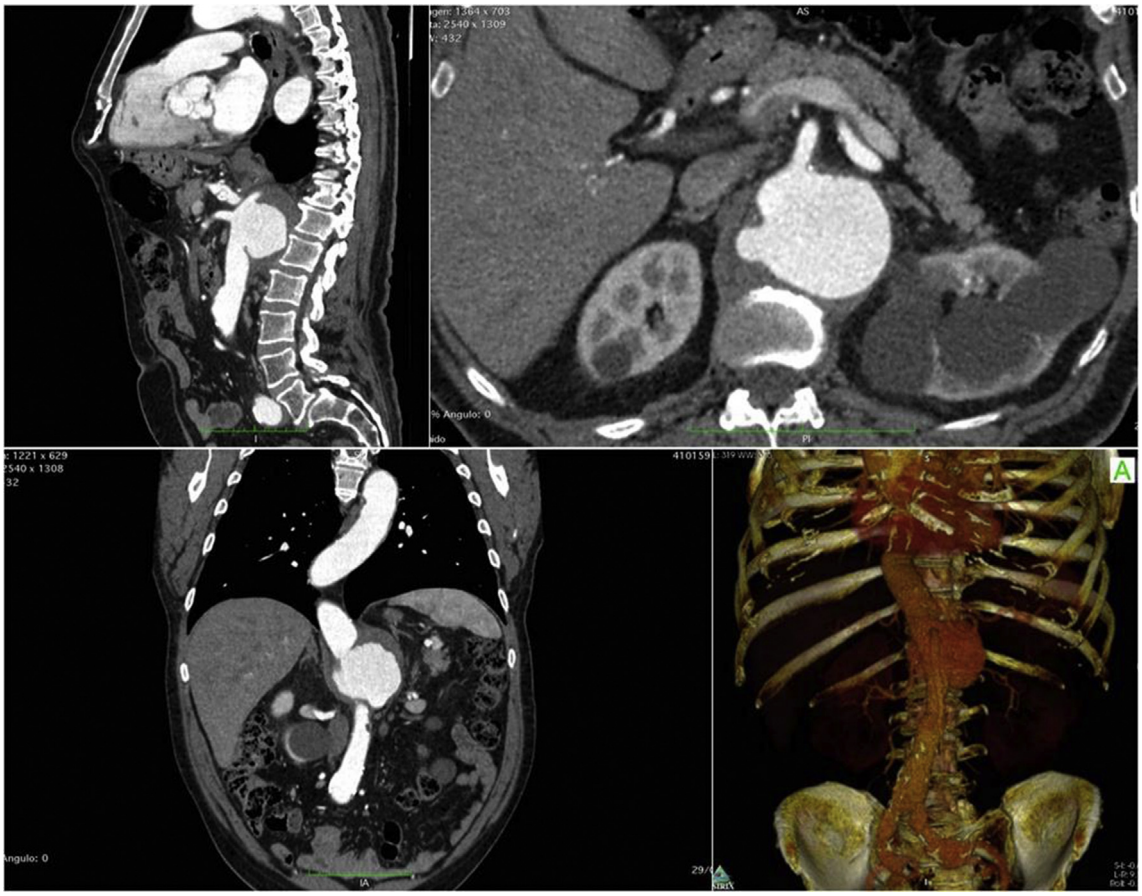

Figure 1. Pre-operative computed tomography scan showing type IV thoraco-abdominal aneurysm with dilatation of both iliac axis.

components and patency of all visceral branches was observed (Fig. 2B and C). A small endoleak was noted at the level of the superior mesenteric artery (SMA) stent. It was decided to treat this conservatively, and the patient left the hospital eight days after the procedure.

In the one month follow up CT scan, the correct positioning of the endoprostheses was verified, with patency of all of the visceral branches (Fig. 3). The SMA endoleak had disappeared and a small type II endoleak was observed at the beginning of the left iliac axis.

Twenty-four hours after acquisition of this CT scan, the patient was transferred from another hospital where he presented with oppressive central thoracic pain radiating to the back, with high blood pressure and poor general condition; about a week before, the patient had abandoned antihypertensive treatment on the recommendation of a nephrologist. An emergency CT scan revealed a type B aortic dissection with a main entry tear in the concavity of the aortic arch after the origin of the left subclavian artery, which was nearly 14 mm in size. The dissection extended to the proximal stent of the fenestrated endograft, without perfusion of the sac (Fig. 4), with a maximum diameter of the affected aorta of 44 mm and a maximum diameter of the false lumen of 17 mm, almost completely collapsing the true lumen near the thoraco-abdominal transition. Strictly speaking, it was not a complicated acute aortic dissection, but there were concerns that dissection could lead to dislodgement of the FEVAR, collapse of the graft, or the appearance of endoleaks. For this reason, despite the patient having undergone a complex procedure one month previously and the higher risk of potential complications from performing a thoracic endovascular aortic repair (TEVAR) in the acute phase of the dissection, the decision was made to treat the dissection performing a TEVAR with two thoracic endovascular grafts (Zenith Alpha, Cook Medical, Bloomington, IN, USA). These were placed just distal to the left subclavian artery origin, which remained patent, to close to 20 mm above the coeliac trunk stent, obtaining complete sealing of the dissection and with no evidence of endoleaks on the final angiogram (Fig. 5A) or on the CT scan (Fig. 5B and C). The post-operative period was complicated by respiratory infection, persistent fever, and pleural effusion, but the patient left the hospital one month after the procedure requiring only adequate family support at home.

In the follow up CT studies, the images corresponded to type II endoleaks, and growth of the contrasted area surrounding the endoprostheses, which could correspond with patent false lumen. The decision was taken to be conservative, and in the latest CT scan performed two years after treatment of the dissection, all TEVAR, FEVAR, and iliac branch devices were patent, as well as all the visceral vessels. No endoleaks were noted, and complete remodelling of the false lumen had been achieved (Fig. 6). During follow up the patient has remained

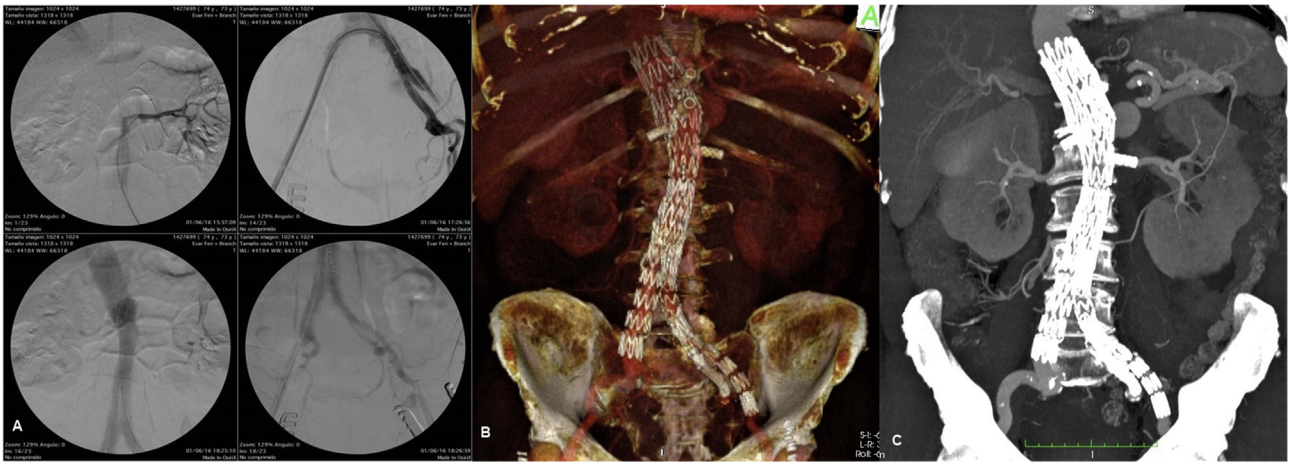

Figure 2. Intraprocedural angiogram showing fenestrated endovascular aneurysm repair with four fenestrations + left iliac branch (A). 3D reconstruction (B) and maximum intensity projection (MIP) (C) of the 24 hour post-operative computed tomography scan showing correct placement of all the components and patency of all visceral branches.

completely asymptomatic and the maximum diameter of the aneurysm has decreased to 68 mm.

DISCUSSION

There are several cases reported in the literature of aortic dissection in patients previously treated by endovascular aneurysm repair (EVAR) (Table 1). The dissections have appeared after the use of different types of endografts, and the time has varied from 48 hours to more than two years. Complications after development of the aortic dissection have included sac growth, collapse and occlusion of the previous EVAR, and even aortic rupture and death.

The aetiology of these aortic dissections is not known with certainty, but several factors have been related to development of a post-EVAR type B aortic dissection, including anatomical factors such as angulation,[2] mild calcification of the aorta just above the renal arteries,[3] and

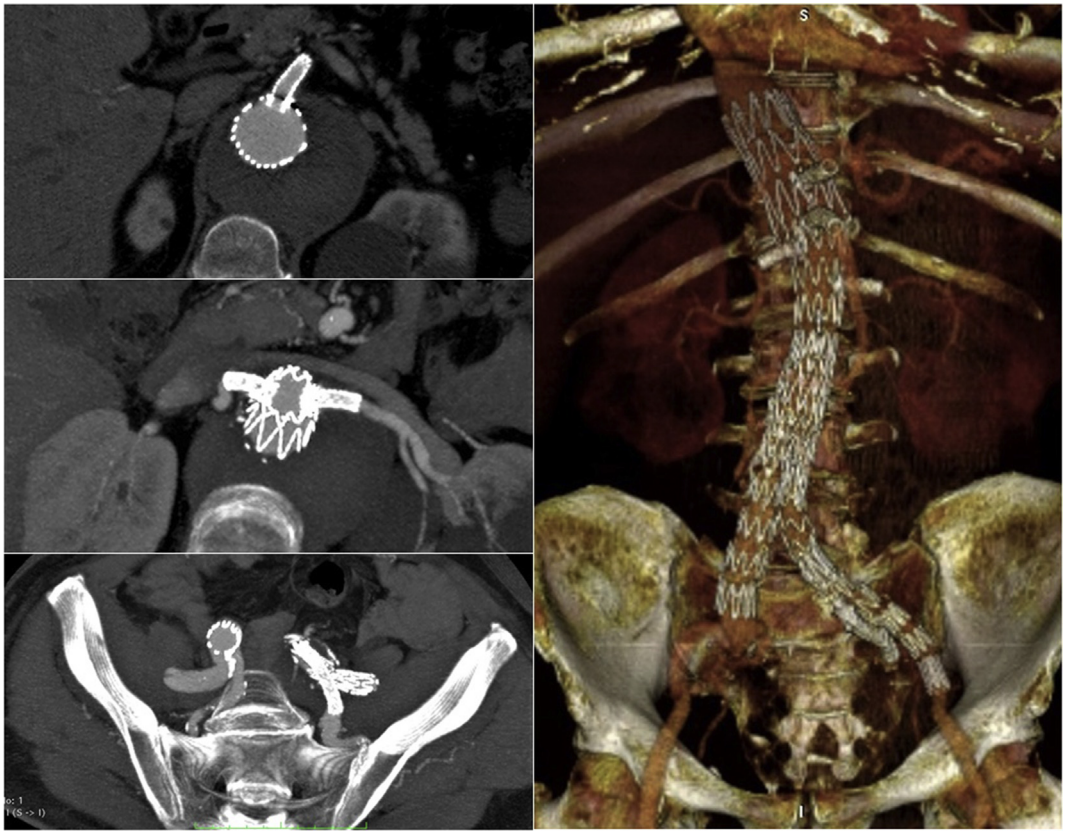

Figure 3. Computed tomography scan 30 days after the initial procedure showing patency of all visceral branches and iliac branch device without endoleaks.

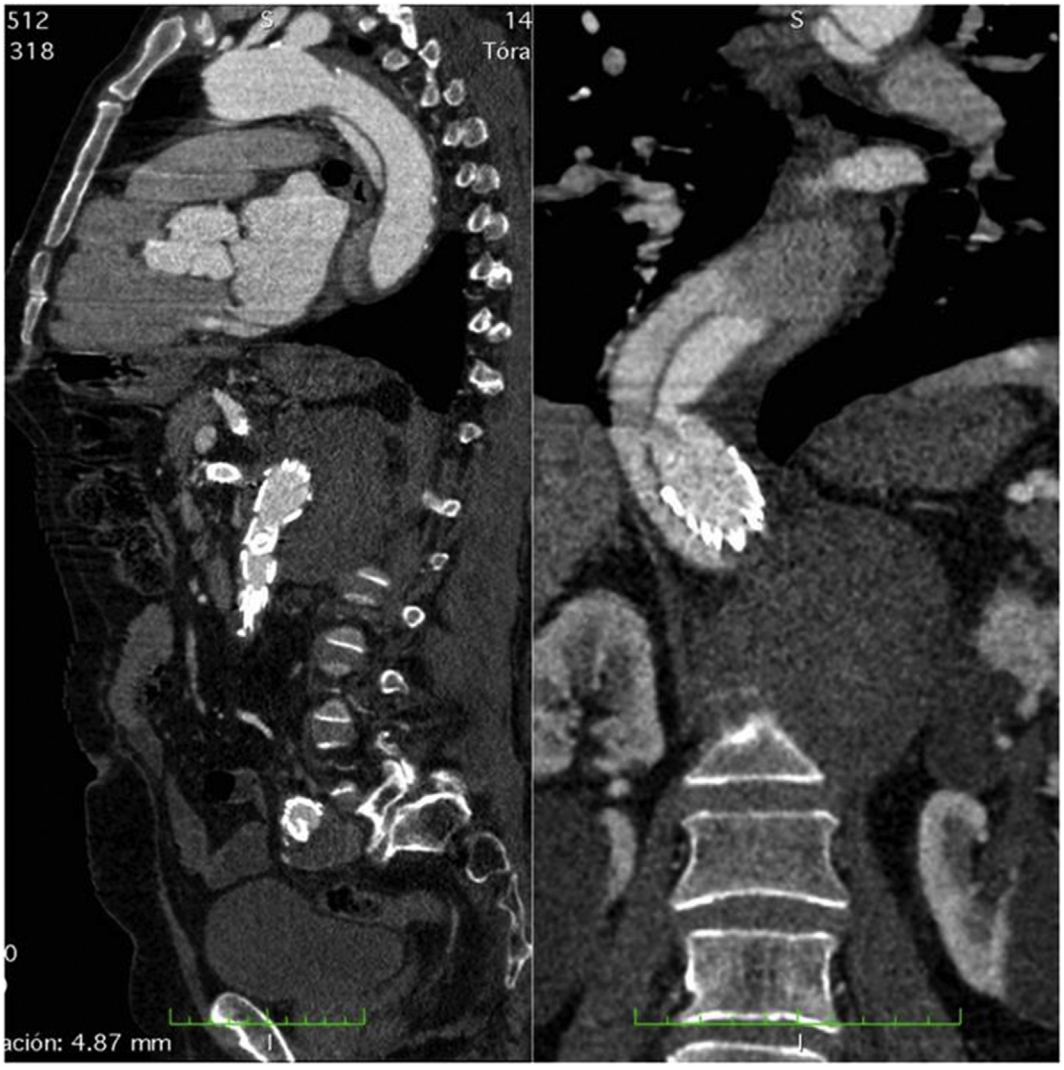

Figure 4. Computed tomography scan showing type B aortic dissection beginning just after the origin of the left subclavian artery and extending to the proximal stent of the fenestrated endograft.

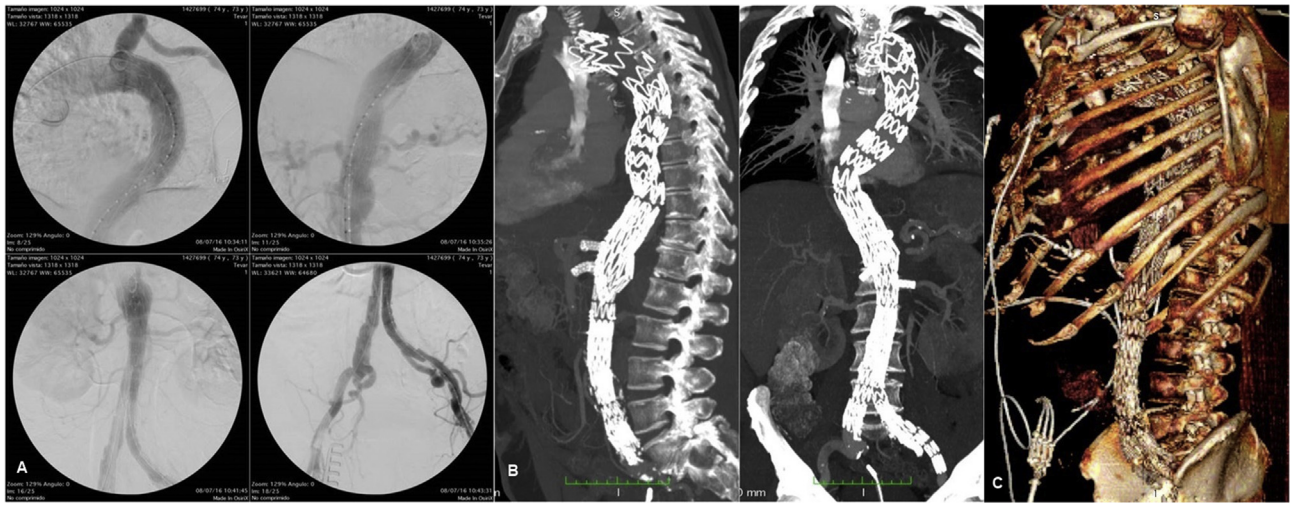

Figure 5. Intraprocedural angiogram during thoracic endovascular aortic repair (A) and MIP (B), and 3D reconstruction (C) computed tomography scan after the procedure.

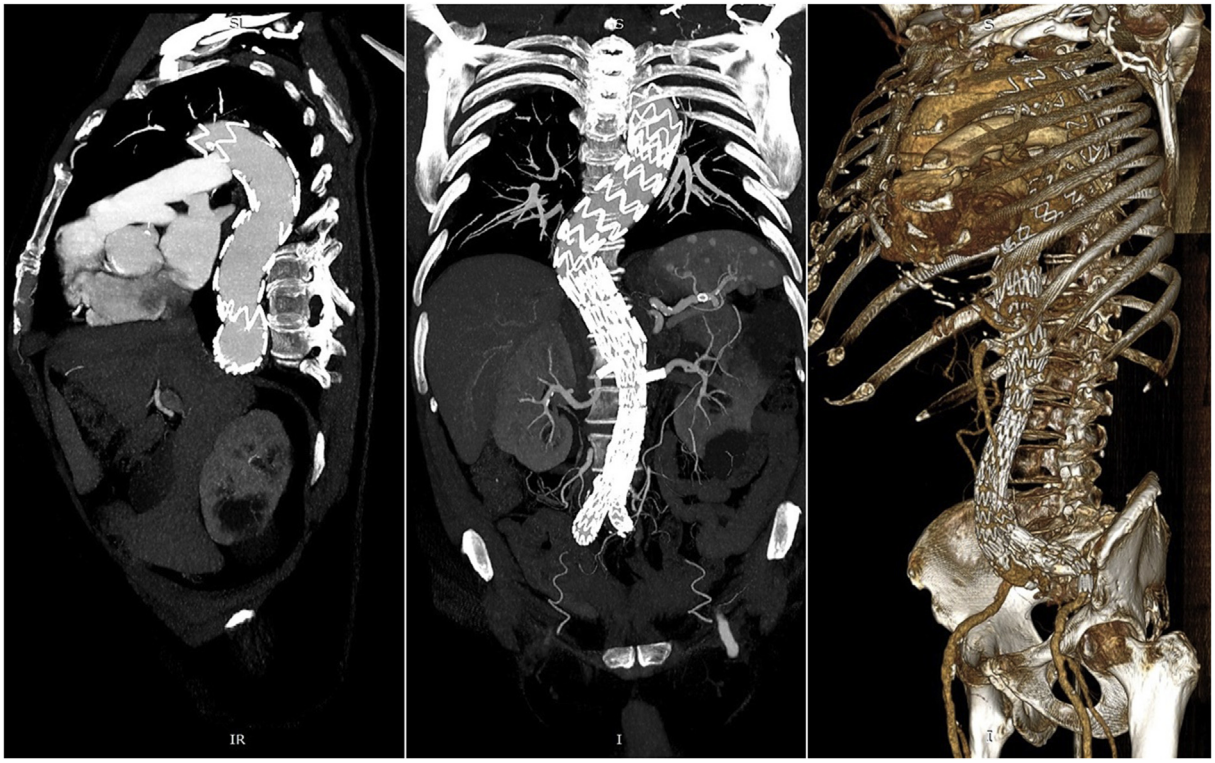

Figure 6. Computed tomography scan two years after thoracic endovascular aortic repair (TEVAR). All TEVAR, fenestrated endovascular aneurysm repair, iliac branch device, and visceral vessels are patent. No endoleaks were noted, and there was complete remodelling of false lumen.

a fragile aortic wall.[3] Technical aspects such as excessive oversizing or wire manipulation which can cause direct injury of the aortic wall,[2,3] have also been advocated. Finally, device specific factors, such as anchor barbs in the bare metal stent[2,4] have been used to explain the appearance of this complication. On the other hand, the late appearance of the dissection would be more related to a spontaneous aortic dissection.[3,5,6] An increased diameter of the thoracic aorta could also be related to the appearance of a type B aortic dissection.[7]

Table 1. Cases of aortic dissection in patients previously treated with EVAR.

Author and date	Device	Time after EVAR	Complication	Treatment	Result
Haulon (2003)[10]	Excluder (Gore)	20 weeks	Collapse and occlusion	No	Death
Iyer (2009)[3]	Zenith Flex (Cook)	11 weeks	Collapse and occlusion	TEVAR + remodelling	Asymptomatic
Tolenaar (2011)[11]	Endurant (Medtronic)	48 hours	Uncontrollable pain	Fenestration	Asymptomatic
Pulli (2011)[5]	Zenith Flex + Iliac Branch (Cook)	108 weeks	Sac expansion	TEVAR	Asymptomatic
Khanbhai (2013)[2]	Zenith (Cook)	6 weeks	Compression	Medical	Asymptomatic
	Endurant (Medtronic)	24 hours	No	Medical	Asymptomatic
	Talent (Medtronic)	3 weeks	No	Medical	Asymptomatic
Mamopoulos (2013)[4]	Endurant (Medtronic)	48 hours	Dilation	Medical	Asymptomatic
Yamamoto (2013)[12]	Zenith (Cook)	72 weeks	Aneurysm rupture	No	Death
Psacharopoulo (2014)[8]	Excluder (Gore)	58 weeks	Collapse and occlusion	Surgical	Death
Sirignano (2015)[9]	Endurant II (Medtronic)	4 weeks	Dilation	TEVAR	Asymptomatic
	Excluder C3 (Gore)	24 weeks	No	Medical	Asymptomatic
Daniel (2016)[6]	Endurant (Medtronic)	52 weeks	Aneurysm rupture	Surgical	Death

EVAR = endovascular aneurysm repair; TEVAR = thoracic endovascular aortic repair.
Modified from Sirignano P, Pranteda C, Capoccia L, Menna D, Mansour W, Speziale F. Retrograde type B aortic dissection as a complication of standard endovascular aortic repair. *Ann Vasc Surg* 2015;**29**(1):127.e5-9. https://doi.org/10.1016/j.avsg.2014.08.011.

The ESVS recommends endovascular repair of complicated type B aortic dissections, and even recommends considering this treatment in some uncomplicated dissections to prevent the appearance of future complications.[7]

An acute type B aortic dissection in the presence of a previous EVAR can lead to endograft collapse,[8] and complications such as visceral and spinal ischaemia, aortic dilatation, and sac rupture have been reported.[9] The presence of the endograft can prevent the re-entry of the dissection, causing a rapid increase of the pressure in the false lumen that leads to rapid dilatation and rupture of the aorta.[10]

In some cases, the appearance of an acute type B aortic dissection causes only mild symptoms and the treatment could be conservative,[2] but aggressive treatment of hypertension and close follow up with CT scans is recommended. In other cases, complications can be life threatening and require more aggressive treatments such as fenestration, open surgical repair, or TEVAR. In any case, it is a serious complication that leads to the death of the patient in up to a third of cases.

CONCLUSION

The onset of an acute type B aortic dissection in a patient previously treated by EVAR is a serious and potentially life threatening situation that could be related to anatomical, technical, and device factors, but spontaneous dissections can also occur in these patients. In the case presented here, the appearance of the dissection 30 days after the initial procedure, and about a week after the patient stopped antihypertensive treatment, makes it likely that it was a spontaneous aortic dissection.

Because the complications related to the fenestrated stent could cause visceral ischaemia, type I endoleak, or growth and rupture of the aneurysmal sac, the present authors believe that the decision to treat this patient by TEVAR was correct, but both options, aggressive and conservative treatment should be considered in such cases.

CONFLICT OF INTEREST

None.

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