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Amplatzer Vascular Plug for Complicated Residual DeBakey Type I Aortic Dissection in the Aortic Arch

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Abstract

Surgical treatment of acute DeBakey type I aortic dissection does not address the entire aorta, which can leave anatomically complex residual aortic dissection in the aortic arch and descending aorta. Open repair has been the standard treatment for this pathology. When the lesions are located in the aortic arch, re-do total arch replacement needs to be performed. Plug placement to close small entry tears in the aortic arch has been reported. This article reports about a 79-year-old man who underwent hemiarch replacement for acute DeBakey type I aortic dissection. One year later, his proximal descending aorta dilated to 6.3 cm. The patient was treated with Amplatzer plug in the false lumen, and a stent graft was placed in the true lumen. Follow-up computed tomography scan confirmed complete thrombosis of the false lumen in the descending aorta which had decreased from 6.3 to 4.0 cm. Plug placement in the false lumen in the aortic arch is a potential treatment strategy for anatomically complex residual aortic dissection to induce thrombosis of the false lumen and encourage remodeling.

Keywords

plug placement, residual aortic dissection

Introduction

Surgical treatment of DeBakey type I acute aortic dissection does not address the entire aorta, which can leave complex residual aortic dissection. The false lumen that remains after treatment can be pressurized and result in aneurysm and rupture. The goal of surgery is to induce thrombosis of the false lumen by closing the proximal tears and encourage remodeling of the false lumen. Open repair is the standard treatment. We report a case of residual DeBakey type I aortic dissection in the aortic arch treated with plug placement and thoracic endovascular repair (TEVAR) in a patient who could not otherwise undergo open surgery due to advanced age.

Case Report

A 79-year-old man with a history of hypertension and atrial fibrillation underwent hemiarch replacement for acute DeBakey type I aortic dissection. One year later, the patient developed chest pain with increasing size of the proximal descending aorta measuring 6.3 cm with pressurized false lumen (Fig. 1a–b). The celiac artery was perfused from both the true and false lumen. The superior mesenteric artery and the renal arteries were perfused by the true lumen. The inferior mesenteric artery was perfused by the false lumen with dissection into the left iliac artery. Since the open arch repair was not an option due to advanced age, the patient underwent endovascular repair. Bilateral femoral access was obtained. The true lumen was accessed from the right femoral artery and the false lumen from the left femoral artery. An angiogram from the true lumen showed a small entry tear in the aortic arch (Fig. 1c). The angiogram from the false lumen revealed a narrow entry tear and the flow going into a pocket extending along the aortic arch distally (Fig. 1d, Supplemental Video). Three 16 mm × 12 mm × 8 mm Amplatzer Vascular Plug II (AVP II; Abbott, Minnesota, USA) were deployed to close this entry and block the proximal flow into the false lumen. A 40 mm × 15 cm Conformable Gore TAG Thoracic Endoprosthesis (WL Gore & Associates, Arizona, USA) was

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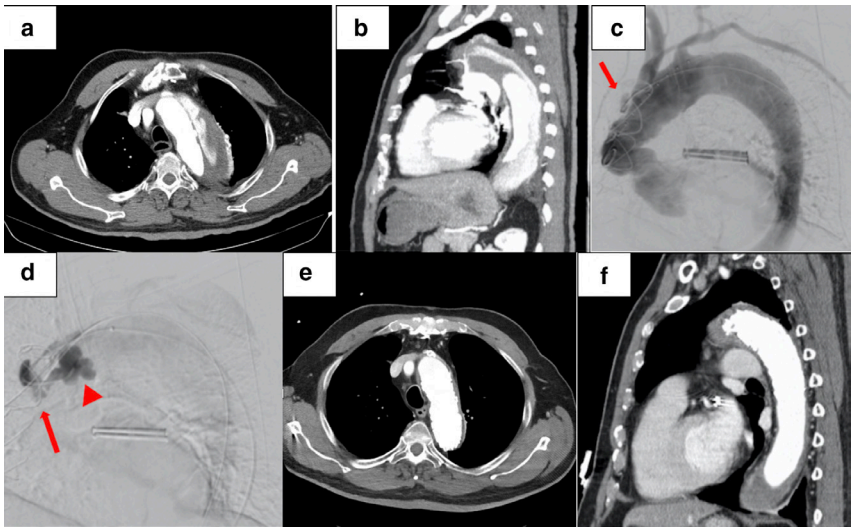

Fig. 1. Preoperative and postoperative computed tomography (CT) and intraoperative angiography. (a–b) Preoperative CT shows a dissected aneurysmal descending aorta. There is a contrast in the false lumen of the aortic arch and the descending aorta. (c) Intraoperative angiography shows angiogram of the true lumen. A small entry tear is seen in the aortic arch (red arrow). (d) Angiogram from the false lumen revealed a narrow entry tear in the aortic arch (red arrow) and the flow going into a pocket extending along the aortic arch (red triangle). The blood was also flowing through this entry tear to the aneurysmal false lumen in the descending aorta. The neck of the pocket was plugged with Amplatzer vascular plug II. (e–f) CT at 2-year follow-up showed completely thrombosed false lumen of the descending aorta.

additionally placed in the aorta distal to the left subclavian orifice for support of the true lumen. Angiogram confirmed that there was no flow into the false lumen. No stroke, spinal cord ischemia, or other complications occurred. The patient was discharged on postoperative day 7. At 2-year follow-up, a computed tomography (CT) scan showed a significant decrease of the proximal descending aorta to a size of 4.0 cm (Fig. 1e–f). No dilation of the abdominal aorta was found.

Discussion

Residual aortic dissection after the treatment of DeBakey type I acute aortic dissection may lead to aneurysm and rupture. It has been reported that this is the most significant cause of death associated with aortic dissection.[1]

Exclusion of the false lumen and obstructing or resecting the primary tear site is the goal of dissection surgery. If the false

Table 1. Literature Review of Amplatzer Plug for Residual Dissection After DeBakey Type I Aortic Dissection.

	Authors	Age	Type of type A repair	Time after type A repair	Residual entry tear location	Device	Second intervention	Size (cm)	FL in descending aorta	Follow-up	Complications
1	Kim et al.[4]	67	Hemiarch replacement	3 years	Near the innominate artery	AVP, coil	None	N/A	Complete thrombosis	2 days	None
2	Falkenberg et al.[5]	57	Ascending replacement	3 years	Proximal arch, LSA	AVP, stent in LSA	AVP, 5 months after	7.0→6.1	Complete thrombosis	20 months	None
3	Falkenberg et al.[5]	53	Ascending replacement	2 years	Proximal arch, LSA	AVP, stent in LSA	Coil in FL of LSA, at 3 months	5.3→4.5	Complete thrombosis	13 months	None
4	Falkenberg et al.[5]	57	Ascending replacement	3 years	Proximal arch	AVP	AVP, at 4 months	6.6→6.8	Persistent flow	5 months	Open repair
5	Kanaoka et al.[6]	52	Ascending replacement	3 years	Descending aorta	AVP	None	6.7→N/A	Complete thrombosis	12 months	None
6	Zink et al.[7]	44	N/A	5 years	Distal aortic arch	AVP, coil	None	6.5→N/A	Complete thrombosis	4 days	None
7	Hata et al.[8]	75	Ascending replacement	1 month	Distal aortic arch	AVP	None	5.2→3.8	Partial thrombosis	1 month	None
8	Our case	79	Hemiarch replacement	1 year	Near the innominate artery	AVP	None	6.3→4.0	Complete thrombosis	24 months	None

Abbreviations: AVP; Amplatzer vascular plug; FL, false lumen; LSA, left subclavian artery; N/A, not available .

lumen of the aortic arch remains pressurized, open repair is necessary. In-hospital mortality of redo aortic arch surgery ranges 5% to 11.7%, and the incidence of permanent stroke is from 3.6% to 7%.[2,3] Favorable outcomes of open repair have been reported. Patients who have a prohibitive risk for open surgery need an endovascular option; however, aortic arch involvement is challenging for TEVAR as it requires arch vessel debranching or the chimney technique.

Plug placement with Amplatzer plug could be an option to avoid open surgery. Possible candidates for entry tear closure with Amplatzer plug placement are patients with small entry tears. It is essential to detect all entries in the lesions and be able to close all of them.

In order to evaluate its efficacy and safety, an electronic search of the National Library of Medicine PubMed database was performed. The search term "Amplatzer plug and residual aortic dissection" was applied to all English literature. Only 3 articles were found. We added additional relevant articles from reference sections in those articles. Finally, a total of 5 articles including 7 patients were found (Table 1).[4–8]

In all of the 8 cases, including our case, ascending aorta replacement or hemiarch replacement was previously performed for type A aortic dissection, and later the proximal descending aorta dilated with the residual tears in the aortic arch or the proximal descending aorta. The median age was 57 (range: 44 to 79). In all cases, Amplatzer plug was used to close the entry tear, and, in some cases, coil and stent were additionally used. All cases, except one, achieved successful thrombosis of the false lumen and decreased the size of the aorta. One case eventually required a total arch replacement at 5 months due to persistent flow into the false lumen.[5]

In our case, the location of the primary entry tear was in the proximal aortic arch. Open repair for this pathology requires an aortic arch replacement; however, considering the patient's age of 79, we thought endovascular repair was safer than open repair. Among the reported cases, the longest follow-up is 24 months from our case without aortic related complications; however, most reports are limited to a short-term follow-up.

We need a long-term follow-up of these patients to evaluate effectiveness. Additionally, failure to thrombose the false lumen with endovascular techniques does not limit future open repair options if that becomes necessary in the future. In order to avoid future open surgery, clarification of which cases are appropriate for endovascular repair will greatly enhance the treatment of patients with this disease. Further study is necessary.

Conclusions

A plug placement can be an option for complex residual aortic dissection in case these lesions are anatomically unapproachable for endovascular repair. There are a limited number of reports about this technique, and further study is necessary.

Declaration of Conflicting Interests

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Supplemental Material

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