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Case Report

Aorto-Uni-Iliac Stent Grafting and Femoro-Femoral Bypass in a Patient with a Failed and Catastrophic Endovascular Aortic Aneurysm Repair

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A 78-year-old man presented at Eulji University Hospital due to an abdominal aortic aneurysm with maximum diameter of 52 mm, which had been increased from 45 mm over 6 months. He underwent embolization of the left internal iliac artery with vascular plug, prior to endovascular abdominal aortic repair with a bifurcated stent graft system. Unfortunately, the inserted vascular plug was maldeployed and protruded into left external iliac artery, and caused acute limb ischemia. Because revascularization of the occluded segment was failed, emergent hybrid approach with aorto-uni-iliac stent grafting and femoro-femoral bypass was done, successfully.

Key Words: Aortic aneurysm, Acute limb ischemia, Stent graft

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INTRODUCTION

An aorto-uni-iliac (AUI) graft with occlusion of the contralateral common iliac with embolization and a femoro-femoral bypass has been performed to treat isolated iliac artery aneurysms or large aneurysms which seldom have a distal neck suitable for the currently available devices for a bifurcated stent graft system, as well as ruptured abdominal aortic aneurysm (AAA) or AAA having iliofemoral artery disease [1,2]. We present this hybrid technique in emergent setting, which was applied for a patient with AAA and a maldeployed vascular plug causing left external iliac artery (EIA) thrombotic occlusion and acute limb ischemia (ALI).

CASE

A 78-year-old man with a 52 mm AAA was assessed with computed tomography angiography (CTA). The maximum diameter had been increased from 45 mm to 52 mm for 6 months. He was a current smoker. His medical history included severe chronic obstructive pulmonary disease, chronic kidney injury, and hypertension. The non-aneurysmal segment of aorta between the renal arteries and the aneurysm (proximal neck) measured 23 mm in maximum diameter and 69 mm in length. The distance from the lower renal artery (left renal artery) to the aortic bifurcation was 130 mm and the lengths of the right and left common iliac arteries (CIA) were 16 mm and 17 mm respectively. The left CIA was found to be not aneurysmal, but there was marked left EIA tortuosity. The left internal iliac artery (IIA) was patent, but angulated severely (Fig. 1A, B). The endovascular approach seemed to be the best option, considering his age, respiratory and cardiovascular risk factors.

As a preliminary stage, embolization of the left IIA with amplatzer vascular plug (AVP; AGA Medical Corp., Golden Valley, MN, USA) was tried in an attempt to prevent a po-

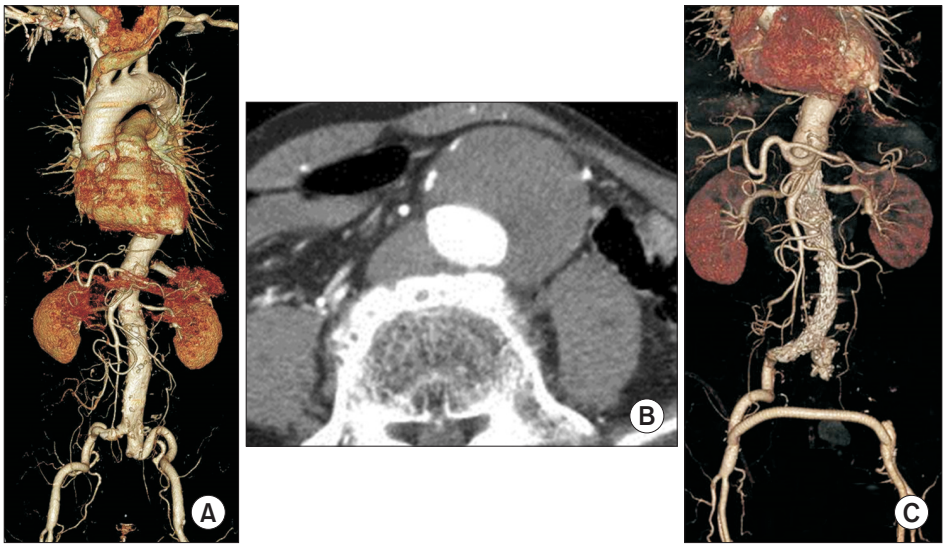

Fig. 1. Preoperative and follow-up computed tomography angiography (CTA). (A, B) Preoperative CTA shows an abdominal aortic aneurysm with a maximal diameter of 52 mm and tortuous iliac anatomy. (C) At 1-month, follow-up CTA shows successful exclusion of aneurysmal sac and patent right-to-left femoro-femoral bypass.

Fig. 2. Vascular plug protruded into the left iliac artery and subsequent limb ischemia. (A) The vascular plug was deployed in the ostium of the left internal iliac artery (IIA) (gray arrow), not the desired level of the left IIA (white arrow). (B) It was slightly protruded into the left external iliac artery (EIA), but there was no flow limitation down to the left leg. (C) Angiogram due to the patient's lower limb ischemic sign showed complete occlusion of left EIA, with thrombus extending distally into the common femoral artery.

tential type II endoleak. After placing an 8-Fr Balkin sheath (Cook Inc., Bloomington, IN, USA) in the left CIA, a 0.035(") hydrophilic guide wire (angled tip; Terumo Corp., Tokyo, Japan) was advanced into the distal part of the left IIA. After that, over the wire, the sheath was advanced beyond the desired level of the left IIA (Fig. 2A). However, the AVP was not advanced because its stiffness could impede the advancement through the vessel, which presented a tortuous anatomy of the left IIA. Therefore, we deployed a 12-mm-diameter AVP in the ostium of the IIA trunk (Fig. 2A). The AVP was slightly protruded into the left EIA, but there was no flow limitation down to the left lower leg (Fig. 2B). Because the contrast dye was used much (more than 300 mL) and the procedural time of the embolization of the left IIA was over 1 hour, we decided to perform endovascular abdominal aortic repair (EVAR), 2 or 3 days after. Femoral hemostasis was achieved with manual compression, and no postprocedural complications arose overnight.

One day after, however, the patient developed lower limb ischemia, with increasing serum muscular enzymes levels.

Angiogram showed complete occlusion of left EIA, with thrombus extending distally to the common femoral artery (CFA) (Fig. 2C). This was a potentially catastrophic condition that could progress rapidly to limb loss and disability if not recognized and treated promptly. First, the decision was made to try catheter-based intervention to restore blood flow and preserve limb viability, but the intervention failed.

Therefore, emergent hybrid rescue procedure (EVAR with AUI stent graft and femoro-femoral bypass) was performed.

The procedure was done through both CFAs cutdown under local anesthesia. Through a right femoral approach, an 8-Fr Balkin sheath was positioned at left CIA, followed by 2 AVPs; 20-mm-diameter and 8-mm-diameter. Next, an AUI endograft-Endurant II (Medtronic Cardiovascular, Santa Rosa, CA, USA) made of 14 to 28 mm in tapered diameter and 105 mm in length was introduced via the right CFA and deployed immediately distal to the origin of the lower renal artery. Then, a limb extension-Endurant stent graft made of 16 mm in diameter and 95 mm in length was deployed. Planned distal landing was the right IIA, and we tried to avoid its occlusion. Follow-up aortogram showed sign of a type IB endoleak. So, 2nd limb extension-Endurant stent graft made of 16 mm in diameter and 80 mm in length was deployed, and post-dilations of the overlapping zone, distal sealing zone were performed with a Reliant stent graft balloon (Medtronic Cardiovascular). However, it was not effective, showing residual type IB endoleak. Finally, we decided to sacrifice the right IIA to extend the distal sealing zone, and the 3rd limb extension-Endurant stent graft made of 16 mm in diameter and 80 mm in length was implanted with being crossed the right IIA, slightly. Fortunately, follow-up angiogram showed no migration of the inserted stent grafts and associated endoleaks.

Finally, a right to left 8 mm ringed polytetrafluoroethylene (PTFE) femoro-femoral bypass was completely performed to perfuse the left lower extremity in an end to side fashion in the right groin and end to side to the left groin, under local anesthesia.

Completion angiography showed good flow through both the aortic stent graft and the crossover graft, without leakage of contrast agent into the aneurysm sac.

On follow-up, CTA confirmed complete exclusion of the aneurysm and patency of the pelvic (Fig. 1C). The patient had an uneventful recovery and remains well and free of endoleak at 3 months follow-up.

DISCUSSION

The IIA embolization is generally performed to cause thrombosis of the vessel and prevent retrograde flow into the aneurysmal sac before EVAR, when a patient with AAA has concomitant iliac aneurysmal disease [3]. IIA embolization has been achieved by inserting multiple detachable coils or AVP into the proximal IIA to induce thrombosis.

Generally, patients with AVP embolization have significantly quicker procedures and shorter fluoroscopy times than patients with coil embolization. Risk of migration is much higher in the coil embolization than in the AVP embolization [4]. This is likely due to delivery system of AVP allowing precise deployment. Since an imprecise coil embolization may lead to buttock claudication, sexual dysfunction, and ischemia after occlusion of the IIA, we prefer the AVP embolization to the coil embolization if feasible.

On the other hand, the AVP does not have an over-the-wire capability. Thus, a long guiding catheter is needed for advancement, and tortuous IIA might not be selected for AVP embolization [5]. Although this patient had a tortuous iliac anatomy, there was no navigational difficulty of the guide wire to reach the target area. At that time, we thought that maldeployed and protruded AVP might not be problematic if we deployed the ipsilateral graft limb and performed balloon dilatation in the left iliac artery.

Recent reports suggest that not all patients require IIA embolization, as IIA coverage solely by the stent graft without embolization is not associated with a significant higher rate of type II endoleak for selected cases [6-8]. In their reports, the acceptable criteria for covering the IIA without embolization was the presence of the IIA with a diameter of less than 5 mm, which was smaller than that of our patient.

One might argue that this complication would not be occurred if IIA embolization were done at the same procedural setting as EVAR. While concurrent IIA embolization with EVAR may offer many advantages, but most intervention radioloigsts favor the stage approach to avoid excessive use of intravenous contrast and prolonged procedural time [3]. In addition, the staged approach appeared to be more beneficial to our patient due to his abnormal baseline renal function.

AUI stent grafting combined with femoro-femoral bypass became only therapeutic option in this patient, because the revascularization was failed.

In patients with AUI stent graft, a complete occlusion of the contralateral iliac artery is required to seal the aneurysm associated with a femoro-femoral bypass in order to reestablish perfusion to the contralateral limb [9,10]. This fact may put the patient at risk, as AUI stent-graft channels all the blood flow into one iliac artery and from there to pelvic circulation and both legs. Even widely patent AUI stent-grafts may limit flow enough to cause claudication, if EIA is small and the patient active [11]. Early critics pointed to poor long-term patency rates of the femoro-femoral bypass, but more recent datas have dispelled this argument pointing to excellent long-term patency of the femoro-femoral portion of AUI repairs. Fortunately, the patency of crossover femoro-femoral bypass is very high in recent published literatures [9,11]. Ng et al. [12] reported a cumulative patency rate at 6 years of 92% for femoro-femoral crossover procedures and a low early mortality rate of 1.3%. Also, despite these procedures might be complicated by the development of graft infection, graft occlusion, false aneurysm formation, seromas in the groin, their incidences are

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very low.

In conclusion, we report a case of AUI stent grafting and femoro-femoral bypass as a viable and emergent option in a patient with AAA and a maldeployed and protruded vascular plug into the ipsilateral iliac artery causing ALI. What's more important is that we should prevent such a catastrophic event.

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