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CASE REPORT

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Endovascular repair using parallel grafts to treat a suprarenal pancreatitis-related abdominal aortic pseudoaneurysm

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Abstract

Arterial pseudoaneurysms represent an uncommon complication of acute pancreatic inflammation or chronic pancreatitis. We describe a contained rupture of a suprarenal abdominal aortic pseudoaneurysm. An aorto-uni-iliac stent-graft was adopted as the aortic main body and was combined with two chimneys and two periscope stents for celiac/superior mesenteric artery and renal arteries, respectively. The procedure was complicated by the entrapment of the celiac sheath into the barbs of the aortic stent-graft and the attempts to remove the sheath resulted in an upward migration of the stent-grafts. A bail-out endovascular procedure was used to reline the stent-grafts and the pseudoaneurysmal sac was embolized with coils.

KEYWORDS

aortic pseudoaneurysm, chimney technique, endovascular aortic repair, parallel graft techniques, periscope technique

1 | INTRODUCTION

Arterial pancreatitis-related pseudoaneurysms are uncommon complications of either acute pancreatic inflammation (late phase) or chronic pancreatitis. Vascular complications occur in a range between 1% and 23% of patients and the majority of them are venous complications. Pseudoaneurysms related to pancreatitis should be repaired as they have a significant risk of bleeding and a reported mortality between 34% and 52%. Arterial pseudoaneurysms are directly related to the presence of pancreatic necrosis associated with peri-pancreatic collections. These collections can evolve either into a pseudocyst or as a walled-off necrosis. Free lipolytic and proteolytic enzymes in the peri-pancreatic collection can penetrate and disrupt the arterial wall resulting in pseudoaneurysm formation or a spontaneous arterial rupture.[1]

We report an impending rupture of a chronic pancreatitis-related suprarenal abdominal aortic pseudoaneurysm successfully treated with the chimney and the periscope graft technique. In addition, this case highlights the crucial role of an accurate preoperative plan and the importance of bail-out endovascular techniques to obtain technical success.

2 | CASE REPORT

A 74-year-old female patient was admitted to a geriatric division of a peripheral center with acute hemorrhagic necrotic pancreatitis. A computed tomography (CT) scan showed a normal aorta and the patient underwent medical treatment and was discharged after 10 days. Three months later, the patient was newly hospitalized at our institution suffering abdominal pain and progressive anemization requiring hemotransfusions. A new contrast-enhanced CT scan revealed a large-neck aortic pseudoaneurysm (maximum diameter

25 mm) located between the celiac artery (CA) and the origin of the superior mesenteric artery (SMA) and associated with a fluid peri-aortic collection (Figure 1A–C). The patient was considered unfit for open surgery repair after a multidisciplinary evaluation that involved cardiologists and anesthesiologists. Nowadays there is no standardized evidence for surgical unfitness and our risk assessment provided several items as follows: qualitative and quantitative definitions of operative risk, patient-related risk definition, and stratification of risk by predictive risk models.[2] Patient was classified American Society of Anesthesiologists (ASA) Grade 4.

Preoperative planning was performed with a post-processing dedicated software (Aquarius Terarecon). The planned operative strategy was designed using a parallel graft (PG) technique to exclude the pseudoaneurysmal sac. An aortouniliac (AUI) stent-graft was planned as an aortic main body combined with two chimney stents for CA and SMA and two periscope stents for renal arteries. Pseudoaneurysmal sac coil embolization was considered through a catheter left into the sac at the end of the procedure. The intervention was performed under general anesthesia in a hybrid room equipped with an Artis Zee ceiling-mounted angiography system (Siemens AG).

The percutaneous approach of both common femoral arteries and the right brachial artery was performed. The left brachial artery was accessed via a surgical cut-down. The left femoral artery was cannulated with a 16F introducer sheath and two 7F long introducer sheaths (Flexor, Cook Medical) were used for each renal artery in a coaxial configuration. Both brachial arteries were cannulated with a 7F 90 cm introducer sheath (Flexor, Cook Medical). A digital subtraction angiography (DSA) was performed and the angiograms were fused with CT images using the Syngo Fusion 3D images software (Siemens Healthcare).

The SMA was engaged through right brachial access and the CA through left brachial access. The renal arteries were catheterized using a 5F 100-cm-long Judkins Right catheter (Performa, Merit Medical Systems) and a 0.035′ stiff guidewire was positioned in each renal artery. Two self-expanding covered stents (Viabahn, WL Gore) 5 × 100 mm were placed in each renal artery. Two balloon-expanding covered stents (E-ventus BX, Jotec GmbH) 10 × 57 and 7 × 57 mm were respectively placed into the CA and SMA. An aortic stent-graft (AUI Endurant II ETUF 2814102, Medtronic Vascular Inc.) was placed just above the origin of CA through the right femoral access. The aortic stent-graft was intended to oversize 20%–30% proximally and 10%–15% distally.

The proximal part of the AUI stent-graft was deployed together with the two balloon expandable stents in SMA and CA. Afterward, the distal part of the aortic stent-graft was entirely deployed with the self-expandable stent grafts previously placed in the renal arteries, leaving a 4F catheter (Navicross) in the pseudoaneurysmal sac (Figure 1D).

The procedure was complicated by the entrapment of the left brachial sheath into the barbs of the AUI stent-graft (Figure 1E) and, moreover, the balloon catheter of the CA chimney stent was joined with the sheath making difficult its withdrawal. As operative risk was very high

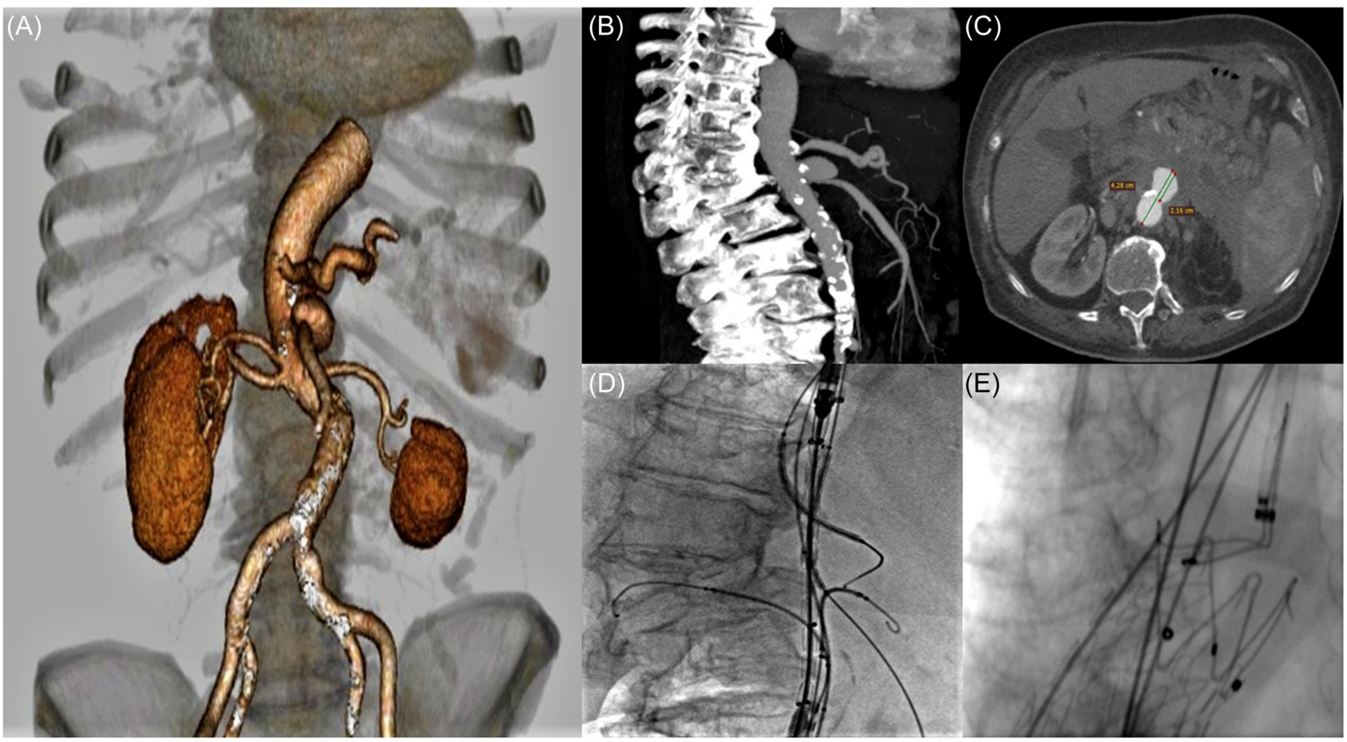

FIGURE 1 (A) Volume rendering (VR) reconstruction. (B) Large-neck aortic pseudoaneurysm at maximum intensity projection (MIP) computed tomography-scan reconstruction. (C) Anatomical characteristics. (D) Pre-deployment intraoperative phase. (E) Left brachial sheath entrapped into the barbs of the aortouniliac stent-graft. [Color figure can be viewed at wileyonlinelibrary.com]

for open surgical conversion, a bail-out endovascular strategy was attempted to solve this issue. We decided to snare and pull down the free flow of the AUI stent-graft and at the same time an opposite force from above to remove the sheath from the left brachial access was applied. During this procedure, a 2 cm upward migration of the AUI stent-graft was observed with the displacement of the two renal stents. The sheath and the balloon were retrieved from the left brachial access and their integrity was immediately assessed. Subsequently, we extended the AUI stent-graft with a tapered stent-graft distally (Gore Excluder PLL 161407, Flagstaff) and the renal arteries were relined using two self-expandable covered stents and fixed with two bare-metal stents (Smartflex stent, Cordis, Cardinal Health) at the distal landing zone. The SMA stent was re-engaged through left brachial access and extended proximally with a balloon-expandable 8 × 57 mm stent to match the proximal edge of the displaced AUI stent-graft. After numerous attempts to re-engage the CA stent, the target vessel was killed leaving the stent between the AUI graft and the aortic wall.

At the end of the procedure, the pseudoaneurysmal sac was embolized with coils (Helix Ev3 Concerto, Covidien) delivered using a catheter previously left within the sac. Completion angiography showed complete exclusion of the aortic pseudoaneurysm with retrograde perfusion of the CA by the SMA and the patency of the renal arteries. No gutter/endoleaks were observed at the end of the procedure.

The patient was admitted to intensive postoperative intensive care unit for 24 h and then transferred to the ward. The postoperative period was uneventful and the in-hospital length of stay was 7 days. A dual antiplatelet therapy medication (daily Aspirin 100 mg and Clopidogrel 75 mg) was started. At 6 months follow-up the patient was healthy, and the CT scan confirmed the exclusion of the aortic lesion and the patency of all the stent-grafts. No endoleak/gutters were observed and the asymptomatic occlusion of the CA stent was confirmed (Figure 2). Unfortunately, the patient died after 10 months from the intervention as a result of myocardial infarction.

3 | DISCUSSION

Arterial pseudoaneurysms are rare but potentially life-threatening complications of pancreatitis. They generally involve visceral arteries and the frequency and the location are as follows: splenic artery, 30%–50%; gastroduodenal artery, 30%; inferior and superior pancreaticoduodenal artery, 20%; left gastric artery, 5%, other, 5%. Only a few cases of aortic pseudoaneurysms secondary to pancreatitis have been described in the literature, and their frequency is about 0.5%.[1]

Etiological factors include a vascular injury determined by the digestion of the arterial wall by pancreatic enzymes. The abdominal aorta is a rare site of pancreatitis-related pseudoaneurysms because seems to be protected by anatomical factors, such as the tunica adventitia and a thick tunica media with a large proportion of elastic fibers. Timely treatment is necessary to prevent the high risk of spontaneous rupture of these pseudoaneurysms and the endovascular approach is becoming the first choice in the last two decades.

The PG techniques, including the chimney, sandwich, and periscope grafts (CHIMPS), are performed with off-the-shelf devices and offer a valid alternative when is not possible to await custom-made manufacturing time, especially in urgent settings.

Several reports described PG techniques as alternative endovascular solutions for aortic repair, even in an urgent setting with bleeding, and a recent systematic review evaluated the effectiveness and durability of PG aortic repair.[3–5]

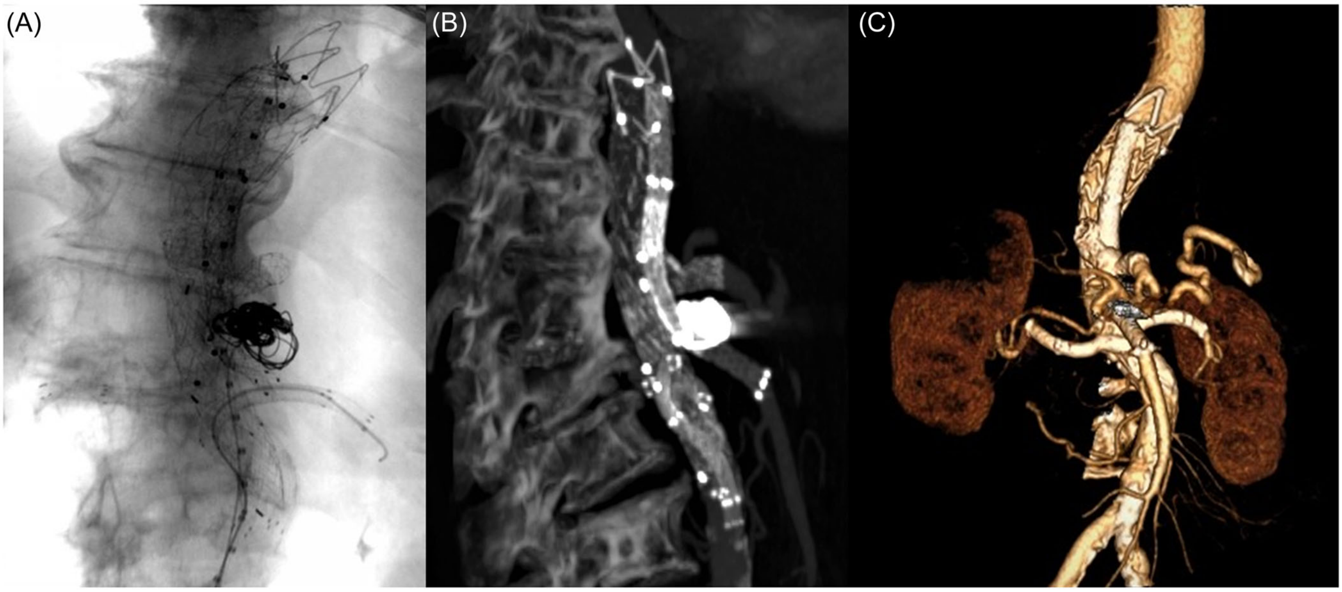

FIGURE 2 (A) Coils pack embolization and parallel-grafts reconstruction at fluoroscopic view. (B) MIP reconstruction at 6 months computed tomography scan. (C) Volume rendering reconstruction showing pseudoaneurysmal sac exclusion and visceral vessels patency. [Color figure can be viewed at wileyonlinelibrary.com]

In spite of the advantages of CHIMPS in emergency situations, in the reported experience other types of endovascular strategies were evaluated. Considering the life-threatening situation, it was impossible to plan a branched or fenestrated custom-made stent-graft because of the long manufacturing time. The exiguous diameter of the taper-shaped aorta at the level of the pseudoaneurysmatic lesion (20.5 mm) and in the landing zones (supra-celiac 22.5 mm/infrarenal 12 mm) represented an important limitation for off-the-shelf branched-EVAR (b-EVAR) stent-grafts. An aortic diameter smaller than 25 mm may compromise the correct opening of the side branches along the suprarenal aorta.[6] A physician-modified stent-graft was excluded for logistic reasons such as the higher risk of malposition and because it is a time-consuming procedure, especially in an emergent setting. Some worries about intraoperative adverse events regarding bridge-stents durability and off-labeled procedures have led us to exclude this type of endovascular strategy.[7]

Custom-made fenestrated (f-EVAR) or b-EVAR stent-grafts are advocated to treat SRAP, but Ch-EVAR may be useful when custom-made devices are not available.[8] In our case, f-EVAR manufacturing time and the unsuitability for off-the-shelf b-EVAR were the most limitations in a life-threatening suprarenal aortic rupture.[9] In the reported case Ch-EVAR represented a tailored approach that may guarantee the exclusion of the aortic lesion with a short length of aortic coverage and preservations of all visceral branches. Sac embolization with coils was performed to promote the thrombosis of the pseudoaneurysmal sac and to prevent future endoleaks/gutters taking into account the four parallel stents needed to complete the procedure. The upward main graft displacement may have compromised the procedure; however, bail-out endovascular rescue techniques allowed us to complete the intervention without severe complications. In our opinion, during Ch-EVAR, a safe maneuver is represented by the withdrawal of the chimney sheath after the deployment of the upper part of the main aortic stent-graft and before the deployment of the top bare stent. This strategy permitted us to gain a safe and accurate deployment of the stent and given this experience we always withdraw the sheath before complete the deployment of the aortic stent-graft.

Jayet et al. reported a similar case, suggesting retrieving the sheath upper than the level of the uncovered portion of the main graft before the deployment. This maneuver may prevent the blockage of the sheath by the hooks. Another crucial aspect relies on an adequate distance between the balloon of the chimney stent and the barbs of the main graft free-flow stents to prevent the perforation of the balloon by the hooks.[10]

4 | CONCLUSION

In this life-threatening case, Ch-EVAR is presented as a tailored solution to exclude the aortic rupture. Although we followed the IFUs for Ch-EVAR, an adverse intraoperative event could have compromised the procedure. Such complications may be avoided by experienced teams, especially in emergency scenarios where preoperative planning plays a crucial role.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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