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Case Report

Different endovascular solutions for short, wide and conic shaped neck

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Abstract

Hostile neck anatomy is the most important issue in prediction of outcomes of endovascular procedures. Surgeon modified fenestrated stent graft (SMFSG) may be an effective and available solution in proper patients by changing the proximal sealing of EVAR to the abdominal visceral aorta. Here we present two frail, comorbid, symptomatic infrarenal abdominal aortic aneurysm (iAAA) cases with reverse tapered wide necks treated with different endovascular techniques.

Keywords: Surgeon modified fenestrated stent graft, funnel technique, hostile neck anatomy, wide neck

INTRODUCTION

Hostile neck anatomy is the most recognized limiting factor for endovascular procedures. Wide (≥34 mm) infrarenal aortic neck diameter is above the limit of sufficient oversizing for standard Endovascular Aortic Repair (EVAR). Surgeon modified fenestrated stent graft (SMFSG) may be an effective and available solution in proper patients by changing the proximal sealing of EVAR to the abdominal visceral aorta. Funnel technique also may take place if there is a wide infrarenal aortic neck and no opportunity of Chimney EVAR (Ch-EVAR), fenestrated EVAR, or open surgery [1-3]. Herein, we would like to share the endovascular treatment choices in two frail patients with hostile neck anatomy and how we selected the techniques on patient basis anatomic specifications.

CASE REPORT

Due to the significant risk of morbidity and mortality and both patient's ASA IV conditions, open surgery was ruled out. Patients' comorbidities and aneurysm specification data are given in Table 1. SMFSG and Funnel-EVAR techniques were performed consecutively.

Table 1. Patient datas

	Case 1	Case 2
Age	74 years old	72 years old
Max aortic diameter	70 mm	80 mm
Associated comorbidities	HT, CAD, CHF, COPD	HT, CAD, CRF, COPD
Infrarenal neck diameter	35.5 mm	37 mm
Neck length	6 mm	12 mm
Neck shape	Wide, reverse-tapered	Wide, reverse-tapered
Infrarenal angulation	10 degrees	70 degrees

HT: hypertension, CAD: coronary artery disease, CHF: congestive heart failure, CRF: chronic renal failure, COPD: chronic obstructive pulmonary disease

For SMFSG, the diameter of the aortic visceral branches, infrarenal and suprarenal angulations, the distance between the branches, and the clock position of each branch ostium were measured from the Computerized Tomographic Angiography (CTA) (Figure 1A). The procedure was performed as described

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before [4,5]. The stent graft was unsheathed on the back table and modification with fenestrations were performed as shown in Figure 1B. Once the fenestration was ensured to be oriented toward the aortic target vessel estimated by the '8' and '0' radiopaque markers, the deployment was performed. The completion angiography (Figure 1C) and the first year CTA (Figure 1D) demonstrated no complication. No selective vessel stenting was performed.

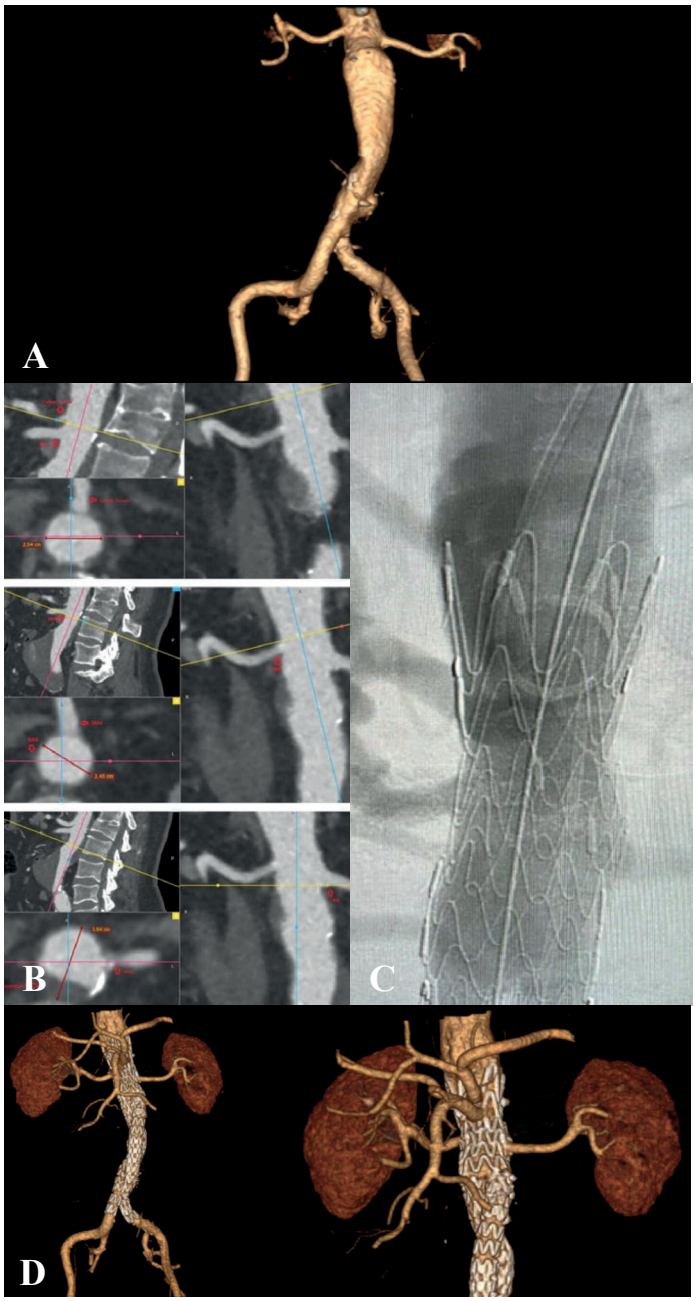

Figure 1. A. Computerized tomographic angiography of abdominal aortic aneurysm, **B.** Aortic diameter at celiac level, at SMA level and LRA level, **C.** Completion angiography, **D.** 1 year follow-up 3D CTA

As the first patient, the comorbidities and ASA IV symptomatic status forced us to change the strategy from open surgery to an endovascular manner. Computerized tomographic angiography reported an angle of >70 degrees and the shape of the aneurysm neck was "reverse tapered" with a proximal diameter of 34 mm only with 8 mm of the short neck and 37 mm providing a 15 mm proximal landing zone. (Figure 2A) We performed the so-called "funnel technique" under the guidance of CO2 DSA. [6] The funnel technique is the assembly of a thoracic endograft inside a bifurcated or uni-iliac endograft. (Figure 2B). Completion angiography was performed also with CO2-guided DSA (Figure 2C). Figure 2D shows the first-year CTA control.

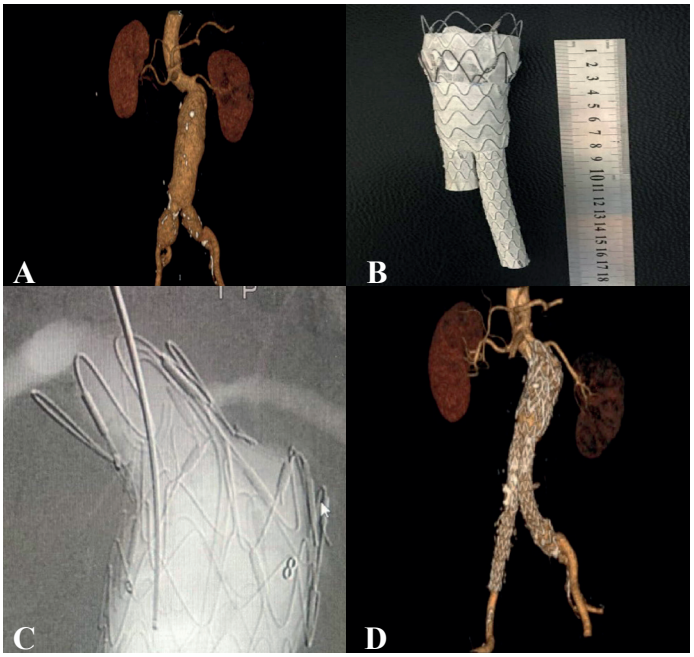

Figure 2. A. Computerized tomographic angiography reported an angle of >70 degrees and the shape of the aneurysm neck was "reverse tapered" with a proximal diameter of 34 mm only with 8 mm of the short neck and 37 mm providing a 15 mm proximal landing zone, **B.** Thoracic endograft inside a bifurcated endograft, **C.** Completion angiogram with the patent LRA and no type 1 or 3 endoleak, **D.** First-year CTA control, no type 1 or 3 endoleak

DISCUSSION

Cardiovascular surgeons may offer an opportunity to undergo endovascular repair and ensure the benefits of such an approach to high-risk patients with advanced skilled techniques. Hybrid surgeries and debranching techniques, chimneys, fenestrated or branched grafts, unique new devices or a back table fenestration are potential solutions. Laparotomies are required for hybrid operations, and the chimney technique's barrier-like propensity for Type 1a endoleaks negates the benefits of EVAR. SMFSG seems to be a safe, effective, and economic assistive endo-revascularization method in our experience.

For optimal outcomes, selecting the best treatment modality for the patient is essential. Our first patient was very suitable for

SMFSG as there was nearly zero supra and infrarenal angulations facilitating the orientation of the fenestrations. The second patient had >60 degrees of angulation, SMFSG was thought to have high risk at orientation therefore Funnel technique was preferred. Experience is needed to choose the correct patient, use the right method, and execute the matchup. This is why these sophisticated, expert procedures should be carried out by trained, high-volume aortic centers. For both patients the first year CTA controls were uneventful.

In the first case, we did not require any stenting procedure for any visceral branch. Whether to deploy a covered stent to a side branch or not is a matter of debate and has its own complications. The endograft integrity, the fabric durability concerns, the patency of the branch vessels, and the absence of bench testing are the main limitations for the SMFSG technique however for midterm there is promising and successful outcomes in the literature and in our experience [7-9].

Replacing the proximal seal upwards creates another problem like extending the aneurysm length and therefore deploying more components. This issue may be responsible for disconnections between the legs. Our approach is extending the length of the overlaps if possible and routinely ballooning the connection parts to reinforce sealing. The endograft integrity, the fabric durability concerns, the patency of the branch vessels, and the absence of bench testing are the main limitations, and still waiting for the answers for the SMFSG technique however for midterm there are promising and successful outcomes in the literature and also in our experience [8-10].

For the second case with a >60 degrees of angulation we decided to perform funnel technique, a combination of a thoracic and abdominal endograft. Stabilizing the graft at the distal part and deploying the funnel side with 60 mm of thoracic LTA endograft after. (Figure 2) The main limitation of this technique is the "Renal- aortic bifurcation distance where 60 mm of LTA thoracic endograft is a potential solution for this handicap [6].

It is the choice of the cardiovascular surgeon whether to perform fEVAR, ChEVAR, open surgery, or funnel technique due to the patient's status, and all these treatment modalities carry long-term complications if the patient survives.

CONCLUSION

Wide infrarenal aortic necks remain a challenge for every type of treatment modality. Hybrid assembly of a thoracic endograft placed through the main body of an abdominal endograft is a solution where other modalities are not available. SMFSG remains a feasible assistive technique for EVAR in maintaining the blood flow of the branch vessels in the abdominal visseral aorta and giving a chance for a secure and sufficient proximal sealing site for EVAR procedure. SMFSG and Funnel technique should be present in the armamentarium of a cardiovascular surgeon as both give satisfactory results for a special subset of the patient group.

Patient Consent for Publication: Patients consent form taken, and study approved by Ankara City Hospital Local Ethics Committee (E1-21-1485).

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