Custom Made Fenestrated Stent Graft Collapse after Thoracic Endovascular Aortic Repair: A Case Report

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Abstract

We performed thoracic endovascular aortic repair with a custom-made fenestrated stent graft and present a case of stent graft collapse after thoracic endovascular aortic repair. The patient was a 70-year-old woman with an asymptomatic aneurysm of the distal aortic arch, and thoracic endovascular aortic repair was performed with a custom-made fenestrated stent graft. The patient showed a blood pressure difference between the left and right arms on postoperative day (POD) 17 prompting performance of a chest computed tomography which revealed stent graft collapse. She then underwent staged debranching thoracic endovascular aortic repair. Stent graft collapse is a rare but well-described complication of thoracic endovascular repair. Therefore, patients who undergo such a procedure should be carefully monitored for signs and symptoms, which suggest the possibility of stent collapse.

Keywords: Thoracic endovascular aortic repair; Collapse; Custom made fenestrated stent graft; Bird-beak deformity

Introduction

An increasing number of elderly patients are undergoing stent graft (SG) interposition treatments for management of thoracic aortic aneurysms. Although two thirds of the published cases of endograft collapse occurred after endovascular repair of aortic injuries, a large series suggest that only 6–11% of all thoracic endovascular aortic repair (TEVAR) cases are performed for acute traumatic lesions [1]. The main cause was endograft oversizing. Mismatch between the endograft and the aortic diameter may lead to incomplete deployment and infolding of the endograft. However, the endograft was oversized in about one third of all cases. The aortic anatomy, which consists of a small radius to the curve of the aortic arch, may be crucial as well in the development of endograft collapse. Proximal fixation of thoracic endografts to oversize and aortic arch, may be crucial as well in the development of endograft collapse. Oversizing of the SG, leakage, nor any other specific problems. The patient was placed in a custom-made fenestrated SG with a built-in Z stent and three holes for the branches of the aortic arch (Figure 1B). The SG traversed the entire aortic arch.

Operation

The operation was performed under general anesthesia, and the left femoral artery was cannulated. Contrast material was injected though the ascending aorta, thereby guiding and ensuring correct placement of the 30-mm custom-made fenestrated SG, which was deployed by using the pull-through method. During the operation, a bird-beak configuration, which is the radiological detection of a wedge-shaped gap between the undersurface of the SG and the aortic wall, was observed in the SG at the lesser curvature of theascending aorta. However, no leakage was observed; thus, touch-up ballooning was not performed.

Postoperative course

Immediately after the TEVAR, the patient was alert. A three-dimensional [3-D] CT performed on POD 3 did not show migration of the SG, leakage, nor any other specific problems. The patient was followed up for another week. A brain CT was performed on POD 11 because the patient experienced deterioration in limb activity, but no abnormal findings were obtained from the study (Figure 1C). On POD 17, the patient showed a blood pressure difference of 50–60 mm Hg between the left and right arms and a 3-D CT was performed. The study revealed poor apposition of the endograft to the arch, which had migrated proximally (Figure 2A). Collapse of the SG and occlusion of the arch branches occurred simultaneously, followed by the appearance of cerebral symptoms in the form of severe dizziness. Therefore, a debranching bypass operation was performed to maintain the blood flow in the occluded parts. The patient was scheduled to undergo a staged operation. To this end, an ascending aorto-bi-axillary bypass (Y graft, 16 × 8 mm; Hemashield®) was performed on POD 21. Since moderate stenosis and plaque on the common carotid artery were observed, we did not want to perform extensive operative manipulation.
Figure 1: A) Preoperative 3-D CT scan showing a saccular aneurysm (maximum diameter, 38 mm) in the distal aortic arch. The length of the proximal landing zone is shorter (about 5 mm). B) The custom-made fenestrated SG with a built-in Z stent and 3 holes for the branches of the aortic arch without the use of snorkels. C) Postoperative CT scan obtained on POD 3, showing no migration of the SG, leakage, or any other problem.

Operation 3

A repeated TEVAR was performed under general anesthesia three days after the operation, and a TAG device (GORE®) was inserted via a right femoral incision. As the previous procedure resulted in distortion of the custom-made fenestrated SG, a 28 mm TAG was inserted this time in the descending aorta and another 31 mm TAG was inserted in the ascending aorta-aortic arch. The second SG was deployed into the collapsed SG, which was pressed against the aortic arch wall. After the SG was reinforced by using touch-up ballooning, imaging studies for visualization of the debranching graft were performed; these studies confirmed that the deployed SG was retained at its appropriate position. A new CT angiography was performed before discharge, which showed a regular graft diameter, normal renal perfusion, and no signs of any endoleaks (Figure 2C).

The patient’s consciousness and limb activity improved drastically. Her overall condition was good, and she was discharged from the hospital on POD 35.

Discussion

Generally, an aortic aneurysm with a 38 mm diameter is not indicated for operation. The present case of aneurysm was not large but was of the saccular type, which has been known to have a tendency to become enlarged over time. Hence, in the present case, TEVAR was performed because of the possibility of enlargement and in accordance with the patient’s wishes.

Anatomic complexities at the aortic arch are the most important reasons for early and late SG treatment failure. Some studies that reported the use of custom-made SGs also reported migration of the SG during early follow-up [3]. An incidence of collapse is reported in approximately 1.4–2.7% [4,5] of TEVAR operation cases.

In this case, SG migration developed between PODs 3 and 17. As the patient did not disclose her symptoms, diagnostic imaging was not performed between PODs 3 and 17 and we elected to observe the patient only. However, SG migration should be considered an indicator of an abnormality when the SG is deployed in the aortic arch, and diagnostic imaging should be performed regularly.

The following are the causes of SG migration and its mechanisms: problems in 1) manipulation techniques, 2) stent placement site, and 3) the stent itself.

1) With regard to the operation technology, we believe this was not a source of the problem because we have had extensive experience with the procedure. However, fixation with a balloon was not performed after SG placement and could be one of the causes of the SG migration in this case.

2) When the SG is deployed in a steep site such as the aortic arch, care is necessary to isolate the site. When the SG shows a bird-beak configuration, migration could develop owing to excessive force applied to the SG. In this case, a bird-beak configuration was
Figure 2: A) The SG was pushed toward the greater curvature of the aortic arch and occluded the left common carotid and subclavian arteries. B) An aorto-bi-axillary bypass (Y graft 16 × 8 mm: Hemashield®) was performed on POD 21. C) Imaging studies for visualization of the debranching graft that confirmed that the deployed SG was retained at its appropriate position.

confirmed after TEVAR. Whether the deployed SG is misplaced or whether a different route should be chosen should be determined.

3) Regarding the stent itself, being custom-made seems problematic. It is an advantage to insert in the vessel wall a custom-made stent made according to the shape of the blood vessel. Although manufacturers of SGs should perform a durability test, some custom-made SGs available in the market might not have undergone a durability test and are thus prone to migration owing to their weak structure.

Recently, a flexible device designed to conform to the configuration of the aortic arch such as Relay NBS plus [6] (Bolton Medical, Sunrise, FL, USA) has been developed and is being used in Europe. This device is comprised of self-expanding sinusoidal nitinol stents, and the proximal end of this SG is an open bare stent [7]. Therefore, SGs should be matched to the shape of the blood vessel by using a new device for adaptation to different situations.

Conclusions

Certain symptoms and signs that develop after SG placement are indicative of collapse and should prompt immediate investigation. If subsequent work-up reveals SG collapse, a suitable correction method should be performed on the basis of the image findings.

Conflict of Interest

The author certifies that there is no conflict of interest with any financial/research/academic organization, with regards to the content/research work discussed in the manuscript.
References


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