A combined surgical and endovascular procedure for thoracic aortic aneurysm in a high risk patient

Torasik aort anevrizmalı yüksek riskli bir hastada kombine cerrahi ve endovasküler işlem

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Introduction

Rupture is the leading cause of death for patients with surgically untreated thoracic aortic aneurysms (1). Perko et al (2) reported that risk of aneurysm rupture increased fivefold when the 6-cm.-diameter threshold was exceeded. Previously, the standard treatment of thoracic aortic aneurysms was open surgery with graft replacement which has perioperative mortality rates within 3% to 35% in multicenter reports (3,4). Despite recent advances of thoracic aortic surgery, complications are still prevalent in repair of aortic arch aneurysms, especially in patients with co-existing morbid conditions.

Since the first report of Dake and co-workers concerning the clinical feasibility of endovascular repair with Dacron-covered stent grafts in 13 cases with descending thoracic aortic aneurysms in 1994, several reports have been released regarding the mid-term follow-up of the efficient and safe use of this new treatment modality for thoracic aortic aneurysms (5,6).

We present a case of thoracic aortic aneurysm also involving distal aortic arch in a high-risk patient and its repair with endovascular stent graft after right subclavian-to-left common carotid and subclavian artery bypass.

Case Report

A 73-year-old man with back pain was referred to our hospital on emergency basis with the diagnosis of thoracic aortic aneurysm by computed tomographic (CT) scan of the chest. On the CT scan aneurysm was measured to be 6 cm in diameter and involvement of the distal aortic arch as well as the descending aorta was shown, without any signs of thrombus and dissection (Fig 1). Digital subtraction angiography further delineated the anatomic features of the aneurysm in which the length was measured to be 70 mm, the proximal neck 35 mm and distal neck 40 mm, also left common carotid and subclavian arteries were found to be involved. A thorough medical history revealed NYHA class III cardiac insufficiency and ejection fraction was 35% on the echocardiography. He has been hypertensive and treated medically for 16 years. Pulmonary function test showed moderate obstruction and mild restriction. Also ultrasound duplex scanning revealed no diameter reduction of both internal carotid arteries.

Antihypertensive therapy was started soon after the admission and he was scheduled for a staged surgical and endovascular approach.

After 20 minutes of regional anesthesia with interscalene block, 6-cm bilateral transverse incision was made above both clavicles and the bypass was constructed between right subclavian artery and left carotid, subclavian arteries with a 8-mm polytetrafluoroethylene graft (Gore-tex, W.L. Gore&Associates). Since there was no diameter reduction of both internal carotid arteries, shunt was not used during the partial carotid artery clamping. After the bypass procedure, proximal parts of the left carotid and subclavian artery were over-sewn (Fig. 2). After 3 days, endovascular graft procedure was ensued.

The implantation of stent-graft endoprosthesis was performed in the angiography suit under epidural anesthesia after full heparinization. Axillary access with a 7F introducer was prepared for proximal procedure screening with an angiographic "pigtail" catheter. Right femoral artery was exposed via vertical incision and a 7F sheath was introduced in order to place 0.032'' guidewire (Terumo, TM, Japan) and the calibrated catheter (COOK Inc. Bloomington, IN) as well, which was necessary for the length measurement of the aneurysm including the proximal and the distal necks. The guidewire was exchanged with a 0.035'' Back-Up Meier guidewire (Boston Scientific Corp, Oakland, NJ) in order to straighten the segment to be treated and give enough support for the delivery system. A 44-mm-diameter, 115-mm-covered length, 130-mm-total length, proximal free flow Talent endovascular stent device (Medtronic AVE, Santa Rosa, CA) was deployed at the arch 10 mm proximally to the aneurysmatic segment covering the ostium of the left common carotid and subclavian arteries (Fig. 3). The total blood loss did not exceed 200 ml and duration of the stent graft implantation procedure was approximately one and half an hour. The postoperative course was uneventful. The patient was

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discharged on the 3rd postoperative day, after CT scanning showing complete exclusion of the aneurysm. Control CT scan of the patient taken in the first month also showed no increase in the diameter of the aneurysm without any signs of endoleak and graft migration (Fig. 4).

Discussion

Although the mortality of conventional surgical methods of the thoracic aortic aneurysms has dropped sufficiently to 2-3% in the last several decades, endovascular stent-graft has currently emerged as a safe therapeutic strategy for aortic aneurysms (3). Endovascular repair of the thoracic aortic aneurysms, has become a widely accepted procedure for a selected group of patients as a less invasive approach alternative to open surgical repair. The mostly encountered complications are endoleak and graft migration, which may necessitate re-intervention. The initial results from several studies suggest that this new treatment modality may potentially reduce postoperative mortality and morbidity rates, as well as duration of the hospital stay (7). However, the endovascular approach for distal aortic arch aneurysms is still a matter of concern.

There are a number of strategies described for managing the left subclavian artery origin during proximal aortic stenting in a patient with a short juxta-subclavian neck or with an aneurysm involving the subclavian artery, including subclavian-

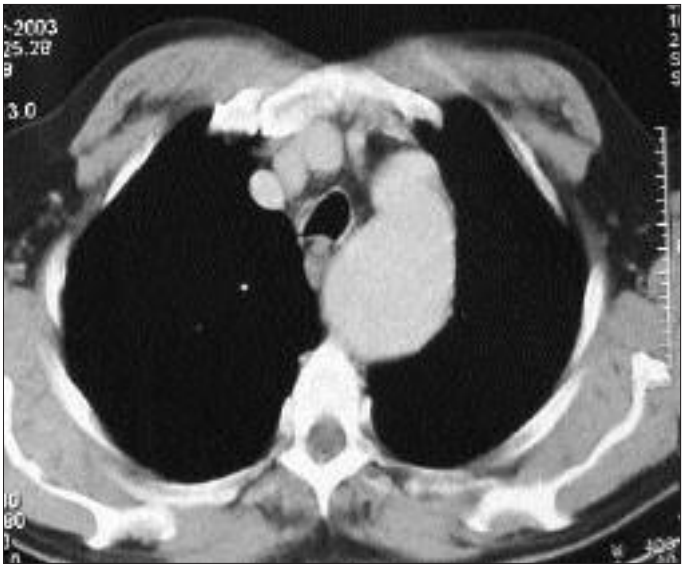

Figure 1. Preoperative computed tomographic scan demonstrating the thoracic aortic aneurysm involving the distal aortic arch

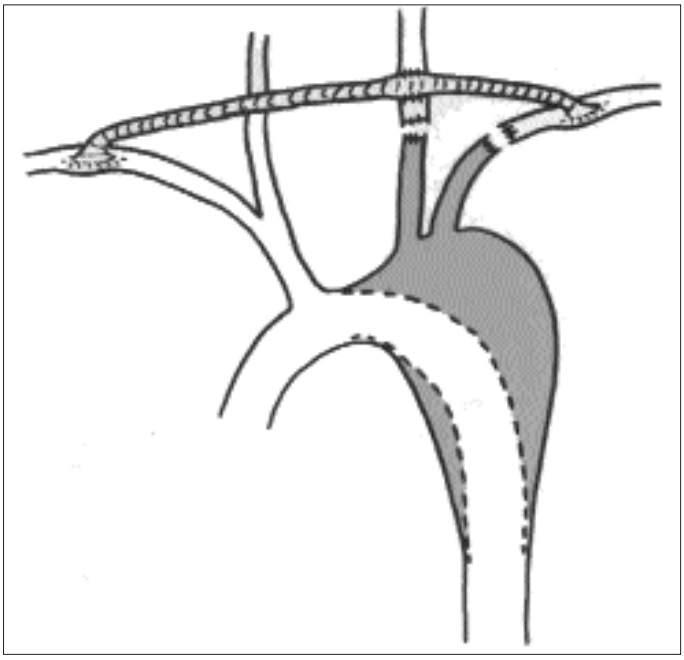

Figure 2.The operative schema of right subclavian-to-left carotid and subclavian arteries bypass, and the thoracic aortic aneurysm involving the left carotid and subclavian arteries

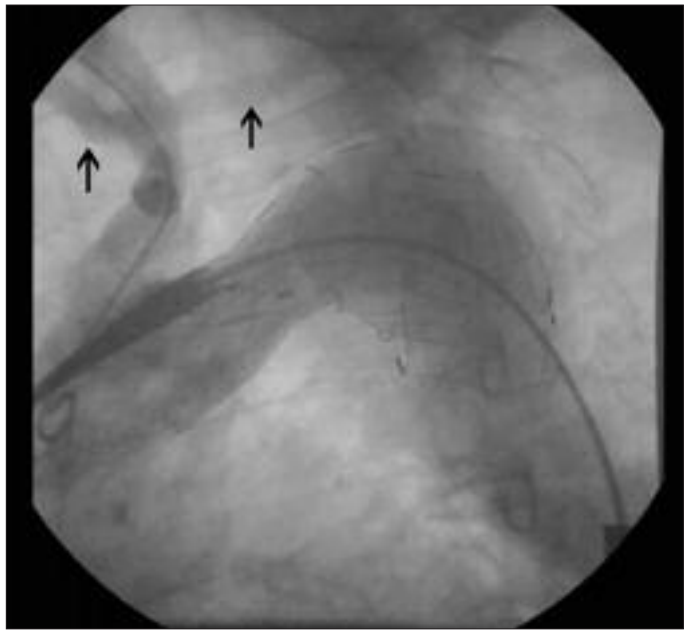

Figure 3. Intraoperative completion angiogram. The thoracic aortic aneurysm was excluded and the proximal portion of the stent was placed distal to the innominate artery. Arrows show the right subclavian-to-left carotid and subclavian arteries bypass

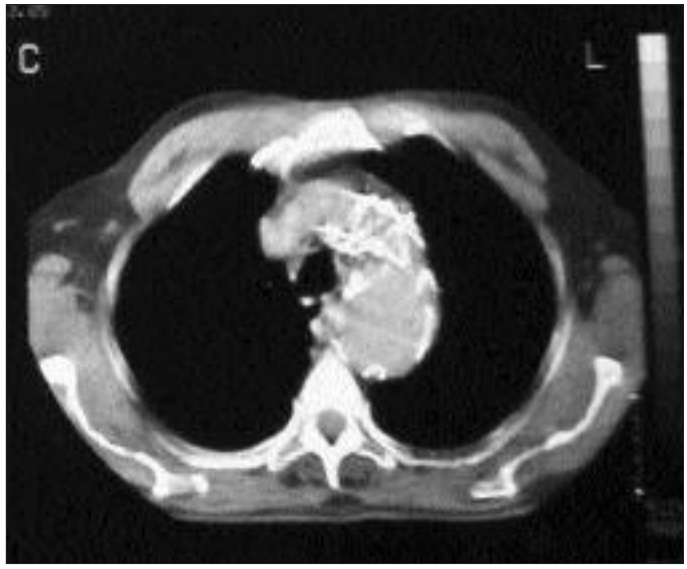

Figure 4. Postoperative computed tomographic scan showing exclusion of thoracic aortic aneurysm by endovascular stent graft

carotid bypass, subclavian-carotid transposition, fenestration of the stent graft material or simply stenting across the subclavian origin relying on collateral perfusion of the left upper extremity (8,9). Lamme et al (8), presented 3 patients in whom a carotid-to-subclavian artery bypass was created in order to increase the proximal sealing zone for the endograft. Also Moore (9), performed subclavian-to-carotid transposition and supracarotid endovascular stent graft deployment for the treatment of traumatic aortic rupture.

There are also reports on use of branched stent grafts for extensive endovascular aneurysm repair. Inoue et al (10) used transluminally placed branched endovascular stent grafts for aortic arch reconstruction. They used 14 single branched and one triple branched stent grafts and showed the technical feasibility of endovascular stent graft repair of aneurysms located at the aortic arch (10). However, as well as further studies, mid and long-term follow-ups are mandatory to determine the effectiveness of those branched stent grafts in preventing dilation of the aneurysm and preservation of the perfusion of the great vessels arising from the aneurysmatic arch. In present case we performed a right subclavian-to-left carotid and subclavian arteries bypass under regional anesthesia to achieve a safe deployment of the stent graft and the entire aneurysm was repaired with endovascular stent graft after 3 days.

For moderate-high risk elderly patients (American Society of Anesthesiologists Classification III-IV) with significant comorbidities, including coronary artery disease, cerebrovascular disease and poor pulmonary and renal reserve, also for patients with thoracic aortic aneurysm which is anatomically difficult to expose like in the aortic arch or previous thoracic surgery, an endovascular procedure is an alternative treatment, avoiding a lengthy thoracotomy and reducing mortality. In present case, it was a high-risk patient due to cardiac and pulmonary insufficiency with an aortic arch aneurysm.

Combined surgical and endovascular treatment also promotes less invasive therapy for high risk patients with aortic arch aneurysms and the ability to treat otherwise inoperable patients with a combined approach is a definite benefit over open repair. The improvements in multibranched stent graft technology and long-term results have being awaited, for treating aortic arch aneurysm without compromising the perfusion of the great vessels arising from the aneurysmatic arch

To conclude, a combined surgical and endovascular approach for thoracic aortic aneurysms, involving aortic arch offers a promising alternative to reduce the mortality in high-risk patients.

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