Hybrid Approach for the Treatment of Type 1b Endoleak Following Endovascular Repair of Thoracoabdominal Aortic Aneursym: Case Report

Torakoabdominal Aort Anevrizmasının Endovasküler Tamiri Sonrası Gelişen Tip 1b Endoleak'in Hibrid Yaklaşımla Tedavisi

Tuğra GENÇPINAR,[a]
Eyüp HAZAN,[b]
Mehmet GÜZELOĞLU,[b]
Gökhan ALBAYRAK,[b]
Aytaç GÜLCÜ[c]

[a]Clinic of Cardiovascular Surgery, Antalya Training and Research Hospital, Antalya
[b]Clinic of Cardiovascular Surgery, Medical Park İzmir Hospital,
[c]Department of Radiology, Dokuz Eylul University Faculty of Medicine, İzmir

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Yazışma Adresi/*Correspondence:*
Tuğra GENÇPINAR
Antalya Training and Research Hospital, Clinic of Cardiovascular Surgery, Antalya,
TÜRKİYE/TURKEY
tugra01@yahoo.com

ABSTRACT Treatment options for thoracoabdominal aortic aneursyms include open repair, endovascular repair or hybrid repair. Although open repair still remains the standart approach. Hybrid approach and endovascular treatments are becoming widespread as they have lower mortality and morbidity rates and they have shorter hospital stay. Hybrid repair refers to a combination of both open surgical and endovascular techniques. Endoleak as a complication of endoluminal grafting of abdominal aortic aneurysms can occur between 11-44% in various reports. There are five types of endoleak. We report a patient with type 1b endoleak that was treated with hybrid approach consisting concomitant visceral artery revascularization and endovascular aneursymal repair.

Key Words: Aortic aneurysm, thoracic; endoleak; aortic diseases

ÖZET Torakoabdominal aort anevrizmalarının tedavi seçenekleri açık cerrahi, endovasküler ve hibrid tamiridir. Açık cerrahi halen standart tedavi yaklaşımıdır. Hibrid ve endovasküler tedaviler düşük mortalite ve morbidite oranları ile yaygınlaşmakta olup, düşük hastane kalış sürelerine sahiptirler. Hibrid tedaviler, açık cerrahi yaklaşımları ve endovasküler tedavilerin birlikteliğidir. Abdominal aortik anevrizma greftlerinin komplikasyonu olan 'endoleak' %11-44 arasında görülür. Endoleak'lerin 5 çeşidi bulunmaktadır. Bu çalışmada, endovasküler anevrizma onarımına ek olarak visseral arter revaskülarizasyonu yapılarak tedavi edilen tip 1 b "endoleak" hastası sunulmuştur.

Anahtar Kelimeler: Aort anevrizması, torasik; iç sızıntı; aort hastalıkları

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The surgical treatment of TAAA over the last decades described by Crawford in 1978.[1] The procedure has rapidly evolved over the years. Nowadays, treatment options for TAAA's include open repair, endovascular repair or hybrid repair. They perform with experienced surgical centers to have much lower mortality and morbidity rates particularly in organ protection. Moreover, high technology has led to the extended use of endovascular grafts in the visceral aorta. Hybrid approach and endovascular extended grafts usage are becoming widespread as they have lower mortality and morbidity rates with shorter hospital stay. Hybrid TAAA repairs providing concomitant visceral artery revascularization and endovascular aneursymal repair. In this paper we report a case with type 1b endoleak that was treated with hybrid treatment consisting inflow to visceral arter-

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ies by means of extra-anatomic bypass followed by aortic endograft.

CASE REPORT

A 65-year-old woman was admitted to our hospital with midline located abdominal pain. Medical history includes left mastectomy because of breast cancer and she has been taking antihypertensive medication for 10 years. Her physical examination was normal. Routine blood count and also biochemical measurements were normal. In PA chest radiograph, lungs were normal, cardiothoracic rate was increased with widened aortic knob. Computed-tomography angiography (CTA) examination revealed a thoracoabdominal aortic aneurysm (TAAA) which was 7 cm wide in largest diameter (Figure 1A). Thoracic aortogram demonstrates TAAA distal to a tortuos desendan thoracic aorta (Figure 2A). TAAA had a distal tapered neck ending at the coeliac trunk origin. TAAA was treated with endovascular stent graft (a 42 mm-42 mm-20 cm thoracic stent graft, Valiant Medtronic) implantation. The distal landing zone deployed just proximal to the level of coeliac trunk ostium. However stent graft distal segment jumped to proximal widened segment just after deployment. Control angiogram demonstrated a type 1B endoleak medial alongside the stent graft (Figure 2B). No any other intervention was performed and the leak was expected to be vanished during follow up. Follow-up CTA obtained before 30 days due to the persistancy of abdominal pain which revealed type 1b endoleak related aneurysmal expansion at the level of coeliac trunk (Figure 3). Therefore, in order to facilitate adequate distal sealing zone, a hybrid approach was carried out including coeliac artery revascularization (right common iliac artery-coeliac artery bypass using otolog saphenous vein graft) and debranching with concomitant endovascular repair (Figure 2C-2D). This time during the stent graft (a 46 mm-46 mm-10 cm thoracic stent graft, Valiant Medtronic) deployment a balloon was inflated in the proximal superior mesenteric artery segment to

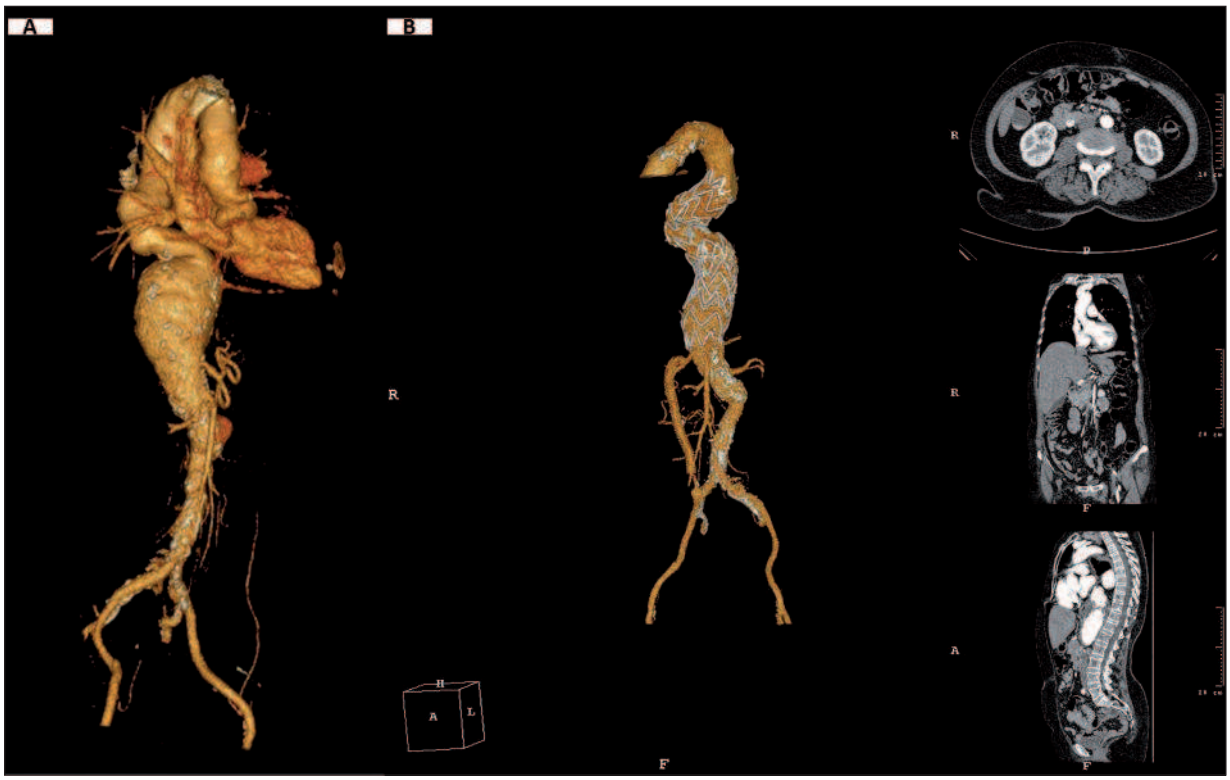

FIGURE 1: A) CT angiography 3D recontruction shows thoracoabdominal aortic aneurysm and tapered short distal neck relation to celiac artery orifice. **B)** Patent vein graft in long term follow-up.

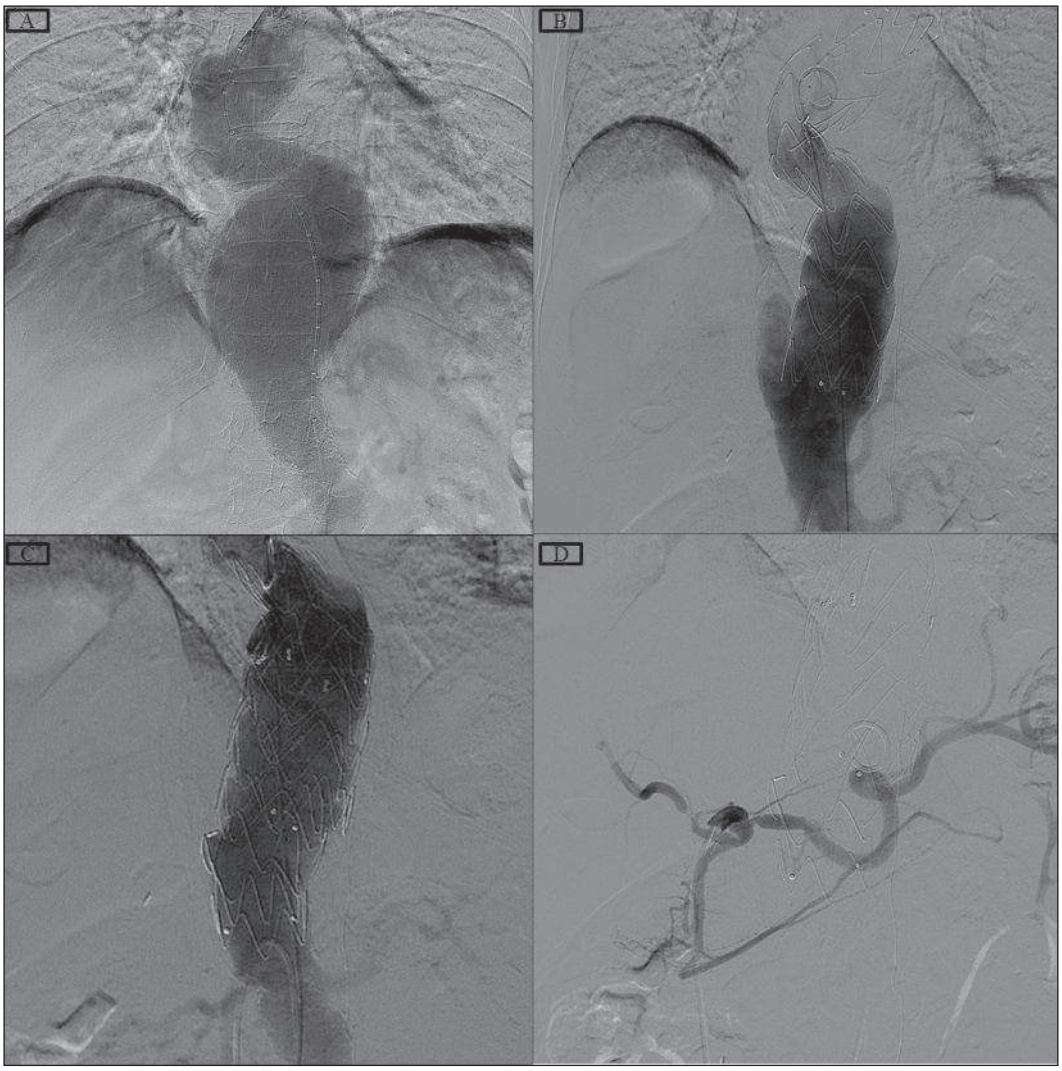

FIGURE 2: A) Thoracic aortogram demonstrates TAAA distal to a tortuos desendan thoracic aorta. **B)** Post TEVAR control angiogram showing type 1b endoleak on the medial alongside of stent graft. **C)** A redo TEVAR excludes aneurysm totally and also covers the coelic artery origin. A balloon catheter was placed in SMA. **D)** Celiac artery is selectively catheterized through the ilio-celiac vein graft and contrast injection reveals filling of the celiac artery branches without endoleak (*TAAA: Thoracoabdominal aortic aneurysm; TEVAR: Thoracic endovascular aortic repair; SMA: Superior mesenteric artery*).

extend distal landing zone as far as possible and to avoid unintenional coverage of the superior mesenteric artery (SMA) ostium. Before the stent graft deployment otolog graft patency was confirmed with angiography. After the stent graft deployment the otolog graft was selectively catheterized via the right common iliac artery and contrast injection through the otolog graft demonstrated filling of the coeliac artery branches without type 2 endoleak (retrograd filling of the aneurysmal sac through the coeliac artery orifice). Patient was discharged without any complication. Follow up CT angiograms demonstrated totally thrombosed aneurysmal sac with patency of the vein graft (Figure 1B).

DISCUSSION

Treatment options for TAAA's include open repair, endovascular repair or hybrid repair. Although open repair still remains the standart approach, hybrid approach and endovascular treatments are becoming widespread as they have lower mortality and morbidity rates with shorter hospital stay. Open repair, performed by experienced teams, has been reported to have significant mortality and

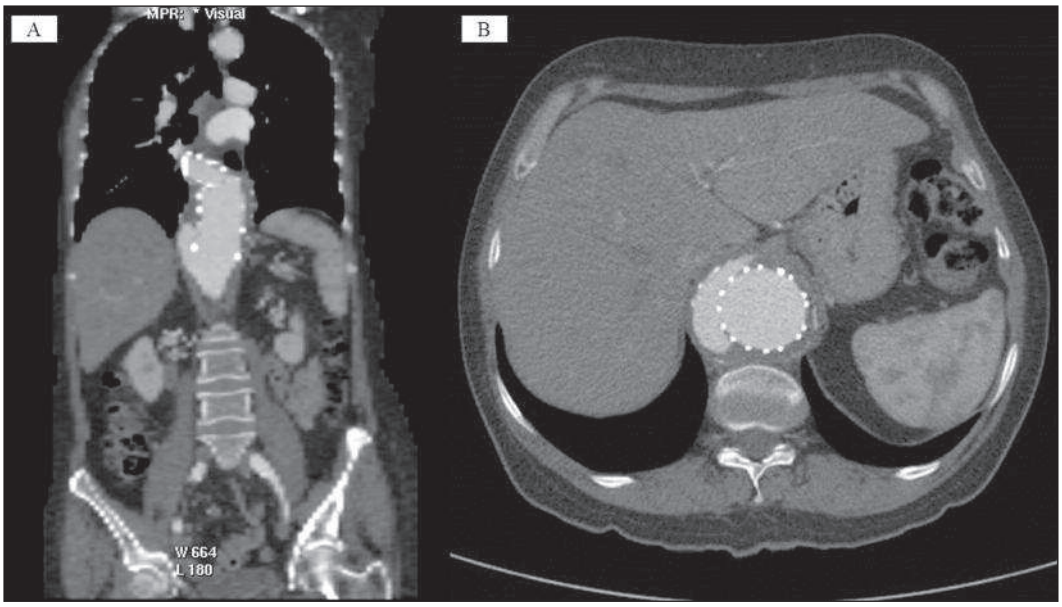

FIGURE 3: A-B) CT Angiography coronal multiplanar CT reconstruction and axial source image shows rapidly enlarging thoracoabdominal aortic aneurysm due to type 1b endoleak.

morbidity rates.[1] These patients also have significant comorbidites which make them ineligible for open repair.

Besides all these important advantages, unknown long term results of endovascular treatments can be considered as a disadvantage. Endoleak can be defined as the persistent perfusion of the aneurysm sac following endovascular aneurysm repair. Endoleak has been published between 11-44% in various reports.[1,2] Primary endoleaks, are those that appear within 30 days of stent-graft placement, while secondary, or delayed, endoleaks are those that appear after 30 days.[3] 70% of endoleaks tend to have spontaneous regression in six months following endovascular treatment. There are five types of endoleak. Type I endoleaks are those in which flow into the aneurysm sac originates a stent graft attachment site to the infrarenal neck or iliac arteries. Separation of the space between the arterial wall and the stent graft allows the direct flow of blood from the aorta into the aneurysm sac.

Neck angulation, severe calcification in distal zone and malposition of the stent-graft, under-dilation of the stent graft, a non-circular landing zone can cause type 1 endoleak.[4] Type I endoleaks can be divided further divided into type Ia endoleaks, which occur at the aortic neck attachment site, and type Ib endoleaks, which occur at the distal iliac attachment sites. Our patient had primary type 1b endoleak. Extension stent-graft or cuff, balloon angioplasty, bare stent, embolization and surgical conversion are treatment options for type1b endoleak. The best treatment depends on the patient and type of endoleak. We usually try to choose less-invasive methods.

As most of the leaks endoleaks tend to have spontaneous regression in six months, we decided to wait for a while following the procedure in our patient. But in the follow-up period, our patient had abdominal pain due to aneurysmal expansion at the level of celiac trunk. In order to facilitate adequate distal sealing zone, a hybrid approach was carried out including coeliac artery revascularization (right common iliac artery-coeliac artery bypass using otolog saphenous vein graft) and debranching with concomitant endovascular repair.

Hybrid repair refers to a combination of both open surgical and endovascular techniques. The renal and visceral arteries are vascularised using Dacron grafts from the iliac arteries followed by the en-

dovascular stent implantation to the diseased aortic segment. Hybrid repair is mainly indicated for type 2 and 3 TAAA. Although it reported to be inappropriate for type 4 aneurysms it has been used by some surgeons under unusual circumstance.[1-4] Paraplegia, stroke, dissection, renal impairment and endoleaks main drawbacks of hybrid repair. Respiratory failure and myocardial infarction have also been reported. Spesific complications related to this approach are prolonged ileus and pancreatitis. The rate of paraplegia in the hybrid series is lower than that of open repairs. Hybrid repair is superior to open repair especially in patients with previous aortic surgery.

The hybrid procedure is performed either in a single stage or in two stages. The odds of single stage procedure are elimination of interval rupture risk and preservation of visceral graft patency. Also stent grafts can be easily implanted through the abdominal aorta while it is open. Staged procedure has reduced complication rate becuse of reduced both operation time and the risk of paraplegia although interval rupture risk remains.

Fenestrated endovascular aneurysm repair is a technically challenging operation with increased cost and its role is still unclear. Other endovascular approaches containing sandwich, chiney or snorkel techniques are also complex and challenging with conflicting results.[5]

Although planned coeliac artery coverage during thoracic endovascular aortic repair is relatively safe in the presence of SMA-coeliac collaterals long-term results are undetermined.[6] Hybrid approach should be considered as an alternative to both open repair and endovascular treatment. We think that, it was an interesting case of leak management with hybrid approach consisting concomitant visceral artery revascularization and endovascular aneursymal repair.

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