CASE REPORT OLGU SUNUMU

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Type IIIb Endoleak Due to Graft Disruption in Thoracic Aortic Endovascular Stent Graft

Torasik Aort Endovasküler Stent Greft Gövde Harabiyetine Bağlı Tip IIIb Endoleak

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ABSTRACT Thoracic aortic aneurysms (TAAs) represent a substantial clinical challenge, primarily due to their association with high mortality rates. Thoracic endovascular aortic repair (TEVAR) has emerged as a favored therapeutic approach; however, its long-term efficacy can be compromised by complications such as Type IIIb endoleaks, which significantly influence patient outcomes. This case report details the occurrence of a late-onset Type IIIb endoleak in an 84-year-old male patient who had previously undergone TEVAR for a TAA. This specific complication was attributed to the deterioration and fragmentation of the stent graft body, resulting in the re-expansion of the aneurysm. A subsequent repeat TEVAR procedure was successfully performed to address this newly diagnosed Type IIIb endoleak. This case strikingly emphasizes the critical need for lifelong surveillance following TEVAR to facilitate the early detection and effective management of potential complications, thereby highlighting the persistent challenges related to long-term stent graft durability.

Keywords: Aortic aneurysm, thoracic; endovascular aneurysm repair; endoleak; graft survival; vascular grafting

ÖZET Torasik aort anevrizmaları (TAA), yüksek ölüm oranları nedeniyle önemli bir klinik zorluk teşkil etmektedir. Torasik endovasküler aort onarımı [thoracic endovascular aortic repair (TEVAR)], tercih edilen bir tedavi seçeneğidir, ancak Tip IIIb endoleak gibi uzun dönem komplikasyonlar hasta sonuçlarını önemli ölçüde etkileyebilir. Bu olgu sunumunda, TAA için TEVAR uygulanan 84 yaşında erkek hastada gelişmiş olan geç Tip IIIb endoleak olgusu tartışılmıştır. Buradaki komplikasyon, stent greft gövdesinin bozulması ve parçalanması ile karakterize olup, anevrizmanın yeniden genişlemesine yol açmıştır. Yeni teşhis edilen Tip IIIb endoleak'in tedavisi için tekrar TEVAR uygulanmıştır. Bu olgu, potansiyel komplikasyonları tespit etmek ve yönetmek için TEVAR sonrası yaşam boyu takibin önemini vurgulamakta, uzun dönem stent greft dayanıklılığı ile ilişkili zorlukların altını çizmektedir.

Anahtar Kelimeler: Aort anevrizması, torasik; iç sızıntı; greft ömrü; damar greftleme

Thoracic aortic aneurysms (TAAs) present a significant clinical challenge, primarily due to their association with high mortality rates. While thoracic endovascular aortic repair (TEVAR) has emerged as a preferred treatment modality due to its minimally invasive nature compared to traditional open surgery long-term complication scan compromise its efficacy. These complications include stent graft deterioration, endoleaks, and aneurysm re-expansion. Specifically, Type IIIb endoleaks are a complex issue, often resulting from an interplay of factors, such as stent graft manufacturing quality, implantation techniques, patient-specific anatomical variations, and post-operative hemodynamic stresses.[1] Stent graft body damage, arising from wear, tear, or material fatigue, can occur during implantation or develop over time.[2,3] This

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complication is life-threatening because it prevents complete stent graft apposition to the aortic wall, which promotes aneurysm persistence and progression. This report details a case of Type IIIb endoleak development following TEVAR, emphasizing the subsequent stent graft body deterioration and compromised graft integrity observed during follow-up. Verbal and written consent was obtained from the patients' family.

CASE REPORT

An 84-year-old male presented with cough and dyspnea. His significant medical history included lumbar disc herniation, cholecystectomy, long-term carbamazepine use for epilepsy, a recent herpes zoster infection, and a prior TEVAR for TAA. Surgical records indicated that a Lifetech Ancura (38 mm x 38 mm x 120 mm) stent graft (Lifetech Ankura™ AAA Stent Graft and Lifetech Ankura™ TAA Stent Graft; Lifetech Scientific, Shenzen, China) had been implanted 8 years earlier for TAA. This procedure involved closure of the left subclavian artery orifice using a plug and an axillo-axillary bypass performed with an 8 mm Dacron graft. Subsequent follow-up revealed a distal Type I endoleak, necessitating a 2nd stent graft extension with the same brand and dimensions [Lifetech Ancura (38 mm x 38 mm x 120 mm)]. Notably, details regarding balloon dilatation during these procedures were absent.

The patient's follow-up was irregular. A chest radiograph, obtained 16 months post-TEVAR, demonstrated proximal graft deformation and dilatation (Figure 1). He was then lost to follow-up for 8 years. A newly obtained thoracic computed tomography (CT) scan revealed a descending aortic aneurysm compressing the trachea and bronchi (Figure 2). The stent graft, positioned in zone 2, showed integrity at the aortic arch level but exhibited significant fragmentation and dilatation distally, with metal ring separations and an 82 mm length and 81 mm diameter true aneurysm appearance due to a Type IIIb endoleak (Figure 3). The distal graft extension remained intact.

Given the patient's age, fragility, recent zoster infection, and the feasibility of a 2nd TEVAR, a re-intervention was planned. Under local anesthesia and sedation, femoral artery access was established. The aortic arch and descending aorta, along with the deformed old TEVAR graft and Type IIIb endoleak, were visualized (Figure 4). A Medtronic (42mmx42mmx200mm) thoracic stent graft was deployed. The landing zone of the new graft was set to Zone 2, covering the proximal part of the old graft. The new stent graft was positioned to cover the entire aneurysm site and connect the 2 old grafts (Figure 5). The patient's hemodynamic course was stable, with

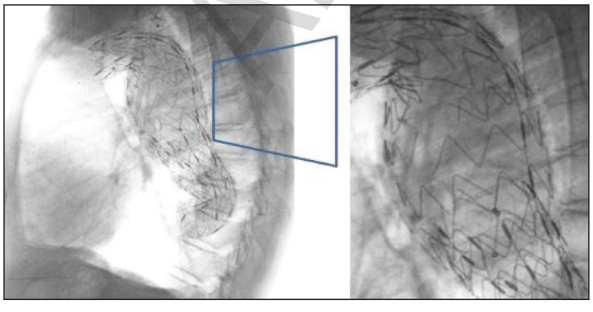

FIGURE 1: : Lateral chest radiograph obtained 16 months after the initial TEVAR procedure, demonstrating fusiform dilatation of the proximal graft and separations and fractures in the metal components.

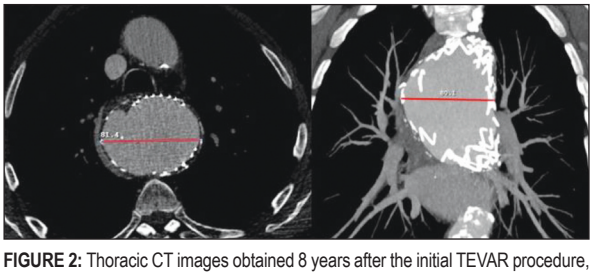

FIGURE 2: Thoracic CT images obtained 8 years after the initial TEVAR procedure, revealing an aneurysm reaching 81 mm in diameter and deformation and dilatation in the metal body of the graft

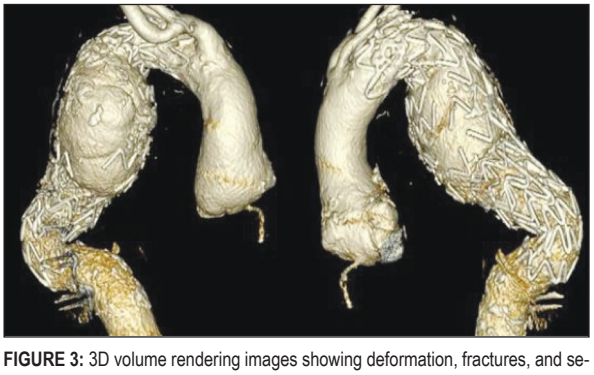

FIGURE 3: 3D volume rendering images showing deformation, fractures, and separations in the metal components of the TEVAR graft

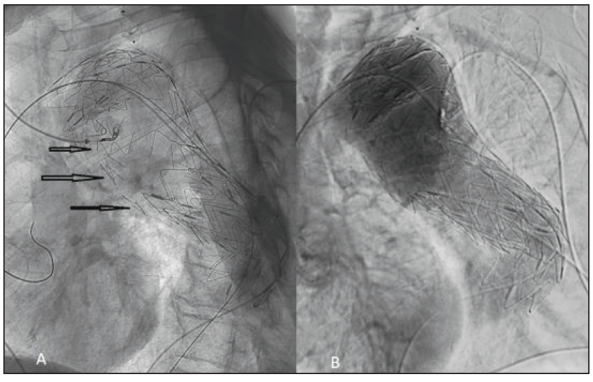

FIGURE 4: Images obtained from the angiography laboratory, demonstrating fractures and separations in the metal rings of the proximal graft. Type IIIb endoleak and contrast filling of the entire aneurysm sac are observed.

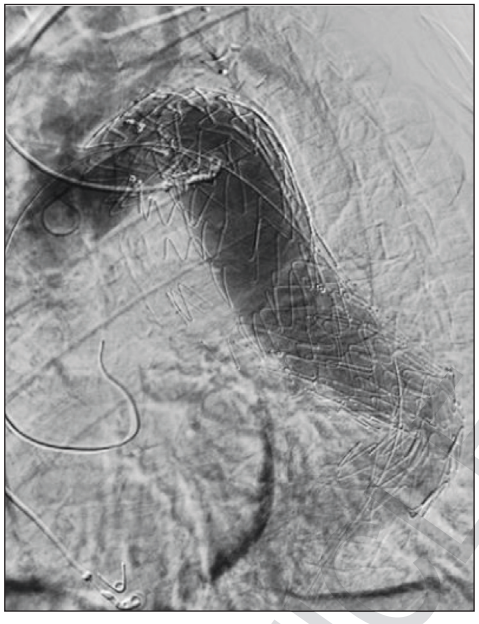

FIGURE 5: Images showing complete closure of the aneurysm sac with the new TEVAR procedure, with the metal components of the old graft remaining outside

persistent cough due to bronchial compression, but overall improvement. He was discharged on the 6th post-operative day.

DISCUSSION

This case highlights the inherent challenges in managing Type IIIb endoleaks following TEVAR, characterized by fractures and separations within the stent graft's metallic components. The occurrence of an initial Type I endoleak and the subsequent extension procedure in this patient underscore the potential for both early and recurrent complications associated with these interventions. The chest radiograph obtained at 16 months post-TEVAR clearly revealed deformation in the metallic structure of the proximal stent body and the development of fusiform aneurysmal dilatation within the graft (Figure 1). Based on this imaging, it can be inferred that while the exact onset of stent graft deformation remains unknown, it likely occurred within the first 16 months after the initial procedure. The significant progressive aneurysm dilatation observed 8 years post-TEVAR further emphasizes the evolving nature of these long-term complications (Figure 2).

Type IIIb endoleaks represent a serious and complex complication of endovascular procedures. Their etiology is multifactorial, potentially stemming from excessive device manipulation during deployment, improper balloon expansion, or intrinsic manufacturing defects.[4,5] A study published in 2021 on 83 TEVAR patients with Navion stent grafts reported no endoleaks within the 1st year, but graft deformation developed in 11 patients between 1-4 years post-procedure. Of these, 6 experienced aneurysms with stent ring enlargement, and 5 developed Type IIIb endoleaks due to suture line opening and stent fracture.[6] Furthermore, manufacturing-related microendoleaks at suture lines can present either during the procedure or several years thereafter.[7]

Consistent with these findings, Murakami et al. reported a Type IIIb endoleak a remarkable 16 years post-EVAR.[2] Similarly, small leaks at stent suture sites have been observed in various brands of explanted endografts removed from patients undergoing reoperation for aneurysm diameter growth.[8-10]

In a study published by Ueda et al., 62 consecutive patients who had Medtronic AneuRx endovascular grafts implanted were examined for an average of 5.1 years. Their findings indicated that 60% of grafts exhibited minor suture separation, 29% had major suture separation, 18% showed metal ring fracture, and 6% developed Type III endoleaks. Re-intervention was required in 15 of these patients.[11]

Determining the precise cause of deformation in the metallic structure of endografts remains challenging**.** It is hypothesized that the chronic pulsatile forces exerted by the heart on endografts lead to grad-

ual separations at material joint points over time, ultimately causing catastrophic deformation and fractures in the metallic components.[12-14] Based on the collective evidence from these studies, it can be concluded that Type III endoleaks in endovascular stent grafts may be associated with manufacturing errors, technical difficulties or complications during application, or material fatigue and deformation over time.

In our present case, the surgical report of the initial procedure lacked any record of balloon dilatation, which could have been a contributing factor. Importantly, imaging obtained 16 months after the procedure did not reveal any separation or slippage at the proximal and distal termination points of the endograft. Instead, the observed deformation in the graft was localized specifically to the body section of the proximal stent. As depicted in Figure 3, the thoracic CT images unequivocally demonstrated disruption of the integrity of the stent's metallic skeleton, with prominent separations and fragmentations in the metal components, indicative of significant body damage. These separations manifested as detachment of the metallic components from the polyester sheath's suture sites and distinct fractures in the metallic wires (Figure 2, Figure 3, Figure 4, Figure 5). Furthermore, as evidenced by the CT images, the damage within the graft extended beyond mere separation of metal rings from joint points and metal fractures; it also involved notable deformation in the polyester sheath, suggesting a more widespread material failure.

This case exemplifies the complex long-term complications and inherent treatment challenges that can arise following TEVAR. Stent graft damage, endoleak, and aneurysm re-expansion are critical factors that can significantly compromise TEVAR success. While factors such as stent graft material issues, implantation technique, patient anatomical characteristics, and comorbidities can increase the risk of complications, material fatigue over time must also be considered a substantial independent risk factor for complication development. Therefore, lifelong regular follow-up of patients after TEVAR and timely detection and treatment of potential complications are of paramount importance.

Source of Finance

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Mehmet Beşir Akpınar;* ***Design:*** *Mehmet Beşir Akpınar;* ***Control/Supervision:*** *Mehmet Beşir Akpınar, Hüseyin Okutan;* ***Data Collection and/or Processing:*** *Mehmet Beşir Akpınar, Elnur Mammadlı;* ***Analysis and/or Interpretation:*** *Mehmet Beşir Akpınar;* ***Literature Review:*** *Mehmet Beşir Akpınar;* ***Writing the Article:*** *Mehmet Beşir Akpınar;* ***Critical Review:*** *Mehmet Beşir Akpınar, Hüseyin Okutan;* ***References and Fundings:*** *Mehmet Beşir Akpınar, Elnur Mammadlı;* ***Materials:*** *Mehmet Beşir Akpınar, Hüseyin Okutan, Elnur Mammadlı.*

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