

Ten-year patency of functionally expanded polytetrafluoroethylene coronary graft detected in an urgent cardiac surgery

Acil kalp cerrahisi sırasında saptanan on yıllık fonksiyonel olarak genişletilmiş politetrafloroetilen koroner greft açıklığı

Bülent Uzunlar,¹ Ahmet Karabulut,¹ Zeki Doğan,¹ Batuhan Özay²

Institution where the research was done:

Department of Cardiology, İstanbul Medicine Hospital, İstanbul, Turkey

Author Affiliations:

Departments of ¹Cardiology, ²Cardiovascular Surgery, İstanbul Medicine Hospital, İstanbul, Turkey

Functionally expanded polytetrafluoroethylene (ePTFE) grafts have not been preferred as a coronary conduit due to their low patency rates. In this article, we report a 69-year-old male case who was operated 10 years ago with an ePTFE coronary conduit. During percutaneous intervention of coronary conduit, perforation was observed and patient was operated immediately. Usage of ePTFE graft was confirmed during surgery. This case report produces an evidence for the long-term patency of ePTFE graft. It also shows a higher complication risk for percutaneous ePTFE grafts compared to the native autologous conduits.

Keywords: Coronary conduit; expanded polytetrafluoroethylene graft; patency rate.

Making a rational choice for a bypass conduit is important for long-term patency in coronary artery bypass grafting (CABG). Although prosthetic and synthetic grafts are widely used in peripheral bypass operations, they are still the last resort in CABG because of their low patency rate.^[1] Herein, we present a case of coronary bypass graft perforation as a complication after percutaneous intervention. During urgent surgery, it was confirmed that the bypass conduit was actually an expanded polytetrafluoroethylene (ePTFE) graft which coronary angiography had indicated was a probable venous graft. The patient had undergone CABG surgery 10 years earlier, but there was no

Fonksiyonel olarak genişletilmiş politetrafloroetilen (ePTFE) greftler, düşük açıklık oranları nedeniyle koroner kondüit olarak tercih edilmemektedir. Bu yazıda, ePTFE koroner kondüit ile 10 yıl önce ameliyat olan 69 yaşında bir erkek olgu sunuldu. Koroner kondüite perkütan girişim sırasında perforasyon gelişmesi üzerine hasta acil ameliyata alındı. Ameliyat sırasında ePTFE greft varlığı saptandı. Bu olgu, ePTFE greftlerinin uzun süreli açık kalabileceğine ilişkin bir kanıt oluşturmaktadır. Ayrıca, perkütan girişim uygulanan ePTFE greftlerinde, nativ olog kondüitlere kıyasla, komplikasyon riskinin daha yüksek olabileceğini göstermektedir.

Anahtar sözcükler: Koroner kondüit; genişletilmiş politetrafloroetilen greft; açıklık oranı.

documentation regarding this surgical procedure. To our knowledge, there have been only two reported case of long-term patent ePTFE coronary grafts (12 and 9.5 years, respectively), which would make our case featuring a patency duration of 10 years just the third to be reported.^[2,3]

CASE REPORT

A 69-year-old male patient presented to our facility with recurrent chest pain. He had undergone a three-vessel CABG operation 10 years previously and was taking medication for hypertension and dyslipidemia. An electrocardiogram showed left ventricular hypertrophy with sinus rhythm, and an



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Correspondence: Ahmet Karabulut, M.D. İstanbul Medicine Hospital, Kardiyoloji Kliniği, 34203 Güneşli, Bağcılar, Turkey.

Tel: +90 212 - 489 08 00 e-mail: drkarabulut@yahoo.com

echocardiogram revealed concentric left ventricular hypertrophy with a 60% left ventricular ejection fraction (LVEF). There was also evidence of ischemia in the exercise stress test, so coronary angiography was scheduled. The left anterior descending artery (LAD), circumflex artery (Cx), and right coronary artery (RCA) were occluded from the proximal segments. In addition, the internal thoracic artery-LAD graft was patent, and 98% stenosis was present in the middle segment of the bypass graft anastomosed to the Cx (Figure 1). Moreover, a third graft was also occluded from the ostium. Afterwards, percutaneous coronary intervention was proposed for the Cx graft. Following the predilation of the lesion, a 4.0x20 mm bare metal stent was deployed at the stenotic segment, and a control contrast injection showed a perforation through the stent's struts (Figure 2). This perforation could not be closed with the deployment of subsequent stents, and the patient was transferred to the operating room for urgent surgery in which two venous grafts were anastomosed to the RCA and Cx, resulting in the successful closing of the perforation. Additionally, we confirmed that the perforated bypass graft was an ePTFE graft which we initially thought was a venous conduit. Unfortunately, despite the closure of the perforation and additional bypass surgery, the patient died due to postoperative respiratory failure.

DISCUSSION

Choosing an appropriate conduit for CABG can go a long way toward ensuring a longer patency rate as well as a favorable prognosis. The internal thoracic

artery and greater saphenous vein are the first-line conduit choices, but the short saphenous vein, upper extremity veins, radial artery, and stated visceral arteries have been used in some cases.^[1,4] However, there is limited availability of these grafts, especially for reoperations, and the associated comorbidities have led to the necessity of distinct bypass conduits, including those that are synthetic. The ePTFE graft is one of the well-known synthetic conduits that has been widely used in peripheral surgery with satisfactory long-term results. However, the use of ePTFE grafts for CABG surgery is usually not proposed because of their lower patency rates.^[1,2] However, it must be noted that the majority of the studies on the use of ePTFEs were done approximately 30 years ago, and the three-year patency rate at that time was 14%.^[5] The ePTFE is an inert fluorocarbon polymer with an electronegative luminal surface. The polymer is non-biodegradable, and the graft is rigid and non-elastic with a low compliance. In addition, the lumen of the ePTFE also lacks an endothelial cell lining which contributes to its poor patency.^[1] In cases in which other conduits are unavailable, hybrid therapy is often suggested before the use of ePTFE grafts.^[1] Thus, ePTFE grafts are generally proposed as a last resort for a CABG conduit, and this is also true at our facility. For this patient, the ePTFE was used despite the availability of venous grafts in the final presentation. On the other hand, the long time patency of ePTFE grafts has been reported in various case reports.^[2,3] McLarty et al.^[2] reported a 12-year patency for ePTFE bypass grafts and proposed that this could be related to high blood flow, larger



Figure 1. Left anterior oblique and anterior caudal projection showing the critical stenosis in the middle segment of the coronary graft anastomosed to the circumflex artery.

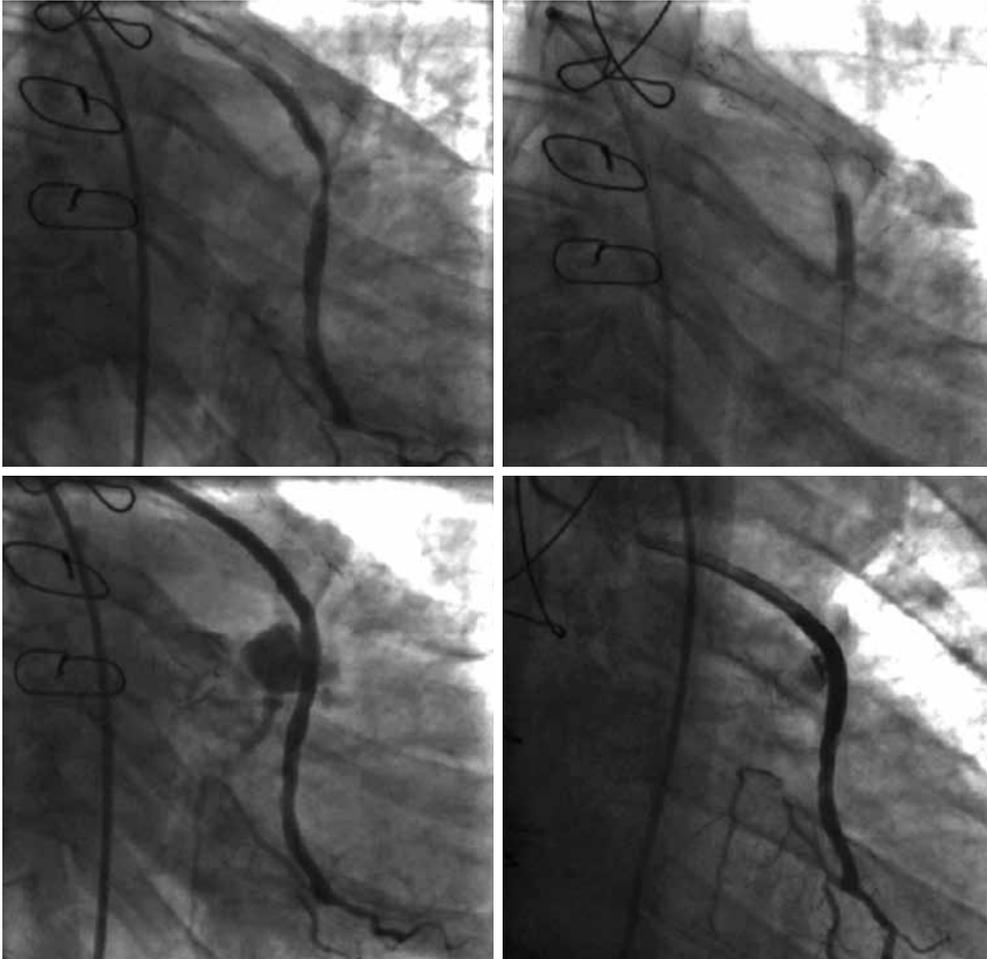


Figure 2. Views of the stenotic bypass graft after predilatation and stent deployment. The extensive perforation through the stent's struts can be seen on the left lower part of the image.

graft diameters, distal run-off in the target vessel, preserved left ventricular function, and/or effective antiplatelet therapy. They also speculated that the circular sequential configuration of the graft could be associated with the longer patency in their study. Our patient also had preserved left ventricular function with rapid run-off in the native vessel. He was taking aspirin and statin therapy at presentation; hence, dyslipidemia was speculated as another factor that might have influenced the long-term patency of the ePTFE graft.^[3] Furthermore, the graft diameter utilized in our patient was >4 mm, which could have been also contributed to the 10-year patency rate.

Long-term stenosis in the ePTFE graft usually occurs secondarily to pseudointimal proliferation rather than thrombosis.^[1,2] Furthermore, it is conceivable that the rigid, non-elastic structure of the ePTFE graft might be the major source of perforation. Despite the appropriate stent diameter,

the perforation in our patient occurred through the stent's struts, leading to the hypothesis that the graft's tough neointimal texture might have caused excessive pressure on the thin-walled ePTFE graft after the stent deployment. However, in the end, we determined that the non-compliant, stiff ePTFE wall was the reason for the perforation. Martin et al.^[6] reported that percutaneous intervention of the ePTFE graft was limited to arteriovenous fistulas in hemodialysis patients. In their series, percutaneous angioplasty was performed only on stenotic segments, and although the long-term patency was lower than expected, they included no data regarding the technical aspects of the intervention or the complication rates.^[6]

Peripheral percutaneous intervention of ePTFE grafts remains a mystery, and to our knowledge, no other reports on this topic exist in the literature. Therefore, further studies are needed regarding this procedure so that the difficulties and complication rates

associated with it can be clarified. Thus, additional documentation of CABG surgery featuring the use of synthetic grafts is crucial for further follow up and to guide future upcoming coronary interventions.

Conclusion

Although ePTFE grafts have not been recommended in the past as coronary conduits, long-term patency is possible when they are employed, as demonstrated by our case. Studies concerning the endothelial cell seeding of ePTFE grafts provide hope for the use of synthetic grafts in the future, and improvements in vascular tissue engineering may make the use of synthetic grafts more clinically viable. In addition, CABG performed with ePTFE grafts should be well documented to guide future percutaneous intervention in patients with stenosis. Hence, the complication rates might be higher in interventions involving percutaneous ePTFE grafts because of their rigid, non-compliant texture.

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