

Treatment of Proximal Left Anterior Descending Artery Aneurysm by Stent-graft Implantation: A Case Report with Adverse Long-term Outcome

Alpay SEZER, MD, Aytaç ÖNCÜL, MD, Ercüment YILMAZ, MD, Mehmet MERİÇ, MD
Istanbul University, Istanbul Faculty of Medicine, Department of Cardiology, Istanbul, Turkey

PROKSİMAL SOL ÖN İNEN ARTER ANEVİZMASININ STENT-GREFT İMPLANTASYONU İLE TEDAVİSİ: UZUN DÖNEMDE OLUMSUZ SONUÇ ALINAN BİR VAKA

ÖZET

Koroner arter anevrizmalarının koroner arterlere stent-graft yerleştirilerek güvenli ve hızlı bir şekilde tedavi edilebileceği bildirilmiştir. Ancak bu uygulamayla ilgili olarak büyük hasta gruplarında elde edilmiş uzun dönem sonuçları henüz mevcut değildir. Bu makalede koroner arterde herhangi bir anlamlı darlık olmaksızın anterior miyokard enfarktüsü ile açığa çıkan bir sakküler proksimal sol ön inen arter anevrizması olgusu takdim edilmiştir. Koroner arter anevrizması politetrafloroetilen kaplı bir stent ile başarıyla kapatılmış, ancak işlemden iki ay sonra hastada anterior reenfarktüs meydana gelmiştir. Koroner anjiyografide anevrizmanın tekrar ortaya çıkmadığı, ancak stentin proksimal kenarında sol ön inen arter ostiumuna doğru uzanan ciddi derecede fokal bir daralmanın olduğu görülmüştür. Bu nedenle hastaya koroner arter bypass cerrahisi uygulanmıştır. Hasta ameliyattan sonraki üç aylık takipte asemptomatiktir.

Anahtar kelimeler: Koroner arter anevrizması, PTFE kaplı stent

Coronary artery aneurysm is defined as coronary dilatation which exceeds the diameter of normal adjacent segments by 1.5 times. It is an uncommon angiographic finding reported in %0.3-4.9 of the patients (1,2). The most common etiology is atherosclerosis followed by Kawasaki's disease and congenital aneurysms (2). Other possible causes of coronary aneurysms include coronary interventions, arteritis, mycotic emboli, dissection and trauma (1,2). The natural history and prognosis are not well defined, and myocardial infarction or sudden death may occur

due to thrombosis, embolism or rupture (2). Controversies exist regarding the choice of surgical or medical treatment in symptomatic patients. Recently, stents covered with autologous venous tissue (3) or expandable synthetic material (4-6) were successfully used for the management of coronary artery aneurysms. This report describes our first experience with the polytetrafluoroethylene (PTFE)-coated coronary artery stent implanted to seal a prominent saccular aneurysm of proximal left anterior descending artery (LAD).

CASE REPORT

A 54-year-old man with a history of hypertension, hyperlipidemia and smoking was admitted to our department for a scheduled coronary angiography procedure three weeks after his acute anterior myocardial infarction. The patient had not received thrombolytic therapy because of late admission (13 hours after the onset of chest pain) to another hospital after relief of his symptoms. QS waves in leads V1, V2 and V3 with mild ST elevation and R voltage loss in leads V4 and V5 were present on his electrocardiogram (ECG) recorded three weeks ago. He had been treated with heparin, aspirin, metoprolol, lisinopril, nitrates and simvastatin in the coronary care unit of that hospital and the course was uneventful. The predischarge echocardiography on day 7 showed mild left ventricular dilatation and moderate left ventricular dysfunction due to regional wall motion abnormalities in apical, septal and anterior segments. A coronary angiography was planned considering the patient's multiple coronary risk factors and the presence of moderate left ventricular dysfunction.

At the admission to our department, physical examination of the patient was unremarkable and the ECG was unchanged. The chest X-ray showed mild left ventricular enlargement and knitted old fracture of left clavicle. The patient had suffered a traffic accident 4 years ago resulting in the fracture of his left clavicle and five ribs on the left side. The biochemical analyses and blood count were in normal limits except persisting mild elevation of Troponin-T level (0.35 ng/ml). Coronary angiography demonstrated a prominent saccular aneurysm of proximal LAD, measuring 8.1x5.2 mm (Fig.1). The aneurysm was connected to the body of LAD with a neck of 3.2 mm diameter and it sho-

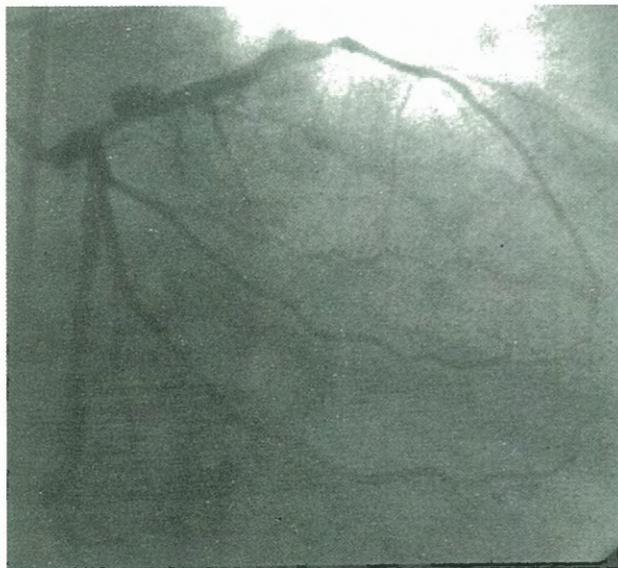


Figure 1. Coronary angiogram of the left coronary artery in the right anterior oblique projection with caudal angulation: There is a prominent saccular aneurysm at the proximal part of the left anterior descending artery.

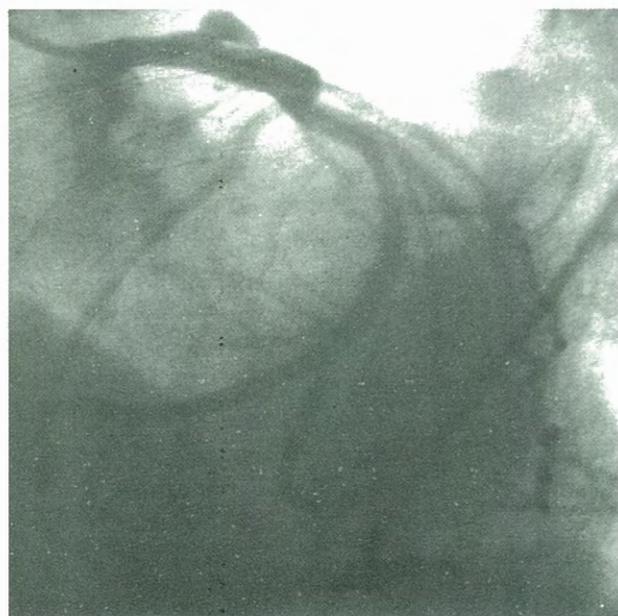


Figure 2. Coronary angiogram of the left coronary artery in the left anterior oblique projection, demonstrating the neck and the saccular shape of the proximal left anterior descending artery aneurysm.

wed late clearance of the contrast agent (Fig.2). Any significant stenosis of the coronary artery tree was not observed. An intravascular ultrasound (IVUS) was not performed. Following the administration of 10000 IU of heparin and 500 mg of ticlopidine a 3.0x16 mm PTFE-coated coronary artery stent (Jostent graft, Jomed Implantate GmbH, Rangendingen, Germany) was implanted to the proximal LAD with a recommended high dilation pressure of 15 atmospheres in 35 seconds. This resulted in complete obliteration and disappearance of the aneurysm, and a

regular coronary artery segment with normal angiographic flow dynamics was obtained (Fig.3). The luminal diameter at this site was 3.2 mm. Two minor septal branches were also occluded by the stent-graft, but no chest pain and ECG or enzyme changes were observed. The patient was discharged 4 days after the procedure on aspirin, ticlopidine, lisinopril and simvastatin.

Six weeks after the procedure, he was asymptomatic and ticlopidine was discontinued. However, he presented with anterior reinfarction 2 months after stent implantation. Thrombolytic therapy with t-PA was applied 2 hours after the onset of chest pain and early reperfusion was achieved. The patient experienced recurrent episodes of chest pain accompanied with ECG changes in the coronary care unit, and responded to beta-blocker and nitrate therapy. Coronary angiography demonstrated sustained occlusion of the coronary aneurysm and a severe but focal stenosis of 95% at the proximal edge of the stent, involving the ostium of LAD (Fig. 4). The patient was referred to urgent coronary bypass surgery, and he underwent uncomplicated bypass grafting with placement of left internal mammary artery graft to mid-LAD. He is asymptomatic 3 months after the operation.

DISCUSSION

We present a case of saccular proximal LAD aneurysm associated with myocardial infarction in the absence of a stenotic lesion treated with a PTFE-coated stent. The wall motion abnormality was consistent with a proximal LAD obstruction. There may be several explanations for the pathogenesis of anterior myocardial infarction in this patient: The saccular morphology of the aneurysm in the presence of a neck is in favor of a pseudoaneurysm. Thus, a ruptured atherom plaque leading to thrombosis and infarction may also have triggered the development of a pseudoaneurysm by causing local dissection and injury in the arterial wall. Other possible mechanisms may be thrombus formation as a complication of an atherosclerotic true aneurysm or a traumatic pseudoaneurysm^(1,2). The patient has multiple risk factors for atherosclerosis, and he had also experienced a blunt chest trauma four years ago which may have caused injury to the vessel wall and promoted the formation of an aneurysm. In each different mechanism, one can speculate that the thrombus was eliminated subsequently by the intrinsic fibrinolytic system and anticoagulant therapy. IVUS may have been helpful in clarifying the underlying mechanism: The differentiation of a false aneurysm from a true aneurysm can be done by using IVUS⁽⁷⁾, and a ruptured coronary plaque or a thinned media layer can be visualized. We did not perform

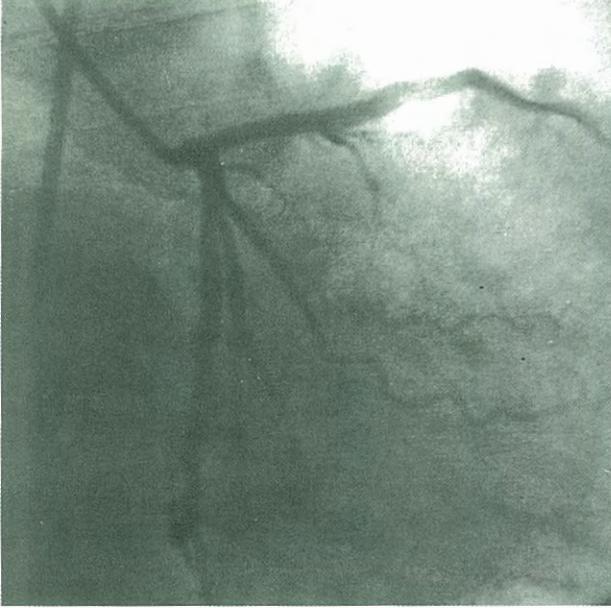


Figure 3. Coronary angiogram after stent-graft implantation, showing complete obliteration and disappearance of the coronary aneurysm. A regular coronary artery segment with normal angiographic flow dynamics was obtained, but two minor septal branches were also occluded by the stent-graft.

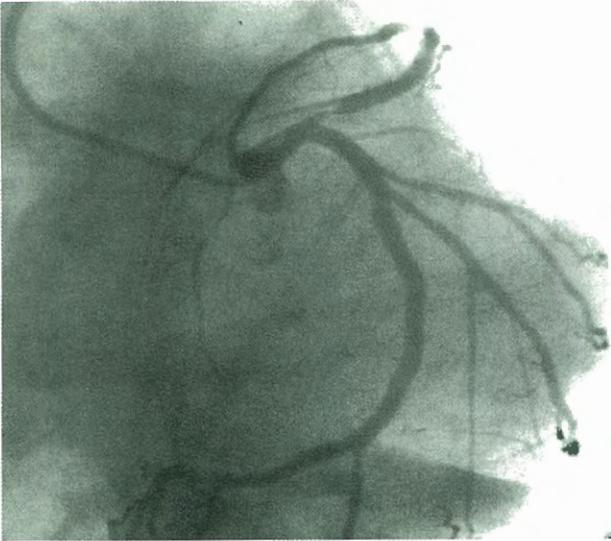


Figure 4. Coronary angiogram performed after anterior reinfarction: The coronary aneurysm is still not visible, but a severe focal stenosis occurred at the proximal edge of the stent, involving the ostium of left anterior descending artery.

IVUS in our patient, because the technical equipment was not available at that time, and the patient refused to undergo a second diagnostic catheterization procedure. The cost of the IVUS catheter was played an important role in his decision. Moreover, we thought that the information gained with this technique would not have changed the treatment

strategy for this prominent saccular aneurysm associated with myocardial infarction and carrying a risk for rupture.

The coronary artery aneurysm of our patient was successfully obliterated using a unique stent-graft without any complication. This new device is constructed using a sandwich technique whereby an ultrathin layer of expandable PTFE is placed between two stents. The cells of the stents are covered with PTFE and therefore it interrupts blood flow to an aneurysm, but also to adjacent side branches after deployment. Thus, the presence of a significant side branch is a major limitation for the use of this device. In our case, a major side branch was not present at the implantation site. Only two small septal branches were occluded (Fig.3), and this was not accompanied by chest pain and ECG or enzyme changes. By using IVUS, the exact position and width of the orifice of the aneurysm can be detected and the best place for stent deployment can be identified. In our case, this was not obligatory because the neck of the aneurysm could be visualized angiographically. On the other hand, IVUS may be very useful in more complex cases: Heuser et al. (4) reported that they had to implant a second PTFE-coated stent-graft to achieve complete occlusion of a right coronary artery aneurysm developed after implantation of two overlapping stents. IVUS guidance was not used in this procedure.

Another important aspect of the PTFE-coated stent is prolonged duration of in-stent epithelization. Therefore, we continued the administration of ticlopidine for six weeks instead of four weeks to prevent late thrombosis (8). Others used this drug for only four weeks after stent-graft application without occurrence of late thrombosis (6), or lengthened this period to 10 weeks after stenting of aortocoronary vein grafts (9). Large randomized trials with this coated stent are necessary to determine the appropriate duration of ticlopidine administration. In our case, late thrombosis of the stent is unlikely, and the cause of reinfarction seems to be the severe stenosis at the proximal edge of the stent, which also provoked postinfarction angina in the coronary care unit when the patient was at rest and under antiplatelet and anticoagulant therapy.

Our case represents one of the few examples of stent-graft implantation to obliterate a proximal

LAD aneurysm lying close to the left main coronary artery (6). Most of the cases in the literature were right coronary artery aneurysms (4,5). In addition, a critical stenosis of the coronary artery accompanied the aneurysm in the majority of the patients (5,6). The stent-graft was used to treat both the stenosis and the aneurysm in these cases. In our case a stenotic lesion was not present, and we implanted the PTFE-coated stent only to obliterate the saccular coronary aneurysm in order to protect the patient from possible life-threatening complications, including rupture of the coronary artery and reinfarction. Promising preliminary results about the long-term patency of the PTFE-coated stent-graft encouraged us for this intervention (5,9,10). Although sustained obliteration of the aneurysm was achieved, implantation of the stent-graft triggered the occurrence of a severe stenosis at the proximal LAD resulting in reinfarction and recurrent episodes of ischemia, and the patient had to undergo coronary bypass surgery. Thus, the intervention instead of the coronary aneurysm provoked recurrent ischemia and reinfarction. In previous reports published before the era of graft-stents, surgery has been recommended for coronary artery aneurysms in symptomatic patients with ischemia or myocardial infarction and in the presence of saccular aneurysms (11,12). However, these recommendations have been based on experience rather than controlled trials, and surgical intervention is a difficult decision in the absence of a significant stenosis because the outcome of these patients is unpredictable. Coronary artery rupture seems to be a rare complication (13,14), and patients with nonobstructive coronary artery aneurysms may do well under medical treatment consisting of antiplatelet and anticoagulant agents (15). Taking these data and the adverse experience in our patient into account, we would also not recommend stent-graft implantation for coronary artery aneurysms if a concomitant significant stenosis is not present. In such situations, this treatment option should be reserved for patients with recurrent ischemic events due to coronary artery aneurysm despite optimal anticoagulant and antiplatelet therapy. Expansion of the coronary aneurysm is another reasonable indication for interventional therapy (4). On the other hand, the observations available in the present time support the suggestion that the PTFE-coated stent-graft implantation is a quick and easy option for the treatment of symptomatic patients with

coronary artery aneurysms accompanied with significant stenoses (5,6). Randomized trials in large patient groups are required to confirm the safety and efficacy of this new device.

REFERENCES

- Barettella MB, Bott-Silverman C:** Coronary artery aneurysms: an unusual case report and review of the literature. *Cathet Cardiovasc Diagn* 1993; 29:57-61
- Syed M, Lesch M:** Coronary artery aneurysm: a review. *Prog Cardiovasc Dis* 1997; 40:77-84
- Gruberg L, Roguin A, Beyar R:** Percutaneous closure of a coronary aneurysm with a vein coated stent. *Cathet Cardiovasc Diagn* 1998; 43:308-10
- Heuser RR, Woodfield S, Lopez A:** Obliteration of a coronary artery aneurysm with a PTFE-covered stent: endoluminal graft for coronary disease revisited. *Catheter Cardiovasc Interv* 1999; 46:113-6
- Kolettis TM, Kyriakides ZS, Kremastinos DT:** Treatment of a coronary artery aneurysm with a novel stent. *Clin Cardiol* 1999; 22:759-61
- Von Birgelen C, Haude M, Liu F, et al:** Treatment of coronary pseudoaneurysm by stent-graft implantation. *Dtsch Med Wochenschr* 1998; 123:418-22
- Regar E, Klauss V, Henneke KH, Werner F, Theisen K, Mudra H:** Coronary aneurysm after bailout stent implantation: diagnosis of a false lumen with intravascular ultrasound. *Cathet Cardiovasc Diagn* 1997; 41:407-10
- Bosmans JM, Claeys MJ, Dilling D, Vrints CJ:** Unsuccessful long-term outcome after treatment of a vein graft false aneurysm with a polytetrafluoroethylene coated Jostent. *Catheter Cardiovasc Interv* 2000; 50:105-8
- Baldus S, Koster R, Elsner M, et al:** Treatment of aortocoronary vein graft lesions with membrane-covered stents: a multicenter surveillance trial. *Circulation* 2000; 102:2024-27
- Lukito G, Vandergoten P, Jaspers L, Dendale P, Benit E:** Six months clinical, angiographic, and IVUS follow-up after PTFE graft stent implantation in native coronary arteries. *Acta Cardiol* 2000; 55:255-60
- Ebert PA, Peter RH, Gunnels JC, Sabiston DC:** Resecting and grafting of coronary artery aneurysm. *Circulation* 1971; 43:593-8
- Alford WC Jr, Stoney WS, Burrus GR, Frist RA, Thomas CS Jr:** Recognition and operative management of patients with arteriosclerotic coronary artery aneurysms. *Ann Thorac Surg* 1976; 22:317-21
- Swaye PS, Fisher LD, Litwin P, et al:** Aneurysmal coronary artery disease. *Circulation* 1983; 67:134-8
- Tunick PA, Slater J, Kronzon I, Glassman E:** Discrete atherosclerotic coronary artery aneurysms: a study of 20 patients. *J Am Coll Cardiol* 1990; 15:279-82
- Wang KY, Ting CT, St John Sutton M, Chen YT:** Coronary artery aneurysms: a 25-patient study. *Catheter Cardiovasc Interv* 1999; 48:31-8