Stent-Related Popliteal Artery Infection After Aspiration Thrombectomy, Nitinol Stenting and Thrombolysis

Aspirasyon Trombektomisi ve Nitinol Stentleme Sonrası Gelişen Stente Bağlı Popliteal Arter Enfeksiyonu ve Cerrahi Tedavisi

İsa COŞKUN, MD,[a]
Orhan Saim DEMİRTÜRK, MD,[a]
Hüseyin Ali TÜNEL, MD,[a]
Meltem AÇIL, MD,[b]
Uğur ÖZKAN, MD,[c]
Öner GÜLCAN, MD[a]

Clinics of
[a]Cardiovascular Surgery,
[b]Anesthesiology and Reanimation,
[c]Interventional Radiology,
Başkent University
Adana Research and Training Center,
Adana

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Yazışma Adresi/*Correspondence:*
Orhan Saim DEMİRTÜRK, MD
Başkent University
Adana Research and Training Center,
Clinic of Cardiovascular Surgery, Adana,
TÜRKİYE/TURKEY
osdemirturk@yahoo.com

ABSTRACT We present a case of nitinol stent-related popliteal artery infection after aspiration thrombectomy and thrombolysis in a 74-year-old patient who was"admitted to the interventional radiology department of our institution instead of cardiovascular surgery because of his comorbidities and the chronicity of his thromboses. Occlusion due to chronic thromboembolism was demonstrated in the right femoral, popliteal and proximal crural arteries. Thromboaspiration was performed. A stent was implanted in the popliteal artery because of accidental intimal dissection. Ten days later in-stent thrombosis was detected. Tissue plasminogen activator was administered. A second stent was implanted proximal to the original stent. Upon detection of high fever, color Doppler ultrasonography was performed. A large hematoma and pseudoaneurysm with stent thrombosis were detected. Surgical intervention was indicated as stent infection and thrombosis were likely. Debridement and saphenous vein femoropopliteal bypass were performed. The patient has no claudication 33 months after the operation. Antibiotic prophylaxis should be administered to high-risk patients requiring long-term endovascular therapy with percutaneous aspiration thrombectomy, intraluminal catheter and stent application.

Key Words: Endovascular therapy; stent infection; aspiration thrombectomy; nitinol stent; surgical treatment

ÖZET Bu çalışmamızda sağ alt ekstremite arteriyel trombozu nedeniyle kurumumuza başvuran, yandaş hastalıklarıyla kronik zemini nedeniyle cerrahi tedavi yerine girişimsel radyoloji bölümümüze kabul edilen ve aspirasyon trombektomisi uygulanması sonrası nitinol stent yerleştirilen 74 yaşındaki erkek hastanın nitinol stente bağlı enfeksiyonu sunulmaktadır. Sağ femoral, popliteal ve proksimal krural arterlerde kronik tromboemboli gösterildi. Tromboaspirasyon yapıldı. Tromboaspirasyonda oluşan intimal diseksiyon nedeniyle popliteal artere stent yerleştirildi. On gün sonra stent içi tromboz saptandı. Doku plazminojen aktivatörü uygulandı. İlk stentin proksimaline ikinci bir stent yerleştirildi. Yüksek ateş saptanması üzerine renkli Doppler ultrasonografisi yapıldı. Büyük bir hematom ve yalancı anevrizma ile stent trombozu saptandı. Stent enfeksiyonu ve tromboz oluşumu kuvvetle muhtemel olduğu için cerrahi tedavi endikasyonu oluştu. Debridmanı takiben safen ven ile femoropoliteal bypass yapıldı. Hasta ameliyattan 33 ay sonra klodikasyosuz yaşamaktadır. Uzun sürecek endovasküler tedavilerde yüksek riskli hastalara perkütanöz aspirasyon trombektomisi, intralüminal kateter ve stent uygulaması gerekecekse profilaktik antibiyotik uygulanmalıdır.

Anahtar Kelimeler: Endovasküler tedavi; stent enfeksiyonu; aspirasyon trombektomisi; cerrahi tedavi

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Endovascular techniques have been used as a therapeutic option in patients with lower extremity arterial thromboembolism.[1] Percutaneous aspiration thrombectomy (PAT) is widely used as an adjunct to

stent placement and thrombolysis in endovascular therapy. Complications following stent insertion include stent thrombosis and prolapse of the stent.[2] Septic complications after percutaneous transluminal intra-arterial procedures are rarely encountered.[3] Stent-related endarteritis is also a rarely observed complication.[2,4] In this case report, we present a patient in whom endovascular intervention was used to treat femoropopliteal acute thromboembolism that developed due to early stent-related popliteal artery suppurative endarteritis. Medline search of the English literature indicated that this is the first reported case of stent-related infection after percutaneous aspiration thrombectomy, thrombolysis and nitinol stenting of the popliteal artery.

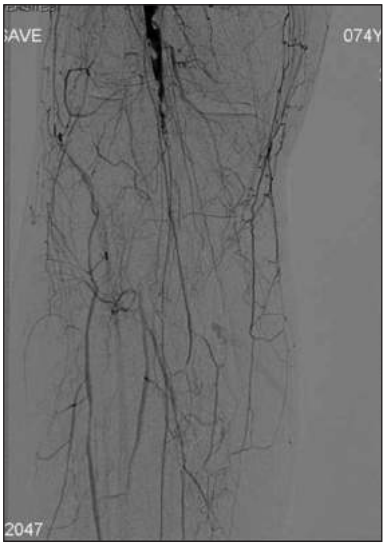

FIGURE 1a: Right lower extremity angiography before first stenting.

CASE REPORT

A 74-year-old male patient was admitted to our hospital with claudication in the right lower extremity for a duration of 10 days with the presence of a blue-colored foot for 3 days. He was hypercholesterolemic and a smoker for the last 50 years. No other risk factors for atherosclerosis were identified. Upon his physical examination, all left lower extremity pulses were palpable. However, the right lower extremity pulses were absent with exception of the femoral artery. He had a blue discoloration below the knee with sensation of coldness and pain. No motor or sensory loss was present. Right lower extremity angiography was performed revealing occlusion of the popliteal artery and all three proximal crural arteries (Figure 1a).

Endovascular approach was chosen because the patient first applied to the interventional radiology department and as well as the fact that subacute occlusion of all three proximal right extermity crural arteries with thrombus was present. They could selectively be entered and aspirated using endovascular technique.

Occlusion due to thromboembolism was demonstrated in the right popliteal and proximal crural arteries. Thromboaspiration was performed on the thrombi in the popliteal and crural arteries using 5F and 6F guide catheters. A dissection accidentally occured in the popliteal artery during thromboaspiration, which required implantation of a self-expanding 6x40 mm nitinol stent (Protege GPS, EV3, St. Paul, MN, USA) in the popliteal artery (Figure 1b). Control angiography showed recanalization.

The patient received anticoagulation therapy with heparin (5000 U bolus and 1000 U of infusion thereafter) during and after the procedure. The dose of heparin was adjusted to a target aPTT of 60-90s. Acetyl salicilic acid at a dose of 300 mg/day was initiated after endovascular treatment to be continued indefinitely. The patient was discharged following the addition of warfarin sodium therapy with the target international normalized ratio (INR) maintained at 2-3. Unfortunately the patient was once again admitted with a blue-colored foot and pain in the same extremity ten days after discharge.

Color doppler ultrasonography indicated in-stent thrombosis. The patient was taken to the interventional angiography laboratory and had an infusion catheter (5F catheter, ev3, California, USA) inserted into the lumen of the present stent to infuse tPA (tissue plasminogen activator) at a dose of 1mg/ hour (Figure 2a). Residual thrombi were aspirated 4 hours later. A second stent was implanted proximal to the original stent (Protege GPS, EV3, St. Paul, MN, USA) (Figure 2b). The patient was

FIGURE 1b: Right lower extremity angiography after the first stenting.

then transferred to the in-patient clinic. He was, heparinized and then warfarinized (Heparin was given at a dose of 5000 IU intravenously bolus, and was continued intravenously (1000IU/h)).

Upon detection of high fever two days after admition, the patient's blood was cultured, indicating the presence of *Staphylococcus aureus*. A case-sensitive antibiotic, sulbactam-ampisillin, was administered. During the first week of observation, color doppler ultrasonography was performed after pain, pulsatile mass, and erythema in the skin were detected at the right posterior knee which revealed a large hematoma and pseudoaneurysm with thrombosis around the stent. Surgical intervention was indicated as stent infection and thrombosis were likely. We thought of stent infection after a careful search through the available literature of similar cases. Warfarin sodium therapy was stopped; vitamin K was administered and 4 units of fresh frozen plasma were infused. The INR level was lowered to 1.6.

The popliteal artery was explored infrapopliteally. An infection was identified in the popliteal fossa. The integrity of the vessel was found to be breached and the stent thrombosed with an infected appearance. The stent was extravasated. It was destructed and infected. The popliteal region had an abscess with serious suppuration testifying our suspicion of stent infection. An extensive debridement was done to the infected tissues. An above-knee to below-knee saphenous vein femoropopliteal bypass was performed resulting in successful revascularization of the distal circulation. Antithrombotic and anticoagulant therapy were began. *S. aureus* was cultivated in the cultures taken from the infected tissues and the stent. Dressings were made in open fashion due to insufficient wound healing for the duration of one week postoperatively. Open dressings and debridement were performed under sterile conditions in the operating room. The wound could only be suture-closed 10 days later. The erythema and calor (heat) in the knee and popliteal regions receded after medical

FIGURE 2a: Right lower extremity angiography before the second stent was implanted.

FIGURE 2b: Right lower extremity angiography after the second stent was implanted.

therapy. The patient was discharged on the 26th postoperative day after general improvement. He applied to our clinic with minimal discharge from the incision one month after discharge. Cultures were taken, again *S. aureus* was cultivated and antibiotics were began. The discharge completely disappeared 10 days after initiation of treatment. The patient is remaines healthy at the last follow-up 33 months after the operation.

DISCUSSION

Vascular catheterization and balloon angioplasty have been performed for decades, but infectious complications have rarely been encountered.[5] The reported septic sequelae following angioplasty include femoropopliteal artery infections after angiography and stenting.[6] This patient had color doppler ultrasonography before digital subtraction angiography. According to Hogg et al, who conducted a thorough review of the literature from 1966 to the present time, just over 30 case reports were found regarding infectious complications following placement of a bare metal stent. Our patient is the first case in the literature of early nitinol stent-related suppurative popliteal artery endarteritis following endovascular therapy of femoropopliteal acute thromboembolism occlusion.

PAT for the treatment of thromboembolic occlusions of lower extremities has recently been the increasingly preferred method as an alternative to surgical therapy.[1] Endovascular approach to thromboembolic and atherosclerotic occlusions differ in terms of method and duration. Application time of PAT is longer than the other methods. It is a widespread method used to apply tPA intraluminally via a an infusion catheter for the treatment of in-stent thrombosis. In our case, in-stent thrombosis developed 10 days after the deployment of the initial stent. Afterwards, a secondary stent was placed proximal to the initial stent. All these procedures were time consuming, which required repeated intraluminal procedures. In the case report by Giannoukas et al. PAT, stenting (Palmaz P294, Strecker) and thrombolysis have been applied for atherosclerotic occlusive disease of the lower extremities. Stents were placed in the superficial femoral artery (SFA) and above-knee popliteal artery. In-stent thrombosis occurred following 30-hour-long thrombolytic therapy through the intraluminal catheter one week after the application of the initial stent. One day later, stent-related suppurative above-knee popliteal artery endarteritis developed.[6] There are similarities in both of these cases; however, there are differences between underlying pathologies and applied stents and stent localizations. In our case, infection was around the stent which occured in the below-knee popliteal artery. In both cases, antibiotic prophylaxis had not been given before intervention.

Stent application to the popliteal artery is a rarely preferred method. Since the popliteal artery site is a mobile region, occurrence of stent fracture is a likely possibility. In the study of Sabeti et al., it was reported that stent fracture was observed following femoropopliteal stent application in 15% of the cases.[7] Use of nitinol stents improved outcomes with respect to old stents. Nitinol stents resist ex-

ternal deformation and can be reasonably placed in areas of flexion, e.g. the proximal SFA, the distal SFA, and the popliteal artery.[8]

Upon review of the published reports, risk factors mentioned for bare metal stent infection include breaks in sterile technique, occult glove perforation, inadequate skin preparation, repeat puncture of the same arterial access site causing needle tract contamination, prolonged use or reuse of an indwelling catheter, increased procedure time, puncture site hematoma formation, less than ideal aseptic environment of angiographic suites, other source of coincident bacteremia, longer wires and catheters, passing wires or catheters through previously deployed stents, and deployment of multiple stents or multiple interventions on the same or adjacent sites.[3,9-11] In our case, risk factors included repeat puncture of the same arterial access site causing needle tract contamination, prolonged use of an indwelling catheter, and increased procedure time which may have been responsible for the development of endarteritis. Dosluoğlu et al, postulate several potential etiologies about stent related endarteritis: [1] transient bacteremia through the stent causing a superinfection; [2] contamination during the original procedure; [3] erosion of the stent into the dermis with paucity of coverage causing seeding and arteritis secondary to skin flora; and [4] unrecognized pseudoaneurysm at the bifurcation upon completion of the original procedure.[12] Clearly, for each infection, several possible scenarios exist with no existing reliable method to determine the actual etiology.

In our case, the diagnosis of nitinol stent-releted endarteritis was made clinically and ultrasonographically. In the first week of observation, color doppler ultrasonography was performed after pain, pulsatile mass, and erythema of the skin were detected at the right posterior knee, which revealed a large hematoma and pseudoaneurysm with in-stent thrombosis. The most frequently employed modalities to diagnose bare metal stent infections are computerized tomography scans, angiography, ultrasonograpy, and tagged white blood cell scans.[13]

No consensus has been reached regarding the prophylactic use of antibiotics for arterial stent placement. Only one of the case reports reviewed explicitly discussed the use of prophylactic antibiotics prior to stent deployment.[10] Several authors reported that no antibiotics were administered.[3,9,11,12] For the majority of the reports, the use of antibiotics remains unknown. Some practitioners recommend selective antibiotic prophylaxis in the following instances: for stents in veins for hemodialysis access, access site hematoma, repeat arterial puncture, diabetic patients, immunosuppressed patients, patients with cirrhosis, long catheterization or long indwelling sheaths.[3,9,11] There is little harm and cost involved in prophylaxis, considering that contamination typically occurs during the original operation and that surgical repair can be morbid. Therefore, our institution now recommends the use of prophylactic antibiotics prior to implantation of an endovascular stent.[9,10,13,14] Antibiotics should not only be administered at the time of the initial procedure, but also during subsequent procedures where the risk of transient bacteremia exists, ie, colonoscopy, dental extraction, or repeat arterial access for subsequent procedures.[10,11] Bunt et al. reported stent infection following cardiac catheterization that occurred 22 months after initial stent placement despite adequate time for neointimal formation.[14] Although animal studies suggest that neointimal formation is accomplished within 3 months, it is difficult to correlate this finding to older, diseased human vessels.[15] This would be similar to administiring prophylaxis in patients with artificial valves.

Several pathogens have been determined to be causative agents in stent-related endarteritis cases. Dosluoğlu et al. have investigated 21 incidences in their case report and review. The most common pathogen was determined to be *S. aureus* with an incidence of 76%.[11] In our case, *S. aureus* was also found to be the pathogen. Stent infection is almost always related to bacteriemia due to the breakage of the early stage septic environment during stent application. In animal studies, intravascular metallic stents have been shown to be a cause of infection after systemic bacteremia.[15] Infected

endovascular stents pose difficult management problems. Removal of all infected tissue and revascularization is often required. Treatment may be morbid and can be technically challenging. When possible, the use of autologous tissue is preferred. The use of homografts has recently gained popularity. However, when autologous conduit or homografts are not available, extra-anatomic reconstruction with prosthetic material is often required. In our case, the use of autologous tissue (saphenous vein) graft was preferred.

In conclusion we should point out that this is the first nitinol stenting-related popliteal artery endarteritis case described following endovascular therapy of acute thromboembolism of the lower extremities. We believe that antibiotic prophylaxis should be administered to high-risk patients requiring long-term endovascular therapy with percutaneous aspiration thrombectomy, intraluminal catheter and stent application. In case of suppurative stent-related endarteritis, early diagnosis, antibiotherapy, aggressive surgical approach, revascularization of extremity and long-term rehabilitation should be applied.

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REFERENCES

1. Oğuzkurt L, Özkan U, Gümüş B, Coşkun İ, Koca N, Gülcan Ö. Percutaneous aspiration thrombectomy in the treatment of lower extremity thromboembolic occlusions. Diagn Interv Radiol 2010;16(1):79-83.
2. Long AL, Page PE, Raynaud AC, Beyssen BM, Fiessinger JN, Ducimetière P, et al. Percutaneous iliac artery stent: Angiographic long-term follow-up. Radiology 1991;180(3): 771-8.
3. Therasse E, Soulez G, Cartier P, Passerini L, Roy P, Bruneau L, et al. Infection with fatal outcome after endovascular metallic stent placement. Radiology 1994;192(2):363-5.
4. Palmaz JC, Garcia OJ, Schatz RA, Rees CR, Roeren T, Richter GM, et al. Placement of balloon-expandable intraluminal stents in iliac arteries: first 171 procedures. Radiology 1990; 174(3 Pt 2):969-75.
5. McCready RA, Siderys H, Pittman JN, Herod GT, Halbrook HG, Fehrenbacher JW, et al. Septic complications after cardiac catheterization and percutaneous transluminal coronary angioplasty. J Vasc Surg 1991;14(2): 170-4.
6. Giannoukas DD, Tsetis DK, Touloupakis E, Alamanos E, Karniadakis S, Korakas P, et al. Suppurative bacterial endarteritis after percutaneous transluminal angioplasty, stenting and thrombolysis for femoropopliteal arterial occlusive disease. Eur J Vasc Endovasc Surg 1999;18(5):455-7.
7. Sabeti S, Mlekusch W, Amighi J, Minar E, Schillinger M. Primary patency of long-segment self-expanding nitinol stents in the femoropopliteal arteries. J Endovasc Ther 2005;12(1):6-12.
8. Laird JR. Limitations of percutaneous transluminal angioplasty and stenting for the treatment of disease of the superficial femoral and popliteal arteries. J Endovasc Ther 2006;13 Suppl 2:II30-40.
9. Pruitt A, Dodson TF, Najibi S, Thourani V, Sherman A, Cloft H, et al. Distal septic emboli and fatal brachiocephalic artery mycotic pseudoaneurysm as a complication of stenting. J Vasc Surg 2002;36(3):625-8.
10. Bukhari RH, Muck PE, Schlueter FJ, Annenberg AJ, Roedersheimer LR, Paget DS, et al. Bilateral renal artery stent infection and pseudoaneurysm formation. J Vasc Interv Radiol 2000;11(3):337-41.
11. Dosluoglu HH, Curl GR, Doerr RJ, Painton F, Shenoy S. Stent-related iliac artery and iliac vein infections: Two unreported presentations and review of the literature. J Endovasc Ther 2001;8(2):202-9.
12. Kaviani A, Ouriel K, Kashyap VS. Infected carotid pseudoaneurysm and carotid-cutaneous fistula as a late complication of carotid artery stenting. J Vasc Surg 2006;43(2):379-82.
13. Hogg ME, Peterson BG, Pearce H, Morasch MD, Kibbe MR. Bare metal stent infections: case report and review of the literature. J Vasc Surg 2007;46(4):813-20.
14. Bunt TJ, Gill HK, Smith DC, Taylor FC. Infection of a chronically implanted iliac artery stent. Ann Vasc Surg 1997;11(5):529-32.
15. Paget DS, Bukhari RH, Zayyat EJ, Lohr JM, Roberts WH, Welling RE. Infectibility of endovascular stents following antibiotic prophylaxis or after arterial wall incorporation. Am J Surg 1999;178(3):219-24.