An Unusual Complication of an Infected Hemodialysis Graft: Dermal Erosion and Protrusion of a Polytetrafluoroethylene Vascular Prosthesis: Case Report

Enfekte Hemodiyaliz Greftinin Nadir Bir Komplikasyonu: Politetrafloroetilen Vasküler Protezin Dermal Erozyon ve Protrüzyonu

Hamit Serdar BAŞBUĞ,[a]
Macit BİTARGİL,[a]
Hakan GÖÇER,[a]
Yalçın GÜNERHAN,[a]
Kanat ÖZIŞIK[a]

[a]Department of Cardiovascular Surgery, Kafkas University Faculty of Medicine, Kars

Geliş Tarihi/*Received:* 24.09.2014
Kabul Tarihi/*Accepted:* 19.02.2015

Bu olgu sunumu, 13. Türk Kalp ve Damar Cerrahisi Kongresi (30 Ekim-2 Kasım 2014, Antalya)'ne poster sunumu olarak kabul edilmiştir.

Yazışma Adresi/*Correspondence:*
Hamit Serdar BAŞBUĞ
Kafkas University Faculty of Medicine, Department of Cardiovascular Surgery, Kars,
TÜRKİYE/TURKEY
s_basbug@hotmail.com

ABSTRACT Prosthetic arteriovenous grafts are used in chronic hemodialysis patients when autogenous arteriovenous fistulas fail, or in case of inconvenient vascular status. Polytetrafluoroethylene (PTFE) grafts are commonly used for this purpose. Graft thrombosis and infection are frequently encountered in those prosthetic grafts. Those complications cause vascular access failure, and may interrupt routine maintenance of hemodialysis process. Graft infection may progress to more serious morbidities such as bacteremia and sepsis. In this paper, we report an uncommon presentation of an infected PTFE graft that protruded outside the skin.

Keywords: Blood vessel prosthesis; polytetrafluoroethylene; prosthesis-related infections

ÖZET Prostetik arteriovenöz greftler, kronik hemodiyaliz hastalarında, otojen arteriovenöz fistülün durduğu veya vasküler yapının uygun olmadığı durumlarda endikedir. Politetrafloroetilen (PTFE) greftler bu amaçla yaygın olarak kullanılmaktadır. Bu prostetik greftlerde greft trombozu ve greft enfeksiyonu sıkça görülür. Bu komplikasyonlar vasküler girişimi bozarak, rutin hemodiyaliz sürecinin kesintiye uğramasına yol açabilirler. Greft enfeksiyonu ilerleyip bakteriyemi ve sepsise yol açarak, daha ciddi morbiditeye sebep olabilir. Bu yazıda, alışılmadık bir şekilde cildin dışına çıkan enfekte bir PTFE greft rapor edilmektedir.

Anahtar Kelimeler: Kan damarı protezleri; politetrafloroetilen; protez kaynaklı enfeksiyonlar

Damar Cer Derg 2016;25(3):145-8

Introduction of extracorporeal hemodialysis (HD) by Willem Johan Kolff in 1943 provided a new perspective to the patients with end-stage renal disease (ESRD).[1,2] However, the real contribution of this new approach had been underestimated until introduction of external arteriovenous shunt described by Quinton and Scribner in 1960.[3] Further definition of the endogenous fistula by Brescia and Cimino in 1966 permitted repeated and smooth access to circulation.[4] Quality and sustainability of a successful HD merely depends on a reliable access to the blood circulation.[5] Constitution of subcutaneous Brescia/Cimino type of radiocephalic arteriovenous fistula (AVF) is the first choice to establish a precise and well-functioning vascular access.[4] This procedure is usually easy to perform, appropriate for venipuncture, and carries relatively low complication risk.[5] Construction of such an AVF is called as the primary access operation, and it is useful in most of the new patients entering an HD program. Although primary access

doi: 10.9739/uvcd.2014-41897

Copyright © 2016 by
Ulusal Vasküler Cerrahi Derneği

is useful in 70-80% of the patients, a second operation may be needed when adequate primary access has been lost.[6] Patients with unsatisfactory or failed primary fistulas are eligible for a second operation, called secondary access.[5]

Although the primary access is usually successful in new patients, an endogenous AVF may fail due to an existing comorbidity like diabetes mellitus or advanced age.[7] If a secondary access is considered, there are several surgical alternatives including autografts, biological grafts, and synthetic grafts.[5] Polytetrafluoroethylene (PTFE) prosthesis is used as a synthetic graft, and despite its high complication rates, it is still a frequently preferred graft in secondary access operations.[8] However, thrombotic and infectious complications remain as major problems leading to graft failure.[9] The incidence of PTFE graft infection may be as high as 35%.[10]

In this report, an ESRD patient with an infected PTFE graft is presented that eroded and came out of the skin.

CASE REPORT

A 74-year-old man with ESRD was referred to the outpatient clinic due to failed and infected prosthetic graft in his left upper arm. Vascular access had been achieved via a temporary internal jugular HD catheter since the prosthetic graft had become nonfunctional for two weeks. On physical examination, a short segment (2.5 cm) of infected graft was seen outside the skin, with a partial tear on it (Figure 1). History of the patient revealed that protrusion occurred five days ago.

The patient began hemodialysis five years ago, and the prosthetic graft was implanted straightly between the brachial artery and the cephalic vein two years ago. The pre-existing surgical incisions at both wrists indicated previously failed Brescia/Cimino AVFs. Duplex ultrasound (DUS) investigation revealed a patent left brachial artery, a thrombosed prosthetic graft, and a post-anastomotic obstruction inside the cephalic vein. Blood tests showed a high serum creatinine level of 7.8 mg/dL. The leucocyte count (17.8 10^9/L) and C-reactive protein level (58 mg/L) were also high. The body temperature was slightly high (37.1°C).

FIGURE 1: Protruded polytetrafluoroethylene graft outside the skin.

Infected and protruded prosthetic graft was totally excised under local anesthesia, (Figure 2A). Both native anastomotic ends were repaired with a 7-0 polypropylene suture. The brachial artery flow was controlled with DUS to secure maintenance of distal circulation. Excised prosthetic material was a PTFE graft with a length of 5 cm. It was thrombosed and infected. The remaining infected tissues were debrided, and the surgical area was irrigated with rifamycin solution that has a high bactericidal effect. The incision was closed with separated polypropylene sutures (Figure 2B). A permanent HD catheter was placed through the right subclavian vein for future maintenance of HD.

Bacterial cultures of both excised graft material and blood were done simultaneously. There was no bacteremia. However, *Staphylococcus epidermidis* was cultured from the removed graft material. The patient was discharged with no further complications following intravenous infusion of vancomycin (2 g/day) for seven days.

DISCUSSION

Recent changes in demographic characteristics of ESRD patients led to an increase in the ratio of patients requiring more complex vascular access

FIGURE 2: The infected polytetrafluoroethylene graft is totally removed **(A)**, and the skin is sutured **(B)**.

routes other than AVFs.[11] Those demographic changes include increased age, high prevalence of diabetes mellitus, and use of high-efficiency dialysis.[11] Increased availability of, and improved knowledge about long-term maintenance of HD resulted in a growing number of patients in whom the accurate vascular access can no longer be provided by standard autogenous AVFs.[12] Several biological and synthetic materials have been developed for construction of adequate vascular access in those patients.[13] PTFE or Gortex grafts were initially introduced by Baker in 1976, and they became the most commonly used synthetic vascular prostheses used as bridge grafts.[14] However, non-autogenous or prosthetic arteriovenous (bridge) grafts are associated with a greater morbidity compared to autogenous AVFs.[11] Additionally, overall secondary patency rates of those prosthetic grafts vary between 60-87% after one year, and 43-69% after three years.[2,5,12,13] Therefore, prosthetic grafts are preferred as secondary access routes as they have higher morbidity and lower patency rates.[11]

In addition to stenosis and thrombosis, graft infection is the major cause of morbidity in PTFE grafts.[13] The incidence of thrombotic and infectious complications may be as high as 35%.[9,10] It is usually associated with tenderness, hyperemia of the skin overlying the graft, swelling and other symptoms of inflammation. Graft removal may be needed in 25% of the cases presenting with graft-related bacteremia if the infection does not respond to antibiotherapy.[9,10]

Regarding the reported case, what was the reason for the graft occlusion? How did the graft erode the skin and get protruded? Could the graft be saved if infection was recognized earlier? How was it possible to have a negative blood culture or bacteremia while the graft culture revealed proliferation of pathogenic bacteria?

Prosthetic graft occlusion is a frequently encountered complication. It occurs due to inadequate arterial blood flow as a result of arterial atherosclerosis or hypotension during HD. Venous outflow obstruction due to intimal hyperplasia also frequently contributes to graft occlusion. Additionally, elongated external mechanical pressure after venipuncture or unconscious application of pressure over AVF during sleep may play a role in the occlusion mechanism.[12]

A graft occlusion results in thrombosis, and unprotected prosthesis that is devoid of blood circulation eventually becomes infected. Graft infection accounts for 19% of all PTFE graft complications.[2] When the infected portion of the graft is small and discrete, it may be possible to bypass the area with a short segment of PTFE. Excision and drainage of the infected part is then performed. When the infection is more generalized or involves one or both anastomoses, the graft should be excised totally, as in the presented case. However, if infection had been recognized earlier while it was localized, and treated by incision, drainage or packing with povidone-iodine solution, the graft might have been be saved even in the case of a positive blood culture.[15]

Protrusion of the graft outside the skin may be described in two ways. First, despite patient gives no history about, a local infection or abscess over the PTFE graft might have been drained with a skin incision, and closed inappropriately. This in-

fected skin segment might be re-opened in time. Second, recurrent needling for HD with suboptimal sterility over the infected PTFE graft might have created a subcutaneous fistula, and this fistula might eventually drained outside, causing a dermal space permitting the PTFE graft to be egressed.

Although there is an undisputed indication for the removal of patent grafts in unresolved bacteremia, there is no strategy for the management of thrombosed non-functional grafts with no evident graft-site infection or bacteremia.[9] On the other hand, in the presented case, an extreme presentation of an infected graft was presented. The graft was removed emergently to prevent further infection and sepsis. Bacteremia was not encountered in blood culture probably because of fully thrombosed anastomotic ends of the graft that formed a mechanical barrier between the skin and blood circulation. These findings also showed that clotted nonfunctional grafts are harbingers of infection. They should always be suspected as a source of infection in all HD patients presenting with fever, even in the absence of visible signs of graft site infection.[9]

In conclusion, PTFE grafts for HD access are preferred as a secondary intervention in elderly patients and in cases whose primary AVFs have been failed. Graft infections are encountered frequently. In the case of an obvious infection, presenting signs as in the reported patient, emergent removal of the infected graft is necessary to prevent sepsis. In the absence of typical signs of infection with a functioning graft, salvage of the graft should be tried first. However, if bacteremia occurs during the antibiotherapy, partial or total removal of the infected graft should be considered.

Conflict of Interest

Authors declared no conflict of interest or financial support.

REFERENCES

1. Kolff WJ, Berk J. Welle M, Van der ley AJW, Van Dijk EC, Van Noordvijk J. The Artificial Kidney: A dialyser with a great area. Acta Med Scand 1944;117(2):121-34.
2. Palder SB, Kirkman RL, Whittemore AD, Hakim RM, Lazarus JM, Tilney NL. Vascular Access for Hemodialysis: Patency Rates and Results of Revision. Ann Surg 1985;202(2): 235-9.
3. Quinton WE, Dillard D, Scribner BH. Cannulation of blood vessels for prolonged hemodialysis. Tr Am Soc Artif Int Organs 1960;6: 104-13.
4. Brescia MJ, Cimino JE, Appel K, Hurwich BJ. Chronic hemodialysis using venipuncture and a surgically created arteriovenous fistula. N Engl J Med 1966;275(20):1089-92.
5. Tordoir JHM, Herman J, Kwan TS, Diderich PM. Long-term follow-up of the polytetrafluoroethylene (PTFE) prosthesis as an arteriovenous fistula for haemodialysis. Eur J Vasc Surg 1988;2(1):3-7.
6. Morgan AP, Dammin GJ, Lazarus JM. Failure modes in secondary vascular access for hemodialysis. ASAIO 1978;1:44-9.
7. Fan PY, Schwab SJ. Vascular access: concepts for the 1990s. J Am Soc Nephrol 1992; 3(1):1-11.
8. Sabanayagam P, Schwartz AB, Soricelli RR, Lyons P, Chinitz J. A Comparative Study of 402 bovine heterografts and 225 reinforced expanded PTFE grafts as AVF in the ESRD patient. Trans Am Soc Artif Intern Organs 1980;26(1):88-92.
9. Ayus JC, Sheikh-Hamad D. Silent Infection in Clotted Hemodialysis Access Grafts. J Am Soc Nephrol 1998;9(7):1314-7.
10. Raju S, PTFE Grafts for Hemodialysis Access: Techniques for intertions and managements of complications. Ann Surg 1987;206(5):666-73.
11. Akoh JA. Prosthetic arteriovenous grafts for hemodialysis. J Vasc Access 2009;10(3):137-47.
12. Tellis VA, Kohlberg WI, Bhat DJ, Driscoll B, Veith FJ. Expanded polytetrafluoroethylene graft fistula for chronic hemodialysis. Ann Surg 1979;189(1):101-5.
13. Bosman PJ, Blankestijn PJ, Van der Graaf Y, Heintjes RJ, Eikelboom BC. A comparison between PTFE and denatured homologous vein grafts for haemodialysis access: a prospective randomised multicentre trial. Eur J Vasc Endovasc Surg 1998;16(2):126-32.
14. Baker LD, Johnson JM, Goldfarb D. Expanded polytetrafluoroethylene (PTFE) Subcutaneous Arteriovenous Conduit: an improved vascular access for chronic hemodialysis. Trans Amer Soc Artif Int Organs 1976;22(1):382-5.
15. Bhat DJ, Tellis VA, Kohlberg WI, Driscoll B, Veith FJ. Management of sepsis involving expanded polytetrafluoroethylene grafts for hemodialysis access. Surgery 1980;87(4): 445-50.