J Artif Organs (2006) 9:114–117
DOI 10.1007/s10047-005-0325-9

CASE REPORT

Gen Kuramochi, MD, PhD · Nobumasa Ohara, MD
Shin Hasegawa, MD · Hisanaga Moro, MD

Femoral arteriovenous fistula: a complication of temporary hemodialysis catheter placement

Abstract The femoral vein is increasingly being used as a temporary route for dual-lumen hemodialysis catheter placement because it is thought to be safer than the internal jugular or subclavian vein sites. However, several factors preclude the wider use of indwelling femoral catheters for hemodialysis, including interference with ambulation and concern over bleeding, infection, and deep thrombosis. Herein we describe a case of right superficial femoral arteriovenous fistula as a complication of the insertion of a dual-lumen hemodialysis catheter into the right femoral vein. The arteriovenous fistula was successfully managed with surgical vascular repair. From this experience, we emphasize that it is important for physicians and nursing staff treating patients with indwelling central catheters to exercise vigilance to allow early detection and treatment of these potentially serious, albeit rare, complications.

Key words Chronic renal failure · Femoral arteriovenous fistula · Hemodialysis catheter

Introduction

Dual-lumen catheters are widely used for temporary access to the circulation in patients who require emergency hemodialysis as a result of acute renal failure or intoxication, for example, and when vascular access has not been created previously or in patients having suddenly lost their regular vascular access. Recently, the clinical practice guidelines for vascular access in the USA, Australia, Europe, and Canada have been updated and publicized.[1–5] The venous access sites used are the femoral vein, the internal (or external) jugular vein, or the subclavian vein. Femoral vein catheterization with hemodialysis via the intravenous catheter was first proposed as an alternative approach by Shaldon and colleagues in 1961. Thereafter, because hemodialysis requires rapid extracorporeal blood flow, the femoral vein has been the site most commonly chosen.[7] The femoral vein is easier to cannulate with fewer potential complications and has the advantage of not predisposing the peripheral venous network to the creation of an arteriovenous fistula. The vein is easily compressible and does not require an X-ray before the initiation of dialysis.[8,9] However, several factors preclude the wider use of indwelling femoral catheters for hemodialysis, including interference with ambulation and concern over bleeding, infection, and deep thrombosis.[10] In Western countries, the internal jugular vein (mainly the right) is indicated in an acute setting for patients without respiratory failure or pulmonary edema;[9,11,12] in addition, the subclavian vein route is frequently used.[13,14] However, several complications associated with insertion in the internal jugular vein, subclavian vein, and femoral vein have been reported.[15–23] Furthermore, it was reported that the subclavian vein should be avoided, or its use restricted to failure of other vein cannulation sites. For these reasons, we usually use the femoral vein as the vascular access site in emergent situations.

Herein we describe a patient with femoral arteriovenous fistula as a complication of the insertion of a polyurethane dual-lumen hemodialysis catheter into the femoral vein. A review of the literature on traumatic complications associated with central venous cannulation is also presented.

Case report

A 69-year-old woman receiving hemodialysis therapy who was initiated on hemodialysis therapy on February 9, 1998,

Received: May 30, 2005 / Accepted: November 18, 2005

G. Kuramochi (✉) · N. Ohara · S. Hasegawa
Department of Internal Medicine, Kariwa-gun General Hospital, The Niigata Prefectural Federation of Agricultural Cooperatives for Health and Welfare, 2-11-3 Kitahanda, Kashiwazaki 945-8535, Japan
Tel. +81-257-23-2165; Fax +81-257-22-0834
e-mail: kurafaw@arion.ocn.ne.jp

H. Moro
Department of Cardiovascular Surgery, Saiseikai Niigata Hospital II, Niigata, Japan

Fig. 1. Enhanced three-dimensional computed tomography image showing the direct communication from the right superficial femoral artery to the femoral vein (*arrow*). Radiographic contrast medium immediately opacified the femoral vein via the superficial femoral artery

as a result of chronic renal failure caused by chronic glomerulonephritis, was admitted to our hospital on November 29, 2004, with shunt obstruction. A polyurethane dual-lumen hemodialysis catheter (Blood access UK-catheter kit, UNITIKA, Amagasaki, Japan) was inserted into the right femoral vein following the usual procedure. We simultaneously took blood through the catheter and confirmed that it was venous blood, and hemodialysis therapy was performed through the dual-lumen hemodialysis catheter. On December 10, 2004, a new Gore-tex arteriovenous graft was created in the left forearm at Saiseikai Niigata Hospital II and about 2 weeks later the graft was used for hemodialysis therapy. During hemodialysis therapy using the femoral catheter, suspected arterial bleeding from the insertion site of catheter occurred once when the catheter was moved. After this, a dual-lumen hemodialysis catheter was left in place. A vascular thrill was present and a vascular bruit was heard on auscultation over the right inguinal site, indicating the presence of an arteriovenous fistula. Three-dimensional (3D) computed tomography (CT) was immediately performed to confirm the site of the arteriovenous fistula. 3D-CT showed an arteriovenous fistula between the superficial femoral artery and the femoral vein in the right inguinal site (Fig. 1). About a month later on January 24, 2005, the patient developed a gastric ulcer and concurrently the arteriovenous graft in the left forearm became obstructed. A dual-lumen hemodialysis catheter was once again inserted into the left femoral vein for hemodialysis therapy. The gastric ulcer was treated with proton pump inhibitors and healed about 1 month later. On March 7 the patient was again transferred to the Saiseikai Niigata Hospital II for the creation of a new graft and repair of the femoral arteriovenous fistula. On March 9 the surgical repair of the arteriovenous fistula between the superficial femoral artery and the superficial femoral vein in the right inguinal site was performed and a new arteriovenous graft was created in the right forearm. Surgical exploration revealed a 5-mm adhesion between the superficial femoral artery and the superficial femoral vein and communication was present in the vascular wall. The adhesion was separated carefully and vascular repairs of both femoral artery and femoral vein were performed. On March 15 the patient returned to our hospital. The vascular bruit and thrill had disappeared and the absence of a arteriovenous fistula was further confirmed by 3D-CT on April 8, 2005. A dual-lumen hemodialysis catheter in the left femoral vein route was left in place on April 12, 2005, and the patient was discharged from the hospital 4 days later.

Discussion

The percutaneous catheterization of the central venous system has become a valuable tool, although vascular access complications are the most common cause of morbidity in patients. Dual-lumen catheters are widely used for temporary access to the circulation in patients who require hemodialysis therapy, for example in emergent initiation or shunt obstruction. Generally, the internal jugular vein, the subclavian vein, or the femoral vein is chosen for catheter placement. However, the best route for catheter placement remains debatable. In Western countries, the internal jugular vein and subclavian vein route are the most commonly used,[9,11–14] although several complications have been reported following percutaneous catheterization attempts.[15–23] Cimochowski and colleagues suggested that, compared to the internal jugular vein route, the long-term stricture rate of subclavian vein catheters was unacceptable high. Therefore, the internal jugular vein route seems a safer alternative to subclavian vein cannulation.[12] However, reports of complications associated with the use of the internal jugular

vein hemodialysis catheter, although quite rare, are evident.[15–19] The most common complications reported for internal jugular vein and subclavian vein routes include infection, deep venous thrombosis, trauma to vital central structures, prolonged bleeding from puncture sites, aneurysm, pseudoaneurysm formation, and arteriovenous fistula.[15–23] Nidus and colleagues reported that femoral vein cannulation is simply and rapidly performed and is well suited for repeated acute dialysis.[7] However, several factors preclude the wider use of indwelling femoral hemodialysis catheters, including interference with ambulation and concern over bleeding, infection, and deep venous thrombosis.

Complications caused by arteriovenous fistulas have been reported, with fistulas present between the carotid artery and the jugular vein,[15–19] the subclavian artery and the internal jugular vein,[17] and the vertebral artery and the jugular vein.[25,26] For our patient, we chose the femoral vein as the insertion site of the hemodialysis catheter because we considered it to be the safest. Consequently, the patient experienced an arteriovenous fistula as a complication of the indwelling hemodialysis catheter. From this experience, the following points should be noted when cannulating the femoral vein as a vascular access site for hemodialysis:

1. In patients in whom it is difficult to palpate the artery, one can often locate it accurately with a small handheld Doppler unit. Ultrasound-guided cannulation has proven to be superior to landmark-guided cannulation and is therefore recommended by NKF-DOQI[1] and other reports.[27–29] Furthermore, the procedure time for cannulation of the femoral vein can be significantly shortened with the use of ultrasound guidance.[30]
2. The commonest mistake of inexperienced operators is to make the venous puncture too close to the artery and puncture the artery by mistake. It is better to start too far medial and gradually move more laterally until one finds the vein.
3. It is a good idea to use a fine-gauge needle (gauge 21) to locate the vein first before using the Seldinger needle to introduce the guide wire.
4. If one inadvertently punctures the femoral artery with the Seldinger needle, it is wise to avoid the use of heparin for at least 24 h.
5. The commonest undiagnosed complication of femoral vein cannulation for hemodialysis is a traumatic arteriovenous fistula. It should be suspected in any patient with persistent discomfort in the groin. There is usually a loud bruit audible with the stethoscope. The diagnosis can be confirmed by ultrasound or 3D-CT, and when found, this injury should always be repaired. If left untreated it will cause or aggravate any existing high-output cardiac failure.[31,32] Therefore, we emphasize the importance of physicians and nursing staff exercising vigilance for patients with indwelling central catheters to allow early detection and treatment of these potentially serious, albeit rare, complications. Any new femoral bruit and thrill should be regarded as a potential complication of the femoral venous catheter until proven otherwise.

Conclusion

A hemodialysis patient experienced a femoral arteriovenous fistula as a complication of the insertion of a hemodialysis catheter into the femoral vein. Physicians and nursing staff treating patients with indwelling central catheters should exercise vigilance to allow early detection and treatment of these potentially serious, albeit rare, complications.

Acknowledgments The authors would like to thank the staff of the hemodialysis units of Kariwa-gun General Hospital and Saiseikai Niigata Hospital II for excellent technical assistance and care.

References

1. National Kidney Foundation. K/DOQI clinical practice guidelines for vascular access: update 2000. Am J Kidney Dis 2001;37(Suppl 1):S137–S181
2. The CARI Guidelines (Caring for Australians with Renal Impairment). Kidney Organization of Australia. http://www.kidney.org.au/cari/index.php
3. Vascular Access Society (Europe). Management of the renal patient: clinical algorithms on vascular access for hemodialysis (VAS Guidelines). http://www.vascularaccesssociety.com/guidelines/main.htm
4. Weijmer MC, Tee Wee PM. Temporary vascular access for hemodialysis treatment. Current guidelines and future directions. In: Ronco C, Levin NW (eds) Hemodialysis vascular access and peritoneal dialysis access. Contrib Nephrol 2004;142:94–111
5. Jindal KK, Ethier JH, Lindsay RM, Barre PE, Kappel JE, Carlisle EF, Common A. Clinical practice guidelines for vascular access. Canadian Society of Nephrology. J AM Soc Nephrol 1999; 10(Suppl 13):S287–S321
6. Shaldon S, Chiandussi L, Higgs SB. Hemodialysis by percutaneous catheterization of the femoral artery and vein with regional heparinisation. Lancet 1961;2:857–859
7. Nidus B, Matalon R, Katz L, Cabaluna C, Tan C, Eisinger R. Hemodialysis using femoral vessel cannulation. Nephron 1974;13: 416–420
8. Denker BM, Chertow GM, Owen WF, Jr. Hemodialysis. In: Brenner BM (ed) The kidney, 6th edn. Saunders, 2000:2373–2453
9. Canaud B, Desmeules S. Vascular access for hemodialysis. In: Hörl WH, Koch KM, Lindsay RM, Ronco C, Winchester JF (eds) Replacement of renal function by dialysis, 5th edn. London: Kluwer, 2004:203–230
10. Erben J, Kvasnicka J, Bastecky J, Groth J, Zahradnik J, Rozsival V, Bastecka D, Fixa P, Kozak J, Herout V. Long-term experience with the technique of subclavian and femoral vein cannulation in hemodialysis. Artif Organs 1979;3:241–244
11. Canaud B, Beraud JJ, Joyeux H, Mion C. Internal jugular vein cannulation using two Silastic catheters. Nephron 1986;43: 133–138
12. Cimochowski GE, Worley E, Rutherford WE, Sartain J, Blondin J, Harter H. Superiority of the internal jugular over the subclavian access for temporary dialysis. Nephron 1990;54:154–161
13. Schwarzbeck A, Brittinger WD, Henning CE, Strauch M. Cannulation of subclavian vein for hemodialysis using Seldinger's technique. Trans Am Soc Artif Intern Organs 1978;24:27–29
14. Uldall PR, Dyck RF, Woods F, Merchant N, Martin GS, Cardella CJ, Sutton D, de Veber G. A subclavian cannula for temporary vascular access for haemodialysis and plasmapheresis. Dial Transplant 1979;8:963–968
15. El-Shahawy MA, Khilnani H, Carotid–jugular arteriovenous fistula: a complication of temporary hemodialysis catheter. Am J Nephrol 1995;15:332–336

16. Hayward R, Swanton H, Treasure T. Acquired arteriovenous communication: Complication of cannulation of internal jugular vein. Br Med J 1984;288:1195–1196
17. Merino-Angulo J, Cortazar JL, Saez-Garmendia F, Montejo M. Subclavian artery to internal jugular vein fistula following percutaneous internal jugular vein catheterization. Cathet Cardiovasc Diagn 1984;10:593–595
18. Makuuchi H, Fuse K, Konishi T, Kukita M. A case of A-V fistula with severe hemolysis following internal jugular venipuncture. Nippon Geka Gakkai Zasshi 1988;89:1310–1313
19. Schwarz E. Mediastinal pseudotumor, caused by a carotid-jugular fistula. Röntgenblätter 1983;36:418–422
20. Vanholder R, Lameire N, Verbanck J, Van Rattinghe R, Kunnen M, Ringoir S. Complications of subclavian catheter hemodialysis: a 5-year prospective study of 257 patients. Int J Artif Organs 1982;5:297–303
21. Clark DD, Albina JE, Chazan JA. Subclavian vein stenosis and thrombosis: a potential serious complication in chronic hemodialysis patients. Am J Kidney Dis 1990;15:265–268
22. Davis D, Petersen J, Feldman R, Cho C, Stevick CA. Subclavian venous stenosis: a complication of subclavian dialysis. JAMA 1984;252:3404–3406
23. Schwab SJ, Quarles LD, Middleton JP, Cohan RH, Saeed M, Dennis VW. Hemodialysis-associated subclavian vein stenosis. Kidey Int 1988;33:1156–1159
24. Bambauer R, Inniger R, Pirrung KJ, Schiel R, Dahlem R. Complications and side effects associated with large-bore catheters in the subclavian and internal jugular veins. Artif Organs 1994;18:318–321
25. Piechowiak H, Buechels H, Ingrisch H, Hess H. Arteriovenous fistula of the vertebral artery: a rare complication following central venous catheterization. A case report. Anästhesist 1984;33:327–329
26. Beeger R, Grabbe E, Vogel H. Arteriovenous fistula of the *A. vertebralis* after catheterization of *V. jugularis interna.* Röntgenblätter 1982;35:348–349
27. Jaques PF, Mauro MA, Keefe B. US guidance for vascular access: Technical note. J Vasc Interv Radiol 1992;3:427–430
28. Hartle E, Conlon P, Capstens R, Schwab SJ. Ultrasound guided cannulation of the femoral vein for acute hemodialysis access. J Am Soc Nephrol 1993;352A (abstr)
29. Troianos CA, Jobes DR, Ellison N. Ultrasound-guided cannulation of the internal vein: a prospective, randomized study. Anesth Analg 1991;72:823–826
30. Kwon TH, Kim YL, Cho DK. Ultrasound-guided cannulation of the femoral vein for acute haemodialysis access. Nephrol Dial Transplant 1997;12:1009–1012
31. Uldall R, Hemodialysis access. Part A: temporary. In: Jacobs C, Kjellstrand CM, Koch KM, Winchester JF (eds) Replacement of renal function by dialysis, 4th edn. London: Kluwer, 1996:277–292
32. Schulman G, Himmelfarb J. Hemodialysis. In: Brenner BM (ed) The kidney, 7th edn. Tokyo: Saunders, 2004:2563–2624