ELSEVIER

European Journal of Radiology xxx (2008) xxx–xxx

EJR
EUROPEAN JOURNAL OF RADIOLOGY

www.elsevier.com/locate/ejrad

Technical note

Endovascular reconstruction of completely occluded left brachiocephalic vein in haemodialysis patients—Tips and tricks

Nour-Eldin A. Nour-Eldin *, Stephan Zangos, Thomas J. Vogl

Institute of Diagnostic and Interventional Radiology, Johan Wolfgang Goethe University Clinic, 60590 Frankfurt am Main, Germany

Received 29 August 2007; received in revised form 12 December 2007; accepted 10 January 2008

Abstract

Venous stenoses or occlusions are common clinical problems in haemodialysis patients and interventional endovascular techniques are highly effective and offer minimally invasive solutions. Not only venous stenoses but also complete occlusions can be treated by endovascular techniques. Tips and tricks for recanalisation in these difficult topographic locations are presented.

Keywords: Endovascular; Venous occlusion; Haemodialysis; Venous stenting

1. Introduction

Thrombotic and stenotic complications of chronic haemodialysis vascular access are common causes of access failure and patient hospitalization. Stenoses in any part of dialysis grafts and fistulas, specifically those occurring between the arterial anastomosis and the axillary vein, disrupt flow and cause graft malfunction. Treatment of these lesions with percutaneous transluminal angioplasty (PTA) decreases access-related morbidity [1], and may extend the useable lifespan of the access [2].

Occlusion in the subclavian or brachiocephalic veins ipsilateral to a functioning haemodialysis access or the superior vena cava (SVC) can also cause graft malfunction, as well as arm, breast, and/or face swelling by limiting the flow of blood leaving the accessed limb. PTA of an occluded central venous system (CVS), supplemented by stent placement as needed, is effective and considered the primary treatment for such lesions owing to the lack of viable and safe surgical options [3,4]. The central venous occlusion in the haemodialysis patient population is primarily a result of previous catheterization, as the dialysis access catheters, placed via either the subclavian or jugular route, cause acute vascular injury during placement as well as chronic injury related to the presence of a foreign body and thrombus deposition. Also central venous occlusion may occur simply due to the presence of a fistula even if not preceded by intravenous catheterization. These stenoses represent a major problem for the haemodialysis patient because their presence may severely limit the number of access sites available and lead to complete venous occlusion [5].

The condition can be complicated by obstruction of the haemodialysis access due to occlusion of the left brachiocephalic vein till the confluence of superior vena cava. This is manifested clinically by extensive left upper limb congestive oedema, chronic headache, and dialysis malfunction due to markedly increased venous pressures under dialysis. An endovascular intervention is the decision of choice for reconstruction of the integrity of the central venous system, to alleviate the congestive oedema and to restore the haemodialysis access.

2. Techniques and considerations

For angiography, angioplasty and stent placement, the approach to the lesion depends on its anatomic location. In this case, brachial vein, proximal to the draining shunt vein is punctured in a retrograde manner in order to avoid traumatic injury of the shunt axis. However, the venous as well as the arterial side of the fistula may be punctured.

Preliminary direct venography is performed not only for proper assessment of the state of veins and assessment of the obstructed segment and the collateral circulation, but also for planning of the approach and route of access. For proper evalu-

* Corresponding author. Tel.: +49 6963014736/7277; fax: +49 6963017288.
E-mail addresses: Nour410@hotmail.com (N.-E.A. Nour-Eldin), T.Vogl@em.uni-frankfurt.de (T.J. Vogl).

0720-048X/$ – see front matter © 2008 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.ejrad.2008.01.005

Fig. 1. Left-sided transbrachial venography revealed: complete obstruction of the left brachiocepahlic vein (white arrow) and extensive collateral circulation from the left subclavian vein (multiple small arrows).

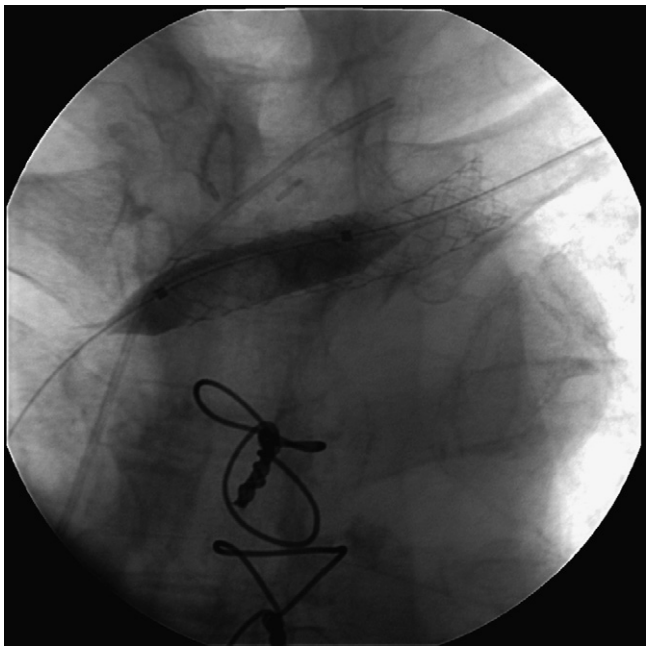

Fig. 3. Balloon angioplasty of the occluded brachiocephalic vein and stent deployment.

ation of the central venous system down to superior vena cava. We found it is extremely important to perform transfemoral central venography for assessment of the superior vena cava and the contralateral brachiocephalic vein to exclude concomitant or partial occlusion and to monitor stent placement (Figs. 1 and 2). Moreover, transfemoral approach allows the use of large bore catheters and stents. Bilateral antecubital vein venography is also a simple method to provide an adequate mapping of the whole central venous system.

Like in (Fig. 1), the complete occlusion was adequately bypassed by negotiating the obstructing thrombus with a micro-

Fig. 2. Transfemoral superior vena cavography reveals complete patency of the superior vena cava (arrow).

catheter, as the hydrophilic soft guide wire was not successful to bypass the obstruction. Stiff guide wire must be avoided, as it carries a high risk of perforation. Thrombus dislodgement by forcible manoeuvres carries the risk thrombus dislodgement and pulmonary embolism.

Stent placement itself can be applied either by transbrachial or by transfemoral, in our case the transbrachial approach was successful (Fig. 3). After balloon angioplasty of the segment, the use of balloon expandable stent allows immediate mechanical support of the dilated segment to a sufficient extent compatible with the preliminary balloon dilatation preceding the stent placement; taking in consideration that the exact location of the stent is the crucial point to guarantee the success of the technique, this includes not only applying the stent across the site of the occlusion but also considering the start point; to be placed over a proximal intact intima, the whole stent traverses the occluded segment, and the end point to be placed over a healthy intima also, taking also in consideration important anatomical considerations (e.g.: orifices of important collateral veins) and the confluence of both innominate veins to form SVC (Fig. 4) [6].

Clinical follow up is sufficient by checking the dialysis protocols for recurrent increases in venous counter pressure during dialysis, signs of recirculation, and prolonged bleeding. If shunt failure is suspected, the patients must be referred to do repeated intervention.

The technical success of central venous PTA is determined by many factors including:

1. Adequate localisation and mapping of the occluded venous segment to rule out the presence of coexistent contralateral venous occlusion or ipsilateral proximal venous occlusion. This is ruled out by transbrachial and transfemoral venogra-

Please cite this article in press as: Nour-Eldin N-EA, et al., Endovascular reconstruction of completely occluded left brachiocephalic vein in haemodialysis patients—Tips and tricks, Eur J Radiol (2008), doi:10.1016/j.ejrad.2008.01.005

Fig. 4. Post-angioplasty venography revealing complete restoration of the patency of innominate vein and the absence of the collaterals denoting normal haemodynamics of the venous system.

phy in case of central venous occlusion. This provides also the exact extent of the occluded segment, and it allows the planning of the site of intervention.

2. The golden step that allows reconstruction of the completely occluded segment is the passage of guide wire across the occluded system. Soft hydrophilic curved guide wires can traverse the occluded vein, in case of acute soft thrombus, or in case of chronic thrombus after its retraction providing a luminal tunnel for the guide wire to pass through. Micro-guide wires are more effective in traversing completely occluded veins. Stiff guide wires or tough jerky manoeuvres must be avoided as they carry high risk of vascular perforation and pulmonary embolism due to thrombus dislodgement. However, in case of fresh thrombus; thrombolysis should be at first performed as PTA carries the risk of thrombus dislodgement.
3. Balloon dilatation and angioplasty of the occluded segment should be done adequately across the occluded segment, guided by the preliminary venography.
4. Stent application provides effective mechanical support to the wall of the recanalised vein allowing longer functional expectancy than dilatation without tenting.
5. The site of stent is very important, not to extend beyond the brachiocephalic vein as this carries a high risk of occlusion of the contralateral brachiocephalic vein or SVC when part of the stent extends to the confluence of both brachiocephalic veins, due to foreign body effect and the turbulence of flow at the site of malpositioned stent.
6. Y stenting technique provides also a good solution to overcome central venous confluence obstruction [7].
7. Other techniques for recanalisation of a chronic occlusion of the brachiocephalic veins that could not be traversed with a guide wire is sharp central venous recanalisation by means of a TIPS needle as a last resort under certain precautions [8].

References

[1] Dember LM, Holmberg EF, Kaufman JS. Randomized controlled trial of prophylactic repair of haemodialysis arteriovenous graft stenosis. Kidney Int 2004;66:390–8.
[2] Tessitore N, Mansueto G, Bedogna V, et al. A prospective controlled trial on effect of percutaneous transluminal angioplasty on functioning arteriovenous fistulae survival. J Am Soc Nephrol 2003;14:1623–7.
[3] NKF-DOQI clinical practice guidelines for vascular access. National Kidney Foundation-Dialysis Outcomes Quality Initiative. Am J Kidney Dis 1997;30(4 suppl 3):S150–91.
[4] NKF-K/DOQI clinical practice guidelines for vascular access: update 2000. Am J Kidney Dis 2001;37(1 suppl 1):S137–81.
[5] Schillinger F, Schillinger D, Montagnac R, Milcent T. Post catheterisation vein stenosis in haemodialysis: comparative angiographic study of 50 subclavian and 50 internal jugular accesses. Nephrol Dial Transplant 1991;6:722–4.
[6] Vorwerk D, Guenther RW, Mann H, Bohndorf K, Keulers P, Alzen G, et al. Venous stenosis and occlusion in hemodialysis shunts: follow-up results of stent placement in 65 patients. Radiology 1995;195:140–6.
[7] Sze DY, Razavi MK, Mitri RK, Regala AC, Dake MD. The "Y" stent: a technique using nitinol stents to treat bifurcations. J Endovasc Ther; 10(4):780–7.
[8] Honnef D, Wingen M, Günther RW, Haage P. Sharp central venous recanalisation by means of a TIPS needle. CardioVasc Interv Radiol 2005;28(5).

Please cite this article in press as: Nour-Eldin N-EA, et al., Endovascular reconstruction of completely occluded left brachiocephalic vein in haemodialysis patients—Tips and tricks, Eur J Radiol (2008), doi:10.1016/j.ejrad.2008.01.005