

8. Diagnosis and treatment of central venous obstruction

Guideline 8.1. If symptomatic central venous obstruction is suspected, angiography of the access and complete venous outflow tract should be performed (Evidence level III).

Guideline 8.2. Treatment should be performed by percutaneous intervention (Evidence level III).

Diagnosis of central venous obstruction

Chronic swelling of the access arm is the most important clinical sign of central venous obstruction [1]. The superficial veins may become prominent (collaterals). Pain and paraesthesia may occur. Central venous lesions have to be treated when they are severe and disabling such as those resulting in arm swelling, troublesome pain or inadequate haemodialysis [2]. In obvious central venous obstruction, angiography of the access and complete venous outflow tract must be performed, since the central veins cannot be examined with ultrasonography. Thus, to completely visualize all mediastinal veins, venography using digital subtraction technique is needed [3]. This can be done preferably with direct antegrade puncture of the access [4]. In the majority of patients central vein obstruction is due to previous inserted central vein catheters. In 40% of the patients with subclavian vein catheters central venous obstruction develops, compared with 10% of patients with jugular vein catheters. In patients without a history of central venous catheterization, other causes, such as extrinsic compression of mediastinal veins (e.g. lymphoma, goitre, thoracic aortic aneurysm, mediastinal fibrosis, pacemakers), hypercoagulopathy, thoracic outlet syndrome or pacemaker wires should be considered. In these cases plain X-rays, computed tomography or MR imaging may be helpful for the differential diagnosis. If treatment of the underlying disease is not possible or fails to resolve arm swelling, PTA with stent insertion is indicated [5].

Management of central venous obstruction

Interventional treatment

In the last decade, several studies of patients treated with PTA alone have been published. Primary patency rates of $\leq 10\%$ at 1 year and numerous restenoses were reported [6–8]. Stent implantation has clearly been shown to improve primary 1-year patency rates to 56% and more [1,4,6,9]. Regular follow-up and reinterventions are required to maintain patency and achieve long-term clinical success [10]. These figures do not differ significantly from those of surgical intervention [1,6,9]. Nevertheless, due to the invasiveness of surgery

for central venous obstructions and the less invasive interventional therapy, PTA with or without stent implantation is recommended as primary option for treatment [4]. Reports show, that symptomatic central venous obstruction in dialysis patients can be treated with a high success rate through radiological intervention [11,12]. Stent placement should avoid overlapping the ostium of a patent internal jugular vein to achieve a safe and sufficient result, since this latter vein is essential for future placement of central venous catheters. Similarly, a stent placed in the innominate vein should not overlap the ostium of the contralateral vein, otherwise contralateral stenosis may occur and preclude future use of the contralateral limb for access creation [4]. Little data are available on the use of thrombolytic agents in central venous thrombosis. It is, therefore, not recommended as a primary treatment regimen.

Surgical treatment

When interventional treatment of central venous obstruction is impossible or fails, assessment of the patient is necessary to define the most effective surgical method and to guarantee long-term vascular access. Surgical evaluation focuses on the general risk (see ASA Physical Status Classification System [13]) and life expectancy as well as on the vascular pathology. If surgery is an option, all angiograms have to be re-evaluated. If an ipsilateral surgical bypass to the jugular vein is impossible due to innominate vein obstruction, additional venography of the contralateral arm should be performed to assess whether a new access can be constructed in that arm or a subclavian–subclavian or subclavian–jugular cross-over bypass should be performed [14–16]. In case of bilateral obstruction of the mediastinal veins, including the superior caval vein, ultrasonography of ilio-caval veins is indicated in the planning of arterio-venous thigh access. Alternative surgical options for upper extremity vascular accesses with compromised venous outflow, are axillo-saphenous/iliac or right atrial bypasses [17,18].

As ultimate treatment access ligation can be considered, which will relief local symptoms.

Recommendations for further research

Improvement of central venous catheter design, may probably prevent vessel wall damage and the development of central venous stenoses. Stent improvement and newer guidewires may enhance central venous obstruction intervention and outcome.

References

1. Bhatia DS, Money SR, Ochsner JL et al. Comparison of surgical bypass and percutaneous balloon dilatation with primary stent placement in the treatment of central venous obstruction in

- the dialysis patient: one-year follow-up. *Ann Vasc Surg* 1996; 10: 452–455
2. Kalman PG, Lindsay TF, Clarke K, Sniderman KW, Vanderburgh L. Management of upper extremity central venous obstruction using interventional radiology. *Ann Vasc Surg* 1998; 12: 202–206
 3. Landwehr P, Tschammler A, Schaefer RM, Lackner K. The value of color-coded duplex sonography of a dialysis shunt. *Rofo Fortschr Geb Ro"ntgenstr Neuen Bildgeb Verfahr* 1990; 153: 185–191
 4. Haage P, Vorwerk D, Piroth W, Schu"rmann K, Gu"nther RW. Treatment of hemodialysis-related central venous stenosis or occlusion: results of primary Wallstent placement and follow-up in 50 patients. *Radiology* 1999; 212: 175–180
 5. Beathard GA. Mechanical versus pharmacomechanical thrombolysis for the treatment of thrombosed dialysis access grafts. *Kidney Int* 1994; 45: 1401–1406
 6. Money S, Bhatia D, Daharamsay S, Mulingtapan R, Shaw D, Ramee S. Comparison of surgical by-pass, percutaneous balloon dilatation (PTA) and PTA with stent placement in the treatment of venous occlusion in the dialysis patient. One year follow up. *Int Angiol* 1995; 14: 176
 7. Quinn SF, Schuman ES, Demlow TA et al. Percutaneous transluminal angioplasty versus endovascular stent placement in the treatment of venous stenoses in patients undergoing hemodialysis: intermediate results. *J Vasc Interv Radiol* 1995; 6: 851–855
 8. Sprouse II, LR, Lesar CJ, Meier III, GH et al. Percutaneous treatment of symptomatic central venous stenosis. *J Vasc Surg* 2004; 39: 578–582
 9. Mickley V. Stent or bypass? Treatment results in benign central venous obstruction. *Zentralbl Chir* 2001; 126: 445–449
 10. Oderich GS, Treiman GS, Schneider P, Bhirangi K. Stent placement for treatment of central and peripheral venous obstruction: a long-term multi-institutional experience. *J Vasc Surg* 2000; 32: 760–769
 11. Dammers R, de Haan MW, Planken NR, van der Sande FM, Tordoir JH. Central vein obstruction in hemodialysis patients: results of radiological and surgical intervention. *Eur J Vasc Endovasc* 2003; 26: 317–321
 12. Kovalik EC, Newman GE, Suhocki P, Knelson M, Schwab SJ. Correction of central venous stenoses: use of angioplasty and vascular Wallstents. *Kidney Int* 1994; 45: 1177–1181
 13. Davis JE, Sugioka K. Selecting the patient for major ambulatory surgery. Surgical and anesthesiology evaluations. *Surg Clin North Am* 1987; 67: 721–732
 14. Dracon M, Watine O, Pruvot F, Noel C, Lelievre G. Axillo-axillary access in hemodialysis. *Nephrologie* 1994; 15: 175–176
 15. Ono K, Muto Y, Yano K, Yukizane T. Anterior chest wall axillary artery to contralateral axillary vein graft for vascular access in hemodialysis. *Artif Organs* 1995; 19: 1233–1236
 16. Sottirai VS, Stephens A, Champagne L, Reisen E. Preservation of hemodialysis access with central obstruction. *Int J Angiol* 1996; 5: 171–174
 17. Kavallieratos N, Kokkinos A, Kalocheritis P. Axillary to saphenous vein bypass for treatment of central venous obstruction in patients receiving dialysis. *J Vasc Surg* 2004; 40: 640–643
 18. El-Sabroun RA, Duncan JM. Right atrial bypass grafting for central venous obstruction associated with dialysis access: another treatment option. *J Vasc Surg* 1999; 29: 472–478