Eur J Vasc Endovasc Surg **32**, 439–444 (2006)
doi:10.1016/j.ejvs.2006.04.011, available online at http://www.sciencedirect.com on ScienceDirect

EDUCATIONAL ARTICLE

Central Vein Obstruction in Vascular Access

V. Mickley*

Department of Vascular Surgery, Kreiskrankenhaus Rastatt, Engelstraße 39, D-76437, Germany

Central venous obstruction has become a major problem because of the frequent need for central venous catheters in haemodialysis patients. This article discusses the epidemiology and clinical features of central venous obstruction and the different surgical and interventional alternatives for its treatment.

Keywords: Central vein obstruction; Haemodialysis; Review; Interventional therapy; Veno-venous bypass.

Introduction

Central vein catheters are known to be the main risk factor for the development of central vein obstruction (CVO) in haemodialysis (HD) patients. If a functioning arteriovenous (AV) access is created distal to such an obstruction, massive venous hypertension may occur producing incapacitating arm edema, ulceration and tissue loss.

Because of the steady growth of the HD population and the persistently high percentage of late referrals requiring emergency renal replacement therapy (RRT), increasing numbers of HD catheters are being implanted. In Europe between 15% (Germany) and 50% (UK) and in the US even 60% of end-stage renal disease (ESRD) patients start their HD career with a catheter.[1] Among prevalent ESRD patients in Europe and the US the percentage of catheter carriers have almost doubled during the last eight years.[2] As a consequence, the treatment of CVO constitutes a growing challenge to access surgeons and interventional radiologists.

Surgical treatment of CVO is often difficult and sometimes hazardous, but not always successful. Interventional therapy is less invasive, but it needs a dedicated and experienced radiologist to achieve satisfying results. This article discusses the relative efficacy of the different interventional and surgical options, with particular respect to their long-term results.

Epidemiology and Etiology

The frequency of symptomatic CVO in the HD population has not extensively been investigated. From November 1999 through September 2005, the author performed 611 primary and secondary surgical and interventional procedures on HD access in 401 patients. Twelve interventions (2.0%) were performed for CVO in nine patients (2.2%, [unpublished data]). Among 640 incident HD patients, Chemla *et al.*[3] identified 10 (1.6%) with CVO. In prevalent US and Canadian patients much higher frequencies of CVO (23%–29%,[4,5]) have been reported.

Some of these stenoses and occlusions may be attributed to thoracic inlet syndrome,[6] previous clavicular fracture, extrinsic compression[7,8] or pacemaker wires.[9,10] The great majority of patients presenting with CVO, however, have a history of central vein catheterization for HD.[7]

CVO is believed to be caused by chronic endothelial trauma resulting from minimal movements of the catheter against the vein wall, possibly enhanced by thrombophlebitic reactions due to catheter-adherent fibrin sheaths and biofilms. Temporary HD catheters implanted in the right internal jugular vein, which has a more or less straight course to the right atrium, are associated with a lower risk of CVO than left internal

Update on Renal Access and Transplantation — one of a series of educational articles edited by Mr Christopher Gibbons, Swansea, UK.

*Corresponding author. Dr med. Volker Mickley, Department of Vascular Surgery, Kreiskrankenhaus Rastatt, Engelstraße 39, D-76437 Rastatt, Germany.
E-mail address: v.mickley@klinikum-mittelbaden.de

1078–5884/000439 + 06 $35.00/0

Table 1. Frequency of central vein stenoses and occlusions following temporary catherterization of the subclavian and the internal jugular vein for hemodialysis

Author, year [reference]	Subcl. Vein		Int. Jug. Vein	
	#	Obstruction	#	Obstruction
Vanherweghem, 1986[11]	42	33%		
Spinowitz, 1987[12]	13	46%		
Barrett, 1988[13]	36	50%		
Schwab, 1988[14]	47	26%		
Wanscher, 1988[15]	53	25%		
Cimochowski, 1990[16]	32	50%	20	0%
Schillinger, 1991[17]	50	42%	50	10%
Surratt, 1991[18]	40	43%		
Hernández, 1993[19]	54	53%		
Salgado, 2004[20] (right int. jug. vein)			127	0%
Salgado, 2004[20] (left int. jug. vein)			44	9%

jugular vein and subclavian vein catheters,[11–20] (Table 1). Femoral vein cannulation carries a 29% risk of iliofemoral vein stenosis when the catheter remains in place for longer than two weeks.[21] Catheter-related infection, and repeated or prolonged catheterization enhance the frequency of CVO.[13,19,21,22] Thus ''permanent'' tunneled catheters are associated with a high incidence of CVO, even when inserted through the right internal jugular vein.[23]

Clinical Findings

In otherwise healthy persons, chronic central arm vein obstruction can be compensated by numerous collaterals along the chest wall, in the neck and in the mediastinum. In the majority of these patients signs and symptoms of CVO are mild or completely absent. However, when an AV access is created peripheral to a central venous stenosis or occlusion, the blood flow through the extremity may rise at least four to tenfold above the resting level. In this situation the collateral capacity may be insufficient so that venous hypertension will develop.

Depending on the location of the obstruction and the collateral capacity there is a wide variety of possible clinical findings. When the subclavian vein is affected, venous collaterals will become visible around the shoulder and the upper chest. Moderate to severe and sometimes painful and incapacitating arm swelling (Fig. 1) is the most frequent finding.[24] Extreme venous hypertension can lead to skin ulceration and tissue loss.[25,26] Acral skin changes, hyperpigmentation, pincer nail deformity and pseudo-Kaposi's sarcoma, have also been described.[27] In more central (brachiocephalic or superior caval) vein obstruction unilateral face and breast swelling (Fig. 3a) may

Fig. 1. Massive left arm edema in a 79 year old woman on HD for diabetic nephropathy due to filiform subclavian vein stenosis six months after creation of a brachiocephalic fistula. Note the subcutaneous venous collaterals around the left shoulder.

additionally occur.[24] Pelvic vein obstruction following femoral vein catherisation frequently cause leg swelling without a thigh access being fashioned, which, of course, would markedly deteriorate with creation of a functioning access.[21,28]

Swelling may cause difficulties in needling the access with the risk of bleeding and haematoma. Skin ulceration will further enhance the risk of infection and access loss. Therefore, once swelling becomes painful and incapacitating or causes needling or skin problems, CVO should be treated.

Diagnostic Evaluation

Before treatment, exact delineation of the venous pathology is essential. Colour-coded duplex-ultrasound