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Bench and Bedside - Bedside

# Endovascular interventions for central vein stenosis

Anil K. Agarwal [1, 2, *]

[1] Section of Nephrology, University Hospital East, Columbus, OH, USA
[2] Interventional Nephrology, The Ohio State University Wexner Medical Center, Columbus, OH, USA

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Abstract

Central vein stenosis is common because of the placement of venous access and cardiac intravascular devices and compromises vascular access for dialysis. Endovascular intervention with angioplasty and/or stent placement is the preferred approach, but the results are suboptimal and limited. Primary patency after angioplasty alone is poor, but secondary patency can be maintained with repeated angioplasty. Stent placement is recommended for quick recurrence or elastic recoil of stenosis. Primary patency of stents is also poor, though covered stents have recently shown better patency than bare metal stents. Secondary patency requires repeated intervention. Recanalization of occluded central veins is tedious and not always successful. Placement of hybrid graft-catheter with a combined endovascular surgical approach can maintain patency in many cases. In the presence of debilitating symptoms, palliative approach with endovascular banding or occlusion of the access may be necessary. Prevention of central vein stenosis is the most desirable strategy.



## Introduction

Central veins are commonly injured as a result of placement of intravascular devices and vascular access for a critical illness and for performance of hemodialysis (HD). Nearly 80% of patients with end-stage renal disease in the United States initiate dialysis using a catheter, and consequently, central vein injury and subsequent restorative response leading to central vein stenosis (CVS) are extremely common. Central veins are generally obscured by the bony skeleton and are difficult to approach surgically. Hence, endovascular intervention with angioplasty and/or stent placement becomes a logistically more amenable approach for treatment of CVS. However, anatomically and functionally, central veins have several important characteristics including the size, elasticity, curvature, and amount of blood flow that make treatment and maintenance of their patency after intervention difficult. This article will describe approaches to endovascular intervention in different clinical scenarios, which should be planned carefully.

## Preintervention planning for CVS

There are several important considerations before formulating a management plan for CVS.

### *Asymptomatic versus symptomatic CVS*

This is a crucial consideration before planning an intervention because central veins are more elastic and prone to recoil. An intravascular ultrasound study showed immediate recoil in >50% of central lesions [1]. Because of the elasticity of such lesions, stent placement is more likely to be required after angioplasty. At present, the natural history of angioplasty and stent placement are compromised by frequent and rapid recurrence. It

* Corresponding author. Interventional Nephrology, 395 W 12th Avenue, Ground Floor, Columbus, OH 43210, USA
*E-mail address:* anil.agarwal@osumc.edu (AK Agarwal).

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is also possible that an asymptomatic lesion can become symptomatic after the intervention. Indeed, stenosis has been shown to progress faster after intervention [2]. Thirty-five asymptomatic HD patients with arteriovenous (AV) graft and >50% CVS underwent 86 venograms. Of the 28% of patients not undergoing intervention, no one progressed to symptoms, stent placement, or additional CVS. However, of the 72% of the patients undergoing percutaneous angioplasty (PTA), 8% experienced acceleration of CVS requiring further interventions. At the same time, a rather high residual stenosis (40%) in the intervention group was potentially indicative of worse prognosis to begin with, making it difficult to compare the 2 groups. Certainly, it is possible that angioplasty can aggravate the venous response and accelerate the stenotic process. The mechanism of angioplasty itself involves cracking and fissuring of the vessel intima which can incite accelerated neointimal hyperplasia, and recurrent lesions after angioplasty have been shown to have more aggressive neointimal hyperplasia with higher proliferative index than the primary lesion [3]. Thus, higher elasticity and potential for worse recurrent neointimal hyperplasia should deter intervention in asymptomatic or mildly symptomatic CVS. These patients require careful follow-up as worsening symptoms would require intervention.

*Availability of other access options*

It is important to plan for a backup option in case the CVS interventions were to fail. All available options should be considered including reduction of access flow, placement of hybrid catheter graft, or surgical bypass if another potential site for access placement is unavailable. Consideration of alternate method of renal replacement therapy should always be a part of the discussion.

*Availability of local expertise and logistics for managing CVS*

Complexity of CVS requires a multidisciplinary approach—ranging from percutaneous to open intervention. Availability of expertise will obviously define the final approach. Formation of a multidisciplinary team for discussion of challenging vascular access cases will facilitate interaction of all practitioners involved in the care of the patient. As newer technologies become available, it will be important to conduct clinical trials that use standard criteria to define severity and outcome.

## Endovascular intervention for CVS

Endovascular approaches to correction of CVS remain limited, suboptimal, and possibly even detrimental in certain cases. As mentioned earlier, more aggressive neointimal hyperplasia and proliferative lesions were found in restenotic areas after angioplasty than in the original stenotic lesions [3]. Consequently, endovascular intervention for CVS requires careful planning while using restraint when clinically feasible and acceptable.

## Percutaneous angioplasty

PTA with or without stent placement has been the recommended preferred approach to CVS. The guideline 20 of Kidney Disease Outcomes Quality Initiative (K/DOQI) suggests that the percutaneous intervention with transluminal angioplasty is the preferred treatment for CVS [4]. PTA has a very high initial technical success rates, ranging from 70% to 90% [5–11]. The unassisted patency rates reported after PTA have varied from 23% to 63% at 6 months and cumulative patency rates from 29% to 100%. At 12 months, the unassisted patency rate after PTA has ranged from 12% to 50% and cumulative patency rate from 13% to 100%. A more recent study using high-pressure balloons noted better results with PTA alone, with unassisted patency rate of 60% at 6 months and 30% at 12 months (Fig. 1) [12]. It is to be noted that the published studies in CVS used criteria that are not uniform in reporting the description of lesion, severity, or outcome and have been conducted in variable demographics using variable technique and equipment with resultant wide variation among the results of these studies. Better results from a second more recent study [10] also suggest presence of changing variables. It is to be noted that the secondary patency can be significantly better with repeated angioplasty, even without the use of stent. It is also difficult to compare PTA or stent placement because of the reporting issues previously discussed.

There remain drawbacks of angioplasty approach to CVS management. As mentioned, intravascular ultrasound study after angioplasty of central veins has shown that central veins are much more likely to recoil than the peripheral veins [1]. Thus, the success of PTA often depends on the elastic or nonelastic nature of the lesion, which may have different structural characteristics of the stenosis. In addition, accelerated neointimal hyperplasia and faster progression of asymptomatic lesions after angioplasty should curb the enthusiasm to intervene in such lesions without significant rationale [2,3].

## Stents

Treatment of CVS is challenging, and stents for CVS were used because of poor long-lasting results of PTA alone [13]. Guidelines for CVS recommend placement of a stent for elastic recoil of the vein that leads to significant residual stenosis after PTA or for lesions recurring within 3 months after angioplasty [4,14]. Self-expandable stents can be placed with a high degree

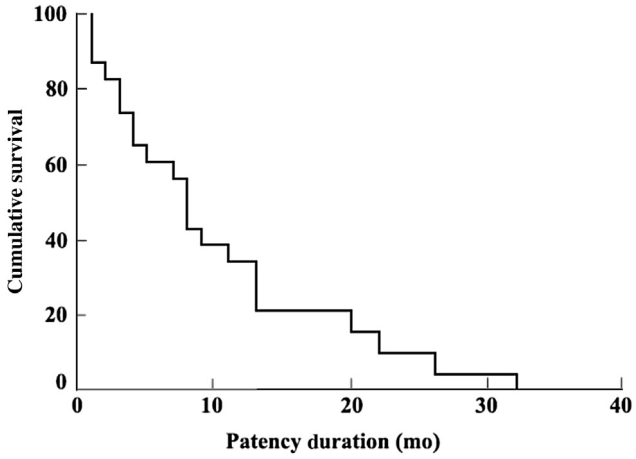


**Figure 1. Kaplan–Meier curve of post-PTA primary patency duration after angioplasty for CVS.**
CVS, central vein stenosis; PTA, percutaneous angioplasty.
*Note*. From "Endovascular treatment of central venous stenoses in patients with dialysis shunts", by E. Buriánková, M. Köcher, P. Bachleda, P. Utíkal, Z. Kojecký, M. Cerná, M. Herman, 2003, *Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub*, 147, p. 203–206. Doi: 10.5507/bp.2003.030. Copyright 2003, Biomedical Papers. Reprinted with permission.