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Management and Treatment of Iliocaval Thrombosis Using Endovascular Recanalization, Stenting, and Reconstruction: What All Practitioners Should Know

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A B S T R A C T

Thrombosis of the inferior vena cava and iliac veins is a significant cause of morbidity, with many patients suffering from painful lower extremity swelling, recurrent deep venous thrombosis, and venous stasis ulcers. Recanalization and stenting of the deep venous system has been shown to be a viable option for patients who fail conservative management. Clinical response and stent patency rates are encouraging for high-volume centers but are less so for smaller patient series, suggesting that the materials and techniques required are specialized and challenging. This article discusses the experience and current literature surrounding iliocaval reconstruction for the treatment of symptomatic iliocaval thrombosis, including preprocedural evaluation, interventional techniques, postprocedural care, and outcomes.

Introduction

Chronic venous insufficiency continues to be a significant cause of morbidity affecting an estimated 1% to 5% of the general population (Jawien, Grzela, & Ochwat, 2003; Wrona et al., 2015). The etiology of chronic venous insufficiency is often a combination of venous reflux and thrombotic obstruction of the proximal deep veins, with a smaller portion of cases due to nonthrombotic obstructive causes such as compression from a mass lesion or an adjacent vascular structure (e.g., May-Thurner syndrome) or venous webbing and stenosis (Mahnken, Thomson, De Haan, & O'Sullivan, 2014; Raju, 2015; Raju, Darcey, & Neglén, 2010; Williams, 2014).

Thrombosis of the inferior vena cava (IVC) and iliac veins causing iliocaval obstruction may remain asymptomatic for years, likely because of compensatory development of venous collaterals arising from paralumbar, azygos, pudendal, or transpelvic veins (Kibbe et al., 2004; Raju, 2015). Over time, however, symptoms eventually manifest, usually after an acute insult, such as deep venous thrombosis, trauma, or cellulitis (Raju, 2015). Symptoms of chronic venous insufficiency include painful lower extremity swelling, recurrent deep venous thrombosis distal to the site of obstruction, venous stasis ulcers, and, in rare cases, limb-threatening phlegmasia (Jawien et al., 2003; Mahnken et al., 2014; Williams, 2014; Wrona et al., 2015).

During the past several decades, retrospective and prospective studies have described favorable clinical outcomes after iliocaval recanalization and stent reconstruction, with modest-to-dramatic clinical improvement (Blättler, Blättler, Haeberli, Foullon, & Roth, 1999; Cockett, Thomas, & Negus, 1967; Hartung et al., 2005, 2009; Hurst et al., 2001; Knipp et al., 2007; Mahnken et al., 2014; Nazarian, Bjarnason, Dietz, Bernadas, & Hunter, 1996; Neglén & Raju, 2000; Neglén, Thrasher, & Raju, 2003; Neglén, Hollis, Olivier, & Raju, 2007; Neglén, Darcey, Olivier, & Raju, 2010; Raju, 2013; Raju, Owen, & Neglen, 2002; Vedantham et al., 2003). Stent patency rates have also been encouraging in the long term with many patients remaining symptom free 5 to 10 years after the procedure (Hartung et al., 2009). As such, iliocaval recanalization and stenting have become the standard of care for patients with severe symptoms secondary to iliocaval thrombosis.

This article discusses the experience and current literature with iliocaval reconstruction for the treatment of iliocaval thrombosis, including preprocedural evaluation, intraprocedural techniques, postprocedural care, and follow-up.

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Evaluation and indications

A complete clinical evaluation of a patient with suspected iliocaval thrombosis should entail a thorough review of the patient's medical history and prior imaging studies, as well as conducting a physical examination. Physical examination will often elicit the severity of symptoms and their impact on the patient's activities of daily living (Mahnken et al., 2014; Raju, 2015; Williams, 2014).

Patients with mild symptoms may be managed conservatively with compression stockings, ambulation, and periodic leg elevation (Mahnken et al., 2014; Raju, 2015; Williams, 2014). Some patients, however, develop life-limiting symptoms despite conservative management. Patients with iliocaval thrombosis who fail conservative management who are clinical, etiology, anatomy, pathology class 3 or higher should be offered iliocaval recanalization and stenting (Mahnken et al., 2014; Raju, 2015). Given the favorable safety profile of this procedure, however, some patients may be offered intervention who fall outside these criteria, and interventionalists should always apply clinical judgment when selecting patients.

Particular care should be taken in determining the symptom time course, as acute and chronic iliocaval thrombosis are managed differently (Williams, 2014). Iliocaval reconstruction should take place either within 2 weeks of symptom onset in the acute setting or after 4 weeks in the chronic setting. Between 2 and 4 weeks, patients should be anticoagulated, and their symptoms should be managed with compression stockings, ambulation, and leg elevation (Mahnken et al., 2014; Williams, 2014). In the acute setting, the fresh thrombus is soft and pliable allowing for recanalization, balloon dilation, and stent placement. Between 2 and 4 weeks, however, the maturing thrombus is large and bulky limiting balloon dilation to suboptimal diameters. After 4 weeks, the chronic clot has scarred down and may be readily dilated and stented after recanalization.

Duplex ultrasonography, computed tomography venography, and magnetic resonance venography are all appropriate noninvasive imaging modalities suited for evaluation of suspected iliocaval thrombosis (Mahnken et al., 2014; Raju, 2015). Although it has been reported that duplex ultrasound may not capture the full extent of the iliac veins, it is still an appropriate screening test in most cases (Mahnken et al., 2014; Raju, 2015). Interventionalists may elect to use cross-sectional imaging if ultrasonography is limited. Traditional venography is not typically performed at this stage given that it is invasive and thought to have similar sensitivity (~50%) to duplex ultrasound, computed tomography venography, and magnetic resonance venography (Mahnken et al., 2014; Raju, 2015; Williams, 2014).

Before the procedure, basic laboratory evaluation should include a complete blood count, renal function panel, and coagulation studies. Testing for hereditary thrombophilias (e.g., factor V Leiden, prothrombin 20210A, antithrombin, protein S, or protein C deficiency) is also warranted if the medical and family history is suggestive (Mahnken et al., 2014; Raju, 2015; Rosendaal & Reitsma, 2009; Williams, 2014). Platelets should be no lower than 50,000/μL with an international normalized ratio of 1.5 to prevent excessive bleeding, although this may be impractical in patients who require systemic anticoagulation, and an elevated international normalized ratio is not a contraindication to iliocaval reconstruction (Raju, 2015; Williams, 2014). A glomerular filtration rate less than 50 mL/min is considered high risk for contrast-induced nephropathy by the American Society of Radiology, and thus carbon dioxide contrast should be used along with judicious use of iodinated contrast when necessary (Ellis et al., 2017). The use of intravascular ultrasound in patients with renal dysfunction may help limit contrast use (Mahnken et al., 2014; Murphy et al., 2017; Neglén & Raju, 2000, 2002; Neglén et al., 2010; Raju, 2013; Raju & Neglen, 2006; Williams, 2014).

Technique

General anesthesia is preferred over conscious sedation in most cases; however, both are appropriate for iliocaval reconstruction. If conscious sedation is used, local anesthetic should be administered to all sites of vascular access to ensure patient comfort throughout the procedure. Nurses should continually reassess patient comfort during the procedure to determine the need for additional sedation. Balloon dilation of stenotic vein segments may be painful (Raju, 2015), and sedation level should be reassessed before angioplasty. In addition, controlled breath holds are required throughout the procedure, so patients should be able to follow commands.

Although there are few published guidelines specifying preferred routes of venous access, the right jugular vein and bilateral femoral veins are commonly cited (Chick et al., 2017; Mahnken et al., 2014; Murphy et al., 2017; Neglén et al., 2010; Raju, 2015; Raju et al., 2006; Williams, 2014). Other reasonable access sites include greater saphenous, tibial, or pedal veins. Popliteal access is also an option if the patient can tolerate prone positioning (Raju, 2015). Access should be acquired under ultrasound guidance for optimal safety (Hartung et al., 2009; Mahnken et al., 2014; Raju, 2015; Williams, 2014). It should be noted that more distal access may be required later in the procedure to allow thorough evaluation of distal vein segments, as robust venous inflow is critical for long-term stent patency and infrainguinal stent extension (Mahnken et al., 2014; Raju, 2015; Williams, 2014).

After vascular access and placement of a sheath, venography of the femoral and iliac veins should be performed. If occlusion or significant stenosis is present, a large trabeculated network of collaterals is commonly seen. Close evaluation may reveal a thin strand of contrast representing an iliocaval conduit (string sign) through the obstruction (Williams, 2014). The string sign may be used as a guide to direct guidewire advancement across the obstruction, although it may be challenging to visualize among the adjacent network of collateral vessels.

Multiple techniques have been described for traversing chronic venous stenoses or total occlusions. Fluoroscopic-guided guidewire advancement through the lesion is the simplest and safest technique, although it is not always feasible (Williams, 2014). For more challenging occlusions, using the back end of a wire, needle recanalization, or radiofrequency wire are all viable options (Khaja et al., 2017; Raju et al., 2002). Although these methods increase the risk of perforation, this is largely a benign event as low venous pressures and surrounding tissues prevent significant hematoma formation (Raju, 2015; Williams, 2014). In the event of suspected perforation, the guidewire may be withdrawn and simply readvanced, often without consequence.

Once the lesion has been traversed, venography of the iliac veins and IVC should be performed to detect defects in the newly recanalized venous conduit such as serious perforation or inadvertent arteriovenous fistula formation (Williams, 2014). Intravascular ultrasound may also reveal defects and residual thrombus and is more sensitive than venography alone (Williams, 2014).

Once through-and-through access has been achieved, the lumen must be dilated to permit later stent placement. Like recanalization, balloon dilation should be performed in a distal to proximal fashion. The purpose of iliocaval reconstruction is to depressurize the deep venous system in the lower extremities. As such, the iliac veins and IVC should be dilated and stented to nominal diameters. It is the opinion of multiple authors that minimal stent diameters for the IVC, common iliac vein, external iliac vein, and femoral vein be 20, 16, 14, and 12 mm, respectively (Chick et al., 2017; Hartung et al., 2009; Mahnken et al., 2014; Murphy et al., 2017; Neglén et al., 2010; Raju, 2015; Thomas et al., 2014; Vedantham et al., 2003; Williams, 2014).