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Venous In-stent Thrombosis Treated by Ultrasound Accelerated Catheter Directed Thrombolysis

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WHAT THIS PAPER ADDS

Currently, there are very few reports of the complications of venous stent placement. This article reports the authors' experience and provides guidance and recommendations for clinicians on how to treat these complications and how to follow up on patients.

Objective/Background: Stent placement in the venous system is an increasingly used treatment modality in chronic venous obstruction and as additional treatment after thrombolytic therapy in ilio-femoral deep vein thrombosis (DVT). Experience in treating in-stent thrombosis with ultrasound accelerated catheter directed thrombolysis (UACDT) is reported.

Methods: A retrospective analysis of patients treated for venous stent occlusion, after percutaneous transluminal angioplasty (PTA) and stent placement for either chronic venous occlusive disease or persistent vein compression in patients with acute DVT was performed. Duration of occlusion and suspected clot age were assessed using patient complaints and typical findings on duplex ultrasonography (DUS). DUS and venography were used to assess patency and to determine the cause of re-occlusion. Acute treatment of occlusion was by UACDT. Additional procedures included PTA, stent placement, and creation of an arteriovenous (AV) fistula.

Results: Eighteen patients (median age 43 years; 67% male), treated for occluded stent tracts with UACDT between January 2009 and July 2014, were identified. Indications for initial stenting were treatment of chronic venous obstructive disease (12 patients) and treatment of underlying obstruction after initial thrombolysis in acute DVT (six patients). Technical success was achieved in 11/18 (61%) patients. Primary patency in 8/11 patients was 73% at last follow up (median follow up 14 months [range 0–41 months]). Additional treatments after successful lysis were re-stenting (seven patients) and creation of an AV fistula (six patients).

Conclusion: Treatment with UACDT of recently occluded stent tracts is feasible and effective. Recanalization of the stent tract can be achieved in most cases. Additional interventions were frequently used after successful UACDT treatment. Suboptimal stent positioning caused the majority of the stent occlusions.

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INTRODUCTION

During the last two decades endovenous recanalization, by percutaneous transluminal angioplasty (PTA) and stenting, in chronic deep venous obstructive disease has quickly gained in popularity. Many authors have shown excellent clinical success rates.[1–3] Because of this, and as stenting seems to be the only treatment aimed at resolving the underlying pathology in post-thrombotic syndrome (PTS) and iliac vein compression syndromes, it has been implemented in many expert venous centers worldwide as a first line treatment. Complication rates have been shown to be low, with generally no clinically relevant pulmonary emboli and no procedure related mortality.[3–5] The most important complication is acute re-occlusion of the stented venous segment, with or without thrombus propagation into proximal or distal vein tracts. This occurs in 20–30% of

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cases, even when adequate anticoagulation regimens are used.[4] In cases of stent re-occlusion return of signs and symptoms of venous disease can be expected, and in some cases worsening of complaints compared with the pre-recanalization state. An important step in preventing re-occlusion is to guarantee adequate in- and outflow for the stents. Inflow problems can arise when veins caudal to the stented segments are also involved in the post-thrombotic process, most notably the femoral and deep femoral vein, as flow volume in such cases might not be sufficient to maintain patency. Outflow problems arise when venous tracts cephalad to the stents are (partly) obstructed owing to endoluminal pathology or external compression. Furthermore, in-stent problems, for example residual compression by overlying arteries, stenosis, kinking, or fractures, are also thought to lead to a higher loss of patency. Prevention by extending stents cephalad or caudal into a healthy vein tract and using stents that withstand the pressure from overlying structures such as arteries and do not kink are therefore very important.[6] Adequate antithrombotic therapy is also important in preventing re-thrombosis.

In cases where re-occlusion occurs, removal of as much of the thrombus load as quickly as possible is generally thought necessary.[7] One possible option is to remove the thrombus by means of pharmaco-mechanical thrombolysis. Ultrasound accelerated catheter directed thrombolysis (UACDT) is used for acute occlusions in the arterial system, deep vein thrombosis (DVT), and pulmonary embolism.[8–11] The literature shows good safety and feasibility for UACDT for these indications. Possible advantages of UACDT over the use of a normal thrombolysis catheter are shortened treatment duration and smaller volumes of thrombolytic used, reducing the risk of (major) bleeding.[12] In the literature, when there is adequate patient selection, the chance of achieving technical success is around 90%, together with a minimal risk of bleeding.[13]

In this study the experience of treating in-stent thrombosis with UACDT in patients referred to a tertiary center is reported. Furthermore, the pitfalls that have been encountered in these cases are described, and recommendations are made on how to follow up patients after venous stenting.

METHODS

Population

From October 2009 to July 2014 all patients treated for venous stent occlusion by UACDT were eligible for inclusion in this retrospective analysis. All patients were evaluated for bleeding risk. Indication for primary stent placement was either chronic venous obstructive disease or persistent vein compression in patients with acute ilio-femoral DVT during thrombolytic therapy. Time between stent placement and occlusion was assessed and patients were divided into two groups (within 6 months of stent placement, and longer than 6 months after stent placement). Occlusion side was noted and, if available, thrombophilia status was reported. No additional testing for thrombophilia factors was performed. Duration of occlusion and suspected clot age were assessed from patient complaints and findings on duplex ultrasonography (DUS).[14] Patient complaints were assessed and used as the criterion to categorize patients into two groups: complaints for $\leq$21 days, and $>$21 days. The last patent duplex scan was taken as a reference value for assessment of clot age. Stent obstruction was diagnosed using DUS with normal B-mode settings, power flow, e-flow, conventional color, and pulse wave Doppler to assess flow in the stent tract. At least one of the available modalities or combinations was used. The venous tract was assessed in both transverse and longitudinal planes. In order to visualize flow in the stented ilio-caval tract a number of flow augmenting maneuvers were performed, such as inspiration and expiration, dorsiflexion of the foot, and gluteal muscle contraction.

Before recanalization and catheter placement, venography was routinely performed to confirm the diagnosis of stent obstruction.

Dutch law allows for retrospective analysis of patient data without specific approval of an ethical committee.

Intervention

The interventional radiologist placed the UACDT catheter under venographic control. The EKOS Endowave Peripheral Lysis System (BTG International Ltd, London, UK) consists of a multilumen infusion catheter with removable, coaxial ultrasound (US) cores and a control unit that simultaneously delivers high-frequency (2.2 MHz), low energy (0.45 W) US energy and thrombolytic drug into the thrombus. All patients received UACDT with the EKOS Endowave system. Urokinase (Medacinase, Lamepro, the Netherlands) was used as the thrombolytic agent in all cases. Urokinase was administered at 100,000 units/hour after a single bolus of 250,000 units at the start of treatment. In cases of bilateral occlusion, two catheters were inserted and the drug dosage was evenly divided over the two catheters, each with their own EKOS machine. During thrombolysis fibrinogen, hemoglobin, activated partial thromboplastin time (APTT), prothrombin time standardized to international normalized ratio (INR), thrombocytes, and D-dimer levels were routinely monitored. During active thrombolysis, anticoagulant treatment was substituted by intravenous unfractionated heparin guided by APTT (between 40 and 60 seconds or 1.2—1.7-fold the reference value of 34 seconds). At the same time, patients were fitted with intermittent pneumatic compression sleeves. Inferior vena cava filters are not used routinely at the authors' hospital. None of the patients received a caval filter. After thrombolysis, patients either resumed or started oral anticoagulation for at least 6 months or, if indicated, for life (recurrent DVT). Adequate anticoagulation was achieved with either Coumadin (Bristol-Myers Squibb, New York, NY, USA) with an INR between 2.5 and 3.5, according to the standards of the Dutch Federation of Thrombosis Services, or rivaroxaban 20 mg once daily. The choice of anticoagulant agent was based on