CLINICAL STUDY

Endovascular Management of May–Thurner Syndrome in Adolescents: A Single-Center Experience

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ABSTRACT

Purpose: To report a single-center experience in regard to the technique, safety, and clinical outcomes of endovascular therapy for treatment of May–Thurner syndrome (MTS) in adolescent patients.

Materials and Methods: A retrospective review identified 10 patients (6 female; mean age, 16 y; range, 12–18 y; mean weight, 73 kg; range, 50–116 kg) treated by endovascular therapy for MTS from 1998 to 2015. Clinical presentations consisted of acute thrombotic MTS (n = 6) and nonthrombotic MTS (n = 4). Catheter-directed thrombolysis was performed in all cases of thrombosis. Venoplasty and stent placement were performed in all cases. Self-expanding stents 12–16 mm in diameter and 4–9 cm in length were deployed.

Results: No major periprocedural complications were observed. Median follow-up was 32 months (range, 6–109 mo). Primary and secondary patency rates were 79% and 100% at 12 months and 79% and 89% at 36 months, respectively. In a single patient with permanent loss of flow in the treated segment, multiple risk factors for thrombosis were identified. Rates of posttreatment symptoms were 0% by Villalta score and 60% (n = 6; mild symptoms) by modified Villalta score at the last clinical follow-up.

Conclusions: Endovascular therapy for the treatment of MTS in our adolescent cohort was safe and effective in relieving venous obstruction. Stent placement in patients with underlying thrombophilic disorders is associated with loss of secondary patency, suggesting the need for further consideration in this population.

ABBREVIATIONS

DVT = deep vein thrombosis, MTS = May–Thurner syndrome, PTS = postthrombotic syndrome

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May–Thurner syndrome (MTS), also known as iliac vein compression syndrome and Cockett syndrome, is a clinical condition resulting from pelvic and lower-extremity venous hypertension caused by compression of the left common iliac vein against the lumbar spine by the overlying right common iliac artery. Decades of reports of feasibility, safety, and high patency rates after catheter-directed thrombolysis, venoplasty, and stent placement for stenoses associated with MTS have resulted in these techniques becoming a standard of care in the adult population (1,2). The indications for endovascular treatment have broadened, and endovascular therapy has also become an accepted treatment option for MTS in the absence of deep vein thrombosis (DVT) or in the presence of chronic thrombotic occlusion (3,4).

While the preponderance of existing literature addresses treatment of adults, data in the pediatric population are limited to several small case series. Raffini et al (5) described a series of three 16-year-old patients with MTS presenting with extensive ileofemoral thrombosis treated with catheter-directed therapy. Two

of the three patients were treated with pharmacomechanical thrombolysis and primary stent placement, with symptomatic improvement and patency of the ileofemoral system in all cases at a mean follow-up of 18 months (range, 15–20 mo). Murphy et al (6) reported endovascular therapy experience with a mixed pediatric and young-adult MTS population with symptomatic ileofemoral DVT after onset of oral contraceptive pill use. In the pediatric subset of five patients, the patency rate was 100% at a mean follow-up of 12 months (range, 6–22 mo). Goldenberg et al (7) reported a prospective study comparing percutaneous pharmacomechanical thrombolysis versus conventional anticoagulation for occlusive proximal-limb DVT in an adolescent population. Although the study was not designed specifically for MTS therapy, a subset of six adolescent patients with MTS anatomy received stents as part of treatment. In this subpopulation, the rates of primary patency were 40% and 20% at 12 and 24 months, respectively. Gaballah et al (8) described experience with endovascular management of ileofemoral thrombosis with stent placement in four patients for residual ileofemoral stenosis. Discrete results of this subgroup were not provided.

Although pediatric interventional radiologists are gaining experience applying endovascular techniques for treatment of MTS, the literature remains limited in the scope and breadth of MTS case reports, technical aspects of intervention, periprocedural management, and clinical outcomes. The purpose of the present work is to describe the feasibility, safety, and clinical outcomes of applying adult-based endovascular thrombolysis, venoplasty, and stent placement techniques to adolescent patients with MTS.

MATERIALS AND METHODS

Patient Selection and Study Design

Following institutional review board approval of this single-center retrospective study, patients were identified for inclusion by query of an interventional radiology database for all pediatric patients who underwent percutaneous endovascular therapy for MTS between January 1998 and January 2015. Patients with a history of MTS as documented in the electronic medical record by conventional venography (n = 8) or magnetic resonance venography (n = 2) and in whom the first intervention occurred before age 19 years were identified. During the study period, a total of 16 patients were treated via endovascular techniques for lower-extremity venous obstruction. Exclusion criteria included catheter-directed intervention with stent placement in the lower-extremity venous system before initial presentation to our institution as a result of the lack of information on initial presentation and management (n = 3) and lack of postprocedural clinical follow-up for outcome assessment (n = 3).

The final study population included 10 adolescent patients presenting with symptomatic MTS treated with a combination of pharmacologic or pharmacomechanical thrombolysis, venoplasty, and stent placement. The patient cohort consisted of six female and four male patients. The mean age of the study population was 16 years, with a range of 12–18 years. The mean weight of the population was 73 kg, with a range of 50–116 kg. Five patients exhibited at least one risk factor for thrombosis, which included factor V Leiden mutation, antiphospholipid syndrome, *MTHFR* gene mutation, protein S deficiency, and oral contraceptive pill use. Six patients presented with acute DVT as defined by the Society of Interventional Radiology (SIR) reporting standards for endovascular treatment of lower-extremity DVT (9) based on the clinical documentation of presentation and imaging findings at venography. The remainder of the cohort presented with chronic venous outflow obstruction without associated thrombus. Patient demographic data and clinical presentations are provided in **Table 1**.

Intraprocedural and postprocedural data, including thrombolysis, complications, and stent patency, were defined and characterized according to SIR reporting standards (9). Thrombolysis success was defined as less than 50% residual thrombus within the treated segment (ie, grade II/III thrombus removal). Technical success of the endovascular intervention was defined as demonstration of brisk antegrade flow and less than 20% residual stenosis after stent placement without dissection or contrast agent extravasation (10).

Posttherapeutic symptoms were quantified by Villalta score (11) and a modified version of the Villalta score designed for the pediatric population (12). If not explicitly reported in the follow-up clinic visit report, Villalta and modified Villalta scores were estimated based on the most recent available documented clinical data.

Procedural Details and Technique

Fellowship-trained interventional radiologists with a mean of 8.6 years of experience (range, 2.2–16.7 y) performed all procedures. A total of 24 endovascular procedures, including venography, thrombolysis, venoplasty, and stent placement, were performed in the cohort. Procedural and periprocedural details are provided in **Table 2**. Nineteen angiographic procedures were performed to establish initial patency, with the remainder performed for the treatment of in-stent thrombosis. Two patients with nonthrombotic MTS underwent staged interventions. Initial venography was performed in one of the two patients to evaluate venous dynamics with the goal of assessing the contribution of venous hypertension to the lower-extremity edema. Venography with venoplasty was performed in the second patient, with delay of stent placement to allow an interval of clinical observation. Venography with stent placement at 3 months was performed in both cases as a result of persistent lower-extremity symptoms.