Medical Coverage Policy

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Venous Angioplasty and/or Stent Placement in Adults

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Overview

This Coverage Policy addresses venous angioplasty and/or stent placement in adults ≥18 years of age. This policy does not address venous angioplasty and/or stent placement in individuals under 18 years of age. Percutaneous revascularization of the lower extremities in adults is addressed in a separate Medical Coverage Policy.

Coverage Policy

Venous angioplasty and/or stent placement in an adult ≥ 18 years of age is considered medically necessary for ANY of the following indications:

- thrombotic obstruction of major hepatic veins (e.g., Budd-Chiari Syndrome)
- iliac or iliofemoral vein intervention for iliac vein compression syndrome (e.g., May-Thurner Syndrome)
- iliac vein or inferior vena cava stenting for obstructive disease, without superficial truncal reflux, in a symptomatic individual with skin or subcutaneous changes, healed or active ulcers (Clinical, Etiology, Anatomy, and Pathophysiology [CEAP] classes 4-6)
- superior vena cava syndrome
- pulmonary vein stenosis
- stenosis associated with central venous catheters or transvenous pacemaker leads
- as an adjunct to catheter-directed thrombolysis for femoroiliocaval deep vein thrombosis post thrombolysis for EITHER of the following:
    - when there is significant residual stenosis (50% or more) acutely
    - when subsequent imaging identifies significant residual stenosis (50% or more) in a symptomatic patient

Repeat venous angioplasty and/or stent placement in an adult ≥ 18 years of age is considered medically necessary for ANY of the above indications when there is angiographic evidence of restenosis.

Venous angioplasty of the subclavian vein after surgical decompression in an adult ≥ 18 years of age is considered medically necessary for venous thoracic outlet syndrome when imaging demonstrates residual stenosis.

Repeat venous angioplasty for venous thoracic outlet syndrome in an adult ≥ 18 years of age is considered medically necessary when there is angiographic evidence of restenosis.

Venous stenting for the treatment of venous thoracic outlet syndrome is considered not medically necessary.

Venous angioplasty and/or stent placement is considered not medically necessary for all other indications (e.g., Idiopathic Intracranial Hypertension (IIH), pulsatile tinnitus,

Left Iliac or left renal Vein Compression Associated with Pelvic Congestion Syndrome (PCS)).

Health Equity Considerations

Health equity is the highest level of health for all people; health inequity is the avoidable difference in health status or distribution of health resources due to the social conditions in which people are born, grow, live, work, and age.

Social determinants of health are the conditions in the environment that affect a wide range of health, functioning, and quality of life outcomes and risks. Examples include safe housing, transportation and neighborhoods; racism, discrimination and violence; education, job opportunities and income; access to nutritious foods and physical activity opportunities; access to clean air and water; and language and literacy skills.

Chronic venous disease (CVD) is defined as "the full spectrum of morphological and functional abnormalities of the venous system" (De Maesenner, et al., 2022). It is estimated that CVD affects 60%–80% of the world population. Approximately 25% of these individuals have CVD characterized by varicose veins while 5% have more severe manifestations characterized by venous insufficiency. The risk for varicose veins and venous insufficiency is greater in women compared to men (2.6% vs 1.9%) and increases with age. Additional risk factors identified include: pregnancy (increasing risk with additional pregnancies), obesity, sedentarism, family history, smoking, and history of venous blood clots. The estimated cost associated with CVD is three billion dollars per year (Ortega, et al., 2021).

General Background

Angioplasty, and/or vascular stenting, is a minimally invasive procedure that has been performed as an alternative to open vascular surgery to improve blood flow when there is narrowing in the body's veins. The procedure is usually performed in an interventional radiology suite.

In an angioplasty procedure, imaging techniques (typically fluoroscopy) are used to guide a balloon-tipped catheter, a long, thin plastic tube, into a vein and advance across the area of vessel narrowing or blockage. The balloon is inflated to open the vessel, then deflated and removed. Many angioplasty procedures also include the placement of a stent, a small, flexible tube made of plastic or wire mesh to support the damaged artery walls. Stents can be self-expandable (opens up itself upon deployment) or balloon expandable (balloon needed to open the stent). Venous angioplasty may have to be repeated for restenosis or blockage. If a stent is placed, the chance of restenosis is reduced but it can still occur.

There are numerous conditions which have been treated with venous angioplasty and/or stenting, including, but not limited to, iliac vein compression syndrome (May-Thurner syndrome), iliocaval obstruction, stenotic or thrombosed arterio-venous-dialysis access grafts, thrombotic obstruction of major hepatic veins (Budd-Chiari syndrome), superior vena cava syndrome, pulmonary vein stenosis, venous thoracic outlet syndrome, idiopathic intracranial hypertension, multiple sclerosis or chronic cerebrospinal venous insufficiency, left iliac vein or left renal vein (Nutcracker syndrome) compression associated with pelvic congestion syndrome, and chronically occluded iliac veins.

Thrombotic Obstruction of Major Hepatic Veins (e.g., Budd-Chiari Syndrome)
Budd-Chiari syndrome (BCS) is a rare, life-threatening disorder caused by obstruction of hepatic venous outflow and/or the inferior vena cava. The approach to management in patients with

Budd-Chiari syndrome depends on clinical and anatomic features. Radiologically-guided treatment, including angioplasty and stenting, can be used to treat patients with acute or subacute Budd-Chiari syndrome who are symptomatic, provided a venous obstruction amenable to percutaneous angioplasty and stenting is visualized radiologically (e.g., on magnetic resonance venography or percutaneous venography) (Zhang and Wang, 2015).

Literature Review: Zhang and Wang (2015) conducted a systematic review with meta-analysis to update and quantitatively assess the successful rate of interventional operation, the rate of vascular restenosis (including vascular re-occlusion at one year after initial operation), and the survival rate at one and five years after initial operation in different types of intervention. Various types of intervention, such as thrombolysis, angioplasty, stent implantation, and transjugular intrahepatic portosystemic shunting (TIPS), have different treatment outcomes for BCS patients. A total of 29 articles on interventional treatment for BCS were included in the meta-analysis, for a total of 2255 BCS patients. The pooled results were 93.7% (92.6–4.8) for successful rate of interventional operation, 6.5% (5.3–7.7%) for restenosis rate of interventional treatment, and 92.0% (89.8–94.3%) and 76.4 % (72.5–80.4%) for the survival rate at one and five years, respectively. The interventional therapy of major BCS patients is safe with successful operation, good patency, and long-term survival. A step-wise management of BCS is proposed to manage and cure all BCS patients with personalized treatment.

Professional Societies/Organizations:
American Association for the Study of Liver Diseases (AASLD): In a guidance document developed by expert panel consensus based on review and analysis of the literature, the AASLD (Northup, et. al., 2021) stated that venous outflow can be restored with local instillation of thrombolytics (e.g., tPA, streptokinase, urokinase) used in combination with angioplasty and/ or stenting. Percutaneous transluminal angioplasty with or without stent placement may restore hepatic vein outflow in cases of segmental stenosis.

American College of Gastroenterology (ACG): In a 2020 clinical guideline on disorders of the hepatic and mesenteric circulation, the ACG stated that "balloon angioplasty of the hepatic vein, with or without stenting, should be reserved for patients with short-segment hepatic vein stenosis". Furthermore, the guideline states that management should proceed in a stepwise fashion from the least to most invasive therapy. Management should begin with systemic anticoagulation. If this fails, then endovascular therapies (e.g., angioplasty, TIPS) are recommended (Simonetto, et al., 2020).

Iliac Vein Compression Syndrome (e.g., May-Thurner Syndrome)
May-Thurner syndrome (MTS) is defined as extrinsic venous compression by the arterial system against bony structures in the iliocaval venous territory. MTS is also referred to as iliocaval venous compression syndrome, iliac vein compression syndrome, Cockett's syndrome, and venous spur. The resultant venous stasis from this compression can lead to venous congestion and the development of deep venous thrombosis (DVT) in the left lower extremity. This syndrome is relatively uncommon. The approach to diagnosis and treatment depends upon whether venous thrombosis is present. If DVT occurs, it is treated with anticoagulation therapy. When the diagnosis is suspected based upon clinical features or noninvasive vascular imaging, a definitive diagnosis is established using intravascular ultrasound (after removal of thrombus, if necessary). The mechanical compression is treated with surgery or stent placement. Minimally invasive treatment, angioplasty and stenting, of the venous lesion relieves outflow obstruction and provides immediate relief of symptoms with good long-term patency rates. For those with venous thrombosis, rates of post-thrombotic syndrome are reduced with endovascular treatment (Kaltenmeier, et al., 2017).

Literature Review: In a multicenter retrospective study, Funatsu et al. (2019) investigated the efficacy and safety of stent implantation for treating May-Thurner syndrome (MTS) with acute DVT. A total of 59 patients from 10 hospitals in Japan were treated with stents for left iliac vein stenosis with acute DVT. All patients had acute symptomatic DVT involving the left common iliac vein and underwent stent implantation. There were no exclusion criteria except for patient's refusal. The primary endpoint for the study was stent patency. The secondary endpoint was recurrence of DVT and development of post-thrombotic syndrome (PTS) during follow-up. Patient success was achieved in 56 patients (95%). Clinical follow-up was conducted for 50 patients (89%) for a median duration of 40 months (range 8-165 months). A total of 44 patients (79%) were followed up using imaging modalities. During this period, four patients (9%), had stent occlusion and one patient was successfully treated using balloon angioplasty. Primary and secondary patency rates were 84% at 19 months and 93% at 20 months, respectively. Recurrence of DVT was documented in three (8%) of the patients. PTS was evaluated in 36 patients. Three patients (8%) had PTS; however, none of the patients had severe PTS. This study is limited by the small sample size and design of the study.

Kaltenmeier et al. (2018) conducted a systematic review of May-Thurner syndrome (MTS). The authors summarized patients' presentations, diagnostic modalities, and treatment strategies between men and women. The systematic review included 104 articles providing relevant information for 254 patients. Multiple treatment modalities have been used to treat MTS, including endovascular interventions without thrombolysis (53%) or with thrombolysis (33. 2%), open surgery (6.8%), and medical management (7%). Endovascular treatment was more common compared with surgical or medical treatment. Before the year 2000, 75% of procedures were performed by open surgery (39/52) and 25% were endovascular (13/52). In contrast, during the following period (2000-2014), 4.1% of treatment involved open surgery (45/1099) and 95.9% (1054/1099) were endovascular interventions. Complications were more common after open compared with endovascular procedures (8.1% vs 3.3%; p=021). The mean reported follow-up time was 25.8 months, and 20 patients had to undergo re-interventions after open (3.2%; n=3/94) or endovascular (1.6%; n=17/1067) treatment. The patency of the treated vein after 12 months was superior for endovascular treatment (96% [576/599]) compared with open surgery (64.2% [20/31]; p <0.01). Information on follow-up could be extracted from 79 articles, most of them being single case reports or large case series if detailed information was provided. MTS is more common in women, with a ratio of at least 2:1 compared with men. Women with MTS tend to present at a younger age and have increased risk of PE compared with men. The authors report that the findings support the current paradigm of endovascular therapy as a modality of choice for MTS and iliac vein compression as well.

Moudgill et al. (2009) reported in a review that current management of May-Thurner syndrome (MTS) largely involves endovascular therapy. A review was conducted of six studies containing at least five patients with MTS treated by endovascular therapy. The authors compiled data on 113 patients, analyzing patient demographics, treatment details, and outcome. Review of 113 patients revealed that the majority were females (72%) presenting with DVT (77%), most of which was acute in onset (73%). Therapy consisted of catheter-directed thrombolysis and subsequent stent placement in most patients, resulting in a mean technical success of 95% and a mean 1-year patency of 96%. Endovascular therapy is the current mainstay of treatment for MTS. Review of the current literature supports treatment via catheter-directed thrombolysis followed by stent placement with good early results.

Iliocaval Venous Obstruction (ICVO)
Iliocaval venous obstruction (ICVO) is a clinico-pathologic condition of the systemic veins of the abdomen that can be due to one of several etiologies and that may contribute to venous hypertension or extensive lower extremity deep vein thrombosis (DVT). Whether to proceed with treatment depends upon the etiology of obstruction, severity of symptoms, and the presence or

absence of thrombus (i.e., nonthrombotic ICVO versus thrombotic ICVO). For symptomatic ICVO stenosis, stenting is preferable but is not universally agreed upon. Stenting is important for maintaining patent venous outflow in the long term. Without stenting, recurrence rates are > 70%. In the iliac segment, residual stenosis has been correlated to the development of post-thrombotic syndrome. Recurrence rates may depend upon underlying pathology and type of stent used. If thrombus is present on the initial venogram, angioplasty and stenting of a stenotic ICVO lesion is performed once thrombus has been cleared. Once vein patency is restored using pharmacomechanical thrombolysis, as confirmed by repeat venography, angioplasty and stenting can be performed (Mousa, et al., 2022a; Mousa, et al., 2022b).

Professional Societies/Organizations:
The 2020 American Venous Forum, the Society for Vascular Surgery, the American Vein and Lymphatic Society, and the Society of Interventional Radiology developed appropriate use criteria (AUC) for chronic lower extremity venous disease to provide clarity for the application of venous procedures (Masuda, et al., 2020). For iliac vein or inferior vena cava (IVC) obstructive disease, defined as ≥50% area reduction by intravascular ultrasound or occlusion and no superficial truncal reflux, the panelists rated stenting as first-line treatment appropriate for symptomatic patients with Clinical, Etiology, Anatomy, and Pathophysiology (CEAP) classes 4 to 6. Although most of the evidence consists of case series, guidelines and summaries suggest that stenting for symptomatic venous obstructions for advanced stages (C4b-C6) is beneficial. The panelists state that the results of treating edema seemed less predictable with stenting (see C3, edema), which accounts, in part, for the rating by the panelists of may be appropriate with or without coexisting superficial truncal reflux. The panelists noted that edema can range from ankle to entire leg and if unilateral would more likely be due to a venous cause. The level of edema below or above the knee is not specified in reports, and its significance in iliocaval disease and how it affects outcomes need further research.

Visible manifestations of venous disorders according to CEAP clinical class (based on revised CEAP classification):
- C0 no visible or palpable signs of venous disease
- C1 telangiectasias or reticular veins
- C2 varicose veins: distinguished from reticular veins by a diameter of ≥3 mm
- C3 edema
- C4a pigmentation or eczema
- C4b lipodermatosclerosis or atrophie blanche
- C5 healed venous ulcer
- C6 active venous ulcer

Appropriateness criteria for iliac vein or inferior vena cava (IVC) stenting as first-line treatment:

<u>Appropriate:</u>
- Iliac vein or IVC stenting for obstructive disease without superficial truncal reflux as first-line treatment in a symptomatic patient with skin or subcutaneous changes, healed or active ulcers (CEAP classes 4-6).

Appropriate treatment is a generally acceptable and reasonable approach for the indication. Treatment is likely to improve the patient's health outcomes or survival.

<u>May be Appropriate:</u>
- Iliac vein or IVC stenting for obstructive disease with or without superficial truncal reflux as first-line therapy in a symptomatic patient with edema due to venous disease (CEAP class 3), provided careful clinical judgment is exercised because of the potential for a wide range of coexisting non-venous causes of edema

May be appropriate treatment may be an acceptable or reasonable approach for the indication or treatment may improve the patient's health outcomes or survival or more research or patient information is necessary to classify the appropriateness of the indication.

Never Appropriate:

- Iliac vein or IVC stenting for obstructive disease in an asymptomatic patient for iliac vein compression, such as May-Thurner compression, for incidental finding by imaging or telangiectasia (CEAP class 1).

In a 2023 position statement on the management of chronic iliofemoral venous obstruction with endovascular placement of metallic stents (Vedantham, et al., 2023) , the Society of Interventional Radiology (SIR) provided the following recommendations after conducting a systematic review of the available evidence (i.e., randomized trials, systematic reviews and meta-analysis, prospective single-arm studies, retrospective studies):

- "Clinical Suspicion: In patients with symptoms or signs of advanced chronic venous disease, the possibility that iliofemoral venous obstruction could be a contributing factor should be considered and evaluated when supported by the medical history, symptoms, physical examination, and prior imaging studies (Level of Evidence E, Strength of Recommendation Strong).
- Clinical Evaluation: A thorough clinical evaluation of the patient's self-reported symptoms, objective clinical signs of venous disease, and their impact on life activities should be performed and documented before undertaking any endovascular treatment for chronic iliofemoral venous obstruction (Level of Evidence E, Strength of Recommendation Strong).
- Conservative Therapy: In patients with chronic iliofemoral venous obstruction, efforts to alleviate symptoms and optimize limb function using conservative means should be made before placing stents (Level of Evidence E, Strength of Recommendation Strong).
- Venous Ulcers: Patients with venous ulcers should receive compression therapy and close active follow-up, ideally in a specialized wound care facility that follows published clinical practice guidelines (Level of Evidence A, Strength of Recommendation Strong).
- Patient Selection for Stent Placement: Venous stent placement may be appropriate in highly selected symptomatic patients with chronic iliac vein obstruction but should be avoided in most patients who do not have the following: (a) life interference
- (symptoms or functional disability) of at least moderate severity, with a high probability that it is attributable to the venous disease; (b) anatomic evidence of significant venous obstruction in the IVC, iliac vein, or common femoral vein; (c) good inflow to the common femoral vein from a patent femoral and/or deep femoral vein; and (d), for patients with an
- individualized risk profile that portends a substantial risk of stent thrombosis, the ability to receive long-term anticoagulation (Level of Evidence C, Strength of Recommendation Weak).
- Intravascular US: The addition of intravascular US is encouraged when catheter venography is performed to evaluate for chronic iliac venous obstruction (Level of Evidence C, Strength of Recommendation Moderate).
- Clinical Trial Enrollment: Enrollment of study-eligible patients with chronic iliofemoral venous obstruction in rigorous randomized controlled clinical trials that evaluate the effectiveness and safety of endovascular therapies including stent placement is strongly recommended (Level of Evidence E, Strength of Recommendation Strong).
- Patients with Cancer: In patients with malignant iliofemoral venous obstruction, application of a palliative care framework is suggested to ensure that patient selection for stent placement is appropriate, considering the multifactorial etiology of symptoms, cancer treatment goals, and palliative goals (Level of Evidence E, Strength of Recommendation Moderate).

- Pregnant Women: For most pregnant women with chronic iliofemoral venous obstruction, deferral of consideration of stent placement to the postpartum period is suggested (Level of Evidence D, Strength of Recommendation Moderate).
- Choice of Stent Device: For iliac vein placement, the use of self-expandable, noncovered stents with longitudinal flexibility and high radial strength is suggested; however, the optimal device to use is uncertain (Level of Evidence C, Strength of Recommendation Moderate).
- Stent Sizing and Deployment: When iliac vein stent placement is performed, careful attention should be given to ensuring appropriate stent sizing to enable durable venous patency, freedom from chronic pain, and freedom from stent migration (Level of Evidence C, Strength of Recommendation Strong).
- Anticoagulant Therapy after Stent Placement: After iliac vein stent placement, anticoagulant therapy is recommended for at least several months in most patients with a history of DVT/PTS but may not be needed for most patients with non-thrombotic disease (Level of Evidence D, Strength of Recommendation Moderate).
- Antiplatelet Therapy after Stent Placement: After iliac vein stent placement, the addition of anti-platelet therapy to anticoagulation for at least several months is appropriate for most patients being treated for PTS who have a low projected risk of bleeding. It is uncertain whether patients receiving stents for NIVLs should receive antiplatelet therapy (Level of Evidence D, Strength of Recommendation Weak).
- Follow-up: After iliac vein stent placement, close clinical follow-up should be performed to ensure that the patient is compliant with antithrombotic therapy and anticoagulation is fully therapeutic, to monitor for bleeding and symptom response, to enable timely reintervention to restore patency in patients who develop recurrent symptoms, and to monitor for late stent complications (Level of Evidence C, Strength of Recommendation Strong).

The authors commented that "It should be recognized that even within a particular descriptive CEAP category (especially CEAP clinical class 3 [edema]), there is broad diversity in disease severity and life consequences. Hence, emphasis should be placed on understanding the life impact of symptoms and disability and the degree to which they are due to venous disease versus other conditions (eg, peripheral arterial disease, lymphedema/phlebolymphedema, cardiovascular conditions that can cause swelling, and mudsculoskeletal and neurological conditions that can cause pain)." "The clinical assessment will help establish baseline status and appropriate expectations for treatment. Routine use of standardized venous assessment tools is recommended—this may include the Revised CEAP System to descriptively classify the condition and assessment scales (eg, Villalta or revised VCSS) to follow disease severity longitudinally over time and evaluate the impact of therapy."

Superior Vena Cava Syndrome
Superior vena cava (SVC) syndrome results from any condition that leads to obstruction of blood flow through the SVC. Malignant obstruction can be caused by direct invasion of tumor into the SVC, or by external compression of the SVC by an adjacent pathologic process involving the right lung, lymph nodes, and other mediastinal structures, leading to stagnation of flow and thrombosis. In some cases, both external compression and thrombosis coexist. In addition, patients with malignancy have a higher risk of venous thrombosis related to indwelling venous devices (e.g., central venous catheter, pacemaker). The diagnosis of SVC syndrome may be suspected based on characteristic symptoms and signs of thoracic central venous obstruction. Confirmation of a diagnosis of thoracic central venous obstruction requires imaging (Drews, et al., 2019).

Patients with acute SVC syndrome caused by malignant disease are generally treated with intravenous heparin followed by warfarin to prevent recurrence and protect the venous collateral

circulation. Symptoms frequently improve after irradiation, chemotherapy, or combination chemoradiation based on the tumor histology. Endovascular treatment with stenting can help achieve rapid symptom resolution in 95% of cases. It is recommended that patients with severe incapacitating symptoms not responding to conservative therapy be considered for interventional treatment, depending on the cause and anatomy of the SVC lesion. Endovascular treatment is now accepted as the first-line treatment in benign and malignant, cases. Treatment modalities include percutaneous transluminal balloon angioplasty (PTA), stenting, and thrombolysis performed alone or in combination. Surgical reconstruction is reserved for patients with extensive chronic venous thrombosis not anatomically suitable for endovascular treatment and for those with less extensive disease who have failed prior endovascular treatment (Drews, 2019; Kalra, et al., 2018).

Pulmonary Vein Stenosis
Pulmonary vein stenosis (PVS) is an uncommon entity (estimated incidence about 2-3 cases per year in large centers). Morbidity and mortality rates are high at advance stages. The condition, linked in the past to congenital heart diseases in childhood and mediastinal processes (i.e., tumors) in adults, is now firstly associated to injury from radiofrequency ablation for atrial fibrillation. PVS is characterized by a progressive lumen size reduction of one or more pulmonary veins that, when hemodynamically significant, may raise lobar capillary pressure leading to signs and symptoms such as shortness of breath, cough, and hemoptysis. Image techniques (transesophageal echocardiography, computed tomography, magnetic resonance and perfusion imaging) are used to reach a final diagnosis and decide an appropriate therapy. (Pazos-López, et al., 2016).

Transcatheter therapy is the most common chosen approach for PVS in adults. While evidence of treatment of PVS due to extrinsic compression, infiltration or cardiac surgery is restricted to case reports in literature several small studies have evaluated the efficacy of percutaneous interventions for PVS after radiofrequency ablation (Pazos-López, et al., 2016). There have been published reports of venous angioplasty being successfully used to treat pulmonary vein stenosis following lung transplant (Loyalka, 2012).

Literature Review: In a single-center retrospective study, Schoene et al. (2018) analyzed catheter interventional treatment of radiofrequency-induced pulmonary vein stenosis (PVS) following atrial fibrillation (AF) ablation. The total rate of PVS following interventional AF ablation was 0.78% (87 of 11,103). Thirty-nine patients with PVS were treated with 84 catheter interventions: 68 (81%) with percutaneous transluminal balloon angioplasty (PTA) and 16 (19%) with stent implantation. The distribution of stent type was 3 drug eluting stents (19%) and 13 bare-metal stents (81%). The overall restenosis rate was 53% after PTA versus 19% after stent implantation (p=0.007) after a median follow-up period of 6 months (interquartile range: 3 to 55 months). The total complication rate for PTA was 10% versus 13% for stenting (p=NS). Despite the lack of randomized studies, the present data and currently available published studies seem to favor stent implantation as a first-line therapy in patients with radiofrequency-induced severe PVS.

In a prospective, observational study (n=124) Fender et al. (2016) evaluated the presentation of severe PVS and examined the risk for restenosis after intervention using either balloon angioplasty (BA) alone or BA with stenting. All 124 patients were identified as having severe PVS by computed tomography in 219 veins. One hundred two patients (82%) were symptomatic at diagnosis. The most common symptoms were dyspnea (67%), cough (45%), fatigue (45%), and decreased exercise tolerance (45%). Twenty-seven percent of patients experienced hemoptysis. Ninety-two veins were treated with BA, 86 were treated with stenting, and 41 veins were not treated. A 94% acute procedural success rate was observed and did not differ by initial management. Major procedural complications occurred in 4 of the 113 patients (3.5%) who underwent invasive assessment, and minor complications occurred in 15 patients (13.3%). Overall, 42% of veins

developed restenosis including 27% of veins (n=23) treated with stenting and 57% of veins (n=52) treated with BA. The 3-year overall rate of restenosis was 37%, with 49% of BA-treated veins and 25% of stented veins developing restenosis ($p<0.001$). Three individuals were lost to follow-up. This study was limited by the study design and this study did not address assessment or treatment of PV restenosis.

Professional Societies/Organizations: The 2017 Heart Rhythm Society (HRS)/ European Heart Rhythm Association (EHRA)/ European Cardiac Arrhythmia Society (ECAS) Asia Pacific Heart Rhythm Society (APHRS)/ Latin American Society of Cardiac Stimulation and Electrophysiology (SOLAECE) expert consensus statement on catheter and surgical ablation of atrial fibrillation states that pulmonary vein (PV) stenosis is defined as a reduction of the diameter of a PV or PV branch. PV stenosis can be categorized as mild 50%, moderate 50%–70%, and severe 70% reduction in the diameter of the PV or PV branch. A severe PV stenosis should be considered a major complication of AF ablation. The incidence of PV stenosis is <1%. Selected treatment options include angioplasty, stent or surgery. For symptomatic patients, PV angioplasty should be considered. Successful PV angioplasty or stenting usually results in a significant relief of symptoms.

Deep Vein Thrombosis (DVT): DVT refers to the formation of blood clots in deep veins, usually of the lower or upper extremities. Post thrombotic syndrome (PTS), the most common long-term complication of DVT, occurs in a limb previously affected by DVT. Lower extremity DVT is treated primarily medically with anticoagulation, but endovascular treatment is an option for patients with proximal venous thrombosis defined as being at the level of the common femoral vein or higher. Thrombosis at this site occurs in about one third of all cases of lower extremity DVT and obstructs venous return from the lower limb. Proximal DVT occurs more frequently in the left leg as a result of compression of the left iliac vein by the overlying right iliac artery (May-Thurner syndrome). Acute severe proximal deep venous occlusion, characterized by a blue limb, pain, and limb ischemia (phlegmasia cerulea dolens) is often associated with malignancy. Chronic PTS occurs over several years in about half the patients with iliofemoral DVT and involves limb swelling, heaviness, and pain. Medical treatment includes compression stockings and anticoagulation. Endovascular treatment of proximal DVT by catheter-directed thrombolysis with or without balloon angioplasty and self-expanding stents reduces the incidence of post-thrombotic syndrome by about 20% (Kinlay, et al., 2019).

Professional Societies/Organizations: Professional Societies/Organizations: The American Vein and Lymphatic Society (AVLS) Guidelines Committee was developed to assess medical literature and make recommendations to help physicians make evidence-based decisions for the benefit of patients with venous disorders. The grade of recommendation for or against a specific diagnostic or therapeutic intervention may be strong (1) or weak (2), based upon the risk:benefit ratio. The quality of evidence may be rated as high (A), medium (B), or low (C).The 2015 AVLS practice guideline for management of obstruction of the femoroiliocaval venous system recommends venous balloon angioplasty and stenting for the following:

- treatment of non-thrombotic and post-thrombotic iliac and common femoral venous obstructions in patients with lower extremity pain or edema affecting quality of life (QOL) not palliated by compression and for patients with impending or active lower extremity venous leg ulceration (Grade 1B)
- treatment of non-thrombotic and post-thrombotic inferior vena cava (IVC) obstructions in patients with lower extremity pain or edema affecting QOL not palliated by compression and for patients with impending or active lower extremity venous leg ulceration (Grade 1C)
- as an adjunct to catheter-directed thrombolysis for acute femoroiliocaval deep vein thrombosis in order to maintain vein patency and flow when a residual stenosis is found on post thrombolysis imaging (Grade 1B)

- for treatment of non-thrombotic and postthrombotic iliac venous obstructions in patients with chronic pelvic pain, deep dyspareunia, or low back pain which severely affect the QOL when other likely causes have been excluded and the severity of the iliac vein obstruction is considered sufficient to explain the symptoms (Grade 1C)

These AVLS recommendations do not address other generally accepted uses of venous balloon angioplasty/stenting such as for dialysis access outflow obstructions, superior vena cava syndrome, Budd-Chiari syndrome, or stenosis associated with central venous catheters or transvenous pacemaker leads (AVLS, 2015).

The American Heart Association Scientific Statement on the management of massive and submassive pulmonary embolism, iliofemoral deep vein thrombosis, and chronic thromboembolic pulmonary hypertension states that percutaneous transluminal venous angioplasty and stent placement have been used routinely concomitant with endovascular or surgical thrombus removal to treat obstructive lesions and prevent re-thrombosis in patients with acute iliofemoral deep vein thrombosis (IFDVT). Specifically, the finding of a left common iliac vein stenosis in association with left-sided IFDVT, known as iliac vein compression syndrome (May-Thurner syndrome, Cockett syndrome), typically has been treated with stent placement in catheter-directed thrombolysis (CDT) studies (Jaff, et al., 2011).

Recommendations for Percutaneous Transluminal Venous Angioplasty and Stenting state:

- Stent placement in the iliac vein to treat obstructive lesions after catheter-directed thrombolysis (CDT), pharmacomechanical (PCDT), or surgical venous thrombectomy is reasonable (Class IIa; Level of Evidence C).
- For isolated obstructive lesions in the common femoral vein, a trial of percutaneous transluminal angioplasty without stenting is reasonable (Class IIa; Level of Evidence C).
- The placement of iliac vein stents to reduce post-thrombotic syndrome (PTS) symptoms and heal venous ulcers in patients with advanced PTS and iliac vein obstruction is reasonable (Class IIa; Level of Evidence C)

The American Heart Association (AHA) published a Scientific Statement for postthrombotic syndrome: evidence-based prevention diagnosis, and treatment strategies (Kahn, et al., 2014).

Recommendations for thrombolysis and endovascular approaches to acute DVT for the prevention of postthrombotic syndrome (PTS):

- Catheter-directed thrombolysis (CDT) and pharmacomechanical CDT (PCDT), in experienced centers, may be considered in select patients with acute (≤14 days) symptomatic, extensive proximal DVT who have good functional capacity, ≥1-year life expectancy, and low expected bleeding risk (Class IIb; Level of Evidence B).
- Systemic anticoagulation should be provided before, during, and after CDT and PCDT (Class I, Level of Evidence C).
- Balloon angioplasty with or without stenting of underlying anatomic venous lesions may be considered after CDT and PCDT as a means to prevent rethrombosis and subsequent PTS (Class IIb; Level of Evidence B).
- When a patient is not a candidate for percutaneous CDT or PCDT, surgical thrombectomy, in experienced centers, might be considered in select patients with acute (≤14 days) symptomatic, extensive proximal DVT who have good functional capacity and ≥1- year life expectancy (Class IIb; Level of Evidence B).
- Systemic thrombolysis is not recommended for the treatment of DVT (Class III; Level of Evidence A).

The AHA guideline states that surgical or endovascular procedures to treat appropriately selected patients with PTS have the potential to decrease postthrombotic morbidity attributable to deep venous obstruction or venous valve incompetence. However, well-designed studies have not been performed because experience with these procedures is limited and only the most severely affected patients are treated. Open surgical and endovenous procedures that correct central postthrombotic venous occlusion or infrainguinal venous valvular incompetence may be offered to patients with severe PTS in an attempt to reduce postthrombotic morbidity and to improve quality of life (QoL). However, Level of Evidence "A" data do not exist; therefore, only weak recommendations (mostly Level of Evidence C) can be made.

Recommendations for endovascular and surgical treatment of PTS

- For the severely symptomatic patient with iliac vein or vena cava occlusion, surgery (e.g., femoro-femoral or femoro-caval bypass) (Class IIb; Level of Evidence C) or percutaneous endovenous recanalization (eg, stent, balloon angioplasty) may be considered (Class IIb; Level of Evidence B).
- For severely symptomatic patients with postthrombotic occlusion of their common femoral vein, iliac vein, and vena cava, combined operative and endovenous disobliteration may be considered (Class IIb; Level of Evidence C).
- For severely symptomatic patients with PTS, segmental vein valve transfer or venous transposition may be considered (Class IIb; Level of Evidence C).

The AHA guideline discusses upper-extremity DVT (UEDVT) stating that it comprises DVT of the subclavian, axillary, or brachial veins. Although PTS develops after UEDVT, reported incidences are variable, in part because there is no accepted standard for its diagnosis. There is a paucity of data to guide the management of upper-extremity PTS. There have been no trials of compression sleeves or bandages to prevent or treat upper-extremity PTS. Similarly, it is uncertain whether thrombolysis or endovascular or surgical treatment of UEDVT results in lower rates of PTS than standard anticoagulation. Because of a lack of studies on compression bandages, compression sleeves, or venoactive drugs to prevent or treat PTS after UEDVT, it is not possible to make specific recommendations on the prevention or treatment of upper-extremity PTS (Kahn, et al., 2014).

The Society of Vascular Surgery and American Venous Forum published a clinical practice guideline on early thrombus removal strategies for acute deep vein thrombosis (Meissner, et al., 2012). The authors state that anticoagulant treatment of acute deep venous thrombosis (DVT) has been historically directed toward the prevention of recurrent venous thromboembolism. Anticoagulant treatment imperfectly protects against late manifestations of the postthrombotic syndrome. By restoring venous patency and preserving valvular function, early thrombus removal strategies can potentially decrease postthrombotic morbidity. Evidence-based recommendations are based on a systematic review and meta-analysis of the relevant literature, supplemented when necessary by less rigorous data. Recommendations are made according to the Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology, incorporating the strength of the recommendation (strong: 1; weak: 2) and an evaluation of the level of the evidence (A to C).

The guideline states that "on the basis of the best evidence currently available, we recommend against routine use of the term "proximal venous thrombosis" in favor of more precise characterization of thrombi as involving the iliofemoral or femoropopliteal venous segments (Grade 1A). We further suggest the use of early thrombus removal strategies in ambulatory patients with good functional capacity and a first episode of iliofemoral DVT of < 14 days in duration (Grade 2C) and strongly recommend their use in patients with limb-threatening ischemia due to iliofemoral venous outflow obstruction (Grade 1A). We suggest pharmacomechanical

strategies over catheter-directed pharmacologic thrombolysis alone if resources are available and that surgical thrombectomy be considered if thrombolytic therapy is contraindicated (Grade 2C). The authors conclude that most data regarding early thrombus removal strategies are of low quality but do suggest benefits for the patient with respect to reducing postthrombotic morbidity".

The Society of Vascular Surgery and American Venous Forum published joint guidelines in 2014 on the management of proximal chronic total venous occlusion/severe stenosis (O'Donnell, et al., 2014). The guideline 6.14: proximal chronic total venous occlusion/severe stenosis with skin changes at risk for venous leg ulcer (C4b), healed (C5) or active (C6) venous leg ulcer-endovascular repair states the following:

In a patient with inferior vena cava or iliac vein chronic total occlusion or severe stenosis, with or without lower extremity deep venous reflux disease, that is associated with skin changes at risk for venous leg ulcer (C4b), healed venous leg ulcer (C5), or active venous leg ulcer (C6), we recommend venous angioplasty and stent recanalization in addition to standard compression therapy to aid in venous ulcer healing and to prevent recurrence (Grade 1: Level of Evidence C).

This was a grade 1 recommendation (strong) but the evidence was considered low/very low quality. The guideline states that in general, quality of the evidence available to support recommendations for endovascular management is mostly limited to level C evidence because of an absence of comparative prospective randomized controlled trials of treatment techniques.

The 2012 American College of Radiology (ACR) Appropriateness Criteria® for radiologic management of lower extremity venous insufficiency variant recommendations do not address angioplasty or stenting as a treatment/procedure for lower extremity venous insufficiency. However, they suggest in the adjunctive treatments section of the document that patients with venous insufficiency and associated venous occlusion or stenosis of the common iliac vein may require venous recanalization with angioplasty and stenting as an adjunctive treatment. This is based on three case reports and one small retrospective analysis (n=39).

Venous Thoracic Outlet Syndrome (vTOS)
Thoracic outlet syndrome (TOS) refers to a constellation of signs and symptoms that arise from compression of the neurovascular bundle by various structures in the area just above the first rib and behind the clavicle, within the confined space of the thoracic outlet. Distinct terms are used to describe the predominantly affected structure, including neurogenic (nTOS) from brachial plexus compression, venous (vTOS) from subclavian vein compression, and arterial (aTOS) from subclavian artery compression. vTOS may be further divided into four distinct presentations: acute thrombosis, chronic stenosis (effort thrombosis), intermittent obstruction without thrombosis, and complete obstruction. vTOS is a rare condition with an incidence of 1/100,000 people per year and accounts for 3% of all cases of thoracic outlet syndrome. vTOS typically occurs in individuals such as athletes who perform vigorous repetitive exertion of the upper extremities, usually with the arms above shoulder level. Forearm fatigue within minutes of using the arm may be present in vTOS. Upper extremity edema due to varying degrees of venous compression or overt deep vein thrombosis is the hallmark of vTOS. In instances of chronic obstruction, collateral superficial veins can sometimes be visualized over the upper arm, neck, and chest. Upper extremity venous thrombosis due to thoracic outlet compression is termed "spontaneous" to distinguish it from instrumentation-related or "catheter-induced" venous thrombosis. Spontaneous upper extremity venous thrombosis is historically referred to as Paget-Schroetter syndrome (PSS) or "effort" thrombosis. Ultrasonography is the initial imaging test to evaluate vTOS. Contrast-enhanced computed tomography (CT) and magnetic resonance (MR) are used to establish the diagnosis of vTOS. Treatment for vTOS involves consideration of three therapies in addition to anticoagulation: thrombolysis, decompression, and venoplasty. Which therapy is selected depends on the clinical presentation of patients with vTOS. Treatment is indicated only for symptomatic patients and

when stenosis of >50% is present. The mere presence of a cervical rib or other rib anomalies does not indicate a need to intervene.

Catheter directed thrombolysis alone has a 23% rate of recurrent thrombosis while >70% of patients treated with anticoagulation alone experience recurrent symptoms. If first rib and cervical rib are present, resection is recommended as well to allow for decompression of the thoracic outlet. Residual stenosis is common after decompression due to fibrous strictures, thrombus, or chronic compression. If venogram reveals residual stenosis, angioplasty is warranted. This allows for a shorter duration of anticoagulation thereby allowing active patients to return to their pre-procedure activities. It has been reported that this percutaneous approach to residual defects has resulted in patency rates of > 91% at one year (Jones, 2019; Hussain, et al., 2016; Moore and Lum, 2015; Tsekouras and Comerota, 2014).

Literature Review: Although evidence in the peer-reviewed medical literature for the treatment of vascular TOS is primarily in the form of retrospective reviews, with a paucity of randomized controlled trials and prospective data, angioplasty is an established treatment option for residual stenosis while evidence to support the safety and efficacy of venous stenting is insufficient (de Boer, et al., 2022; Madden, et al., 2019; Rajendran et al., 2019; Hussain, et al., 2016; Moore and Lum, 2015; Siracuse, et al., 2015; Povlsen, et al., 2014; Tsekouras and Comerota, 2014).

de Boer et al. (2022) conducted a single center, retrospective cohort review of patients who underwent first rib resection followed by upper limb deep venous stenting to evaluate the efficacy of deep venous stenting for the treatment of ongoing stenosis associated with vTOS. The review included 26 patients (33 stents placed) (37% male) who's median age was 48 years. Patients were included in the review if they had undergone first rib resection followed by upper limb deep venous stenting. Patients who had undergone first rib resection were evaluated one month post-operatively via venous duplex to assess for patency and residual stenosis. Those found to have residual stenosis or ongoing residual symptoms (e.g., pain, sensation of "heaviness" of the limb, swelling of the upper limb, signs of venous congestion) underwent venography within six weeks to evaluate for placement of deep venous stents. Stents were deemed appropriate after surgical decompression for residual stenosis (> 50%) or collaterals on venogram following angioplasty, in the setting of recurrent symptoms. Placement of the stents took place across the stenotic lesions, extending to and from non-diseased portions of the subclavian or axillary vein. The primary outcome measure was stent patency rates as determined on venous duplex. Primary patency (i.e., stent patency after the index procedure without the need for re-intervention) was achieved in 66% of stent placements, while primary assisted patency (i.e., patent stent within stent stenosis or non-occlusive thrombosis that was retreated), secondary patency (i.e., complete stent occlusion with subsequent successful treatment to restore patency), and total occlusion were observed in 88%, 91%, and 9% respectively. Re-intervention (i.e., pectoralis minor release, angioplasty, stent extension, thrombolysis, mechanical thrombectomy, stent relining) was performed on 13 lesions with a total of 23 re-interventions performed. Follow-up occurred at four to six weeks, three months, and six months post-operatively and annually thereafter (median 50 months). There were no major complications reported. One patient underwent relining of a stent due to stent fracture. Author noted limitations of the review included the short-term follow-up, retrospective design, selection bias, and small patient population. Larger, prospective, multi-center studies are needed to confirm these findings.

Rajendran et al. (2019) conducted a single center retrospective case series review of 24 upper limbs in 21 patients to evaluate outcomes following endovascular reconstruction of the axillo-subclavian vein using dedicated venous stents. Patients ranged in age from 21-67 years. All patients who underwent the procedure were included between 2012 and 2017. Exclusion criteria were not reported. Outcomes assessed included: stent patency, re-intervention rates, and change in symptom severity. Median follow up with ultrasound from stent placement occurred at 50

months. A treatment protocol was followed consisting of identification of acute thrombosis, followed by thrombolysis, then trans-axillary rib resection and venolysis, and finally PTA with venous stenting for those with residual stenosis. Three of the 21 patients had deviated from this treatment protocol in that they underwent venous stent placement prior to rib resection as the procedures were performed prior to the initiation of the protocol at the facility. No major complications were reported. Primary patency after 24 months was 55%; primary-assisted patency was 95%; and 100% after secondary patency. There were 14 re-interventions: one with acute thrombosis of the stent requiring lysis and placement of an extension stent, one with fracture of the stent requiring re-lining, and the remainder requiring venoplasty. Two out of the three patients who underwent stent placement prior to rib resection required angioplasty following decompression. Three of the 21 patients reported residual symptoms including heaviness, bluish discoloration, and prominent veins on the chest. Author noted limitations included: small sample size, short term follow up, and retrospective data collection.

In a Cochrane systematic review, Povlsen et al. (2014) evaluated the beneficial and adverse effects of the available operative and non-operative interventions for the treatment of TOS a minimum of six months after the intervention. This review was complicated by a lack of generally accepted diagnostic criteria for the diagnosis of TOS. The authors reported that their findings suggest that further high quality prospective randomized controlled clinical trials are needed in this field, which is dominated by low quality, observer-biased observational studies. In particular, there was a lack of any randomized controlled trials for the treatment of vascular thoracic outlet syndrome. There is a need for randomized, double-blind trials that compare the effects of different interventions with each other, such as different types of surgeries, or surgeries versus more conservative treatments options, or commonly-used interventions versus no interventions.

In a single-center retrospective case series review, Bamford et al. (2012) evaluated the management and outcomes of vTOS. Initially, 35 cases were identified, all of which underwent first rib resection for subclavian venous thrombosis. Two individuals were excluded from the review due to loss of follow-up and incomplete notes. Of the 33 cases reviewed, 20 individuals were treated for vTOS prior to 2006 (group A) and the remaining 13 were treated in 2006 and after (group B). Duplex ultrasound imaging was recorded on presentation in 31 of the 33 cases (94%) and of these, 3 cases had additional magnetic resonance angiography (MRA) of the affected limb. A total of 17 of the 33 cases (51.5%) were initially treated with catheter-directed thrombolysis (CDT) and six cases (35%) underwent balloon angioplasty before decompression of the thoracic outlet. The remaining 11 (65%) had recanalized sufficiently to proceed with thoracic outlet decompression with CDT alone. Most cases of CDT, 10/17 (58.8%) occurred in group B. In group A, most cases, 13/33 (39.3%) were treated initially with a variable period of anticoagulation. All individuals who subsequently underwent thoracic outlet decompression had evidence of venous recanalization before surgery. Postoperatively, 91% of individuals had patent veins at discharge from follow-up and were free of symptoms at a median of 44 months. Those treated within 7 days of symptom onset with CDT and excision of first rib in less than 30 days had improved symptom-free rates. The authors reported that the lack of power in this study made it difficult to reach firm conclusions regarding the effectiveness of the proposed protocol for vTOS management. Further noted was that while not conclusive, this study suggests that a treatment algorithm of early referral, immediate CDT and surgical decompression may lead to improved vTOS outcomes. The authors reported that multicenter, prospective trials over a longer period of time are needed in this field to fully evaluate the impact of this proposed management strategy. The quality of evidence available for the individual areas for management of vTOS is limited and, as such, standardization of treatment for vTOS is lacking.

Skalicka et al. (2011) performed a single center retrospective analysis of 73 patients treated for venous thrombotic complications secondary to vTOS to analyze long-term outcomes of different treatments stratified by symptom severity. Long-term follow-up with duplex ultrasound was

completed 6-12 months after the initial clinical event. The initial treatment provided was based on severity of symptoms. Endovascular procedures were attempted in 41 cases (56%) as a primary thrombosis treatment. A total of 12 additional individuals were treated with an endovascular approach due to failure of conservative treatment based on low molecular weight heparin alone. Endovascular treatment by balloon angioplasty was performed in 35 individuals. In seven cases, re-treatment was necessary due to suboptimal patency or re-thrombosis. In 12 individuals, failure of the endovascular approach resulted in primary surgical intervention consisting of thrombectomy followed by decompression. An additional 22 individuals with persistent symptoms underwent subsequent surgical decompression. Conservative treatment consisting of IV or low molecular weight heparin was used for 32 cases (44%) with mild symptoms. Of these, 12 subsequently were referred for endovascular treatment and eight for elective surgery due to persistent symptoms. None of the cases required primary surgical thrombectomy or revascularization. Follow-up assessment of patency by ultrasound and clinical exam was performed in 62 (82%). Surgery was associated with a significantly lower rate of ultrasound-detected signs of persistent vascular compression as compared to treatment consisting only of endovascular and/or conservative therapy. However, the rate of persistent clinical symptoms was similar in both groups. Study data demonstrated that initial endovascular treatment provided as first-line therapy to highly symptomatic individuals and to those with failure of conservative treatment improved symptoms in 77%, avoiding the need for acute surgery. A total of 13 (23%) did have persistent clinical symptoms. Study limitations included a limited sample of cases from a single center. The authors concluded that long-term outcomes in those for whom surgery was required were satisfactory and comparable to those requiring only conservative and/or endoluminal treatment.

In a prospective study, Schneider et al. (2004) evaluated the safety and efficacy of combined thoracic outlet decompression with intraoperative percutaneous angioplasty (PTA) performed in one stage. Residual subclavian vein stenosis after operative thoracic outlet decompression is common in patients with venous thoracic outlet syndrome. Over 3 years 25 consecutive patients underwent treatment for venous thoracic outlet syndrome with a standard protocol at two institutions. Twenty-one patients (84%) underwent preoperative thrombolysis to treat axillosubclavian vein thrombosis. First-rib resection was performed through combined supraclavicular and infraclavicular incisions. Intraoperative venography and subclavian vein PTA were performed through a percutaneous basilic vein approach. Postoperative anticoagulation therapy was not used routinely. Venous duplex ultrasound scanning was performed postoperatively and at 1, 6, and 12 months. Intraoperative venography enabled identification of residual subclavian vein stenosis in 16 patients (64%), and all underwent intraoperative PTA with 100% technical success. Postoperative duplex scans documented subclavian vein patency in 23 patients (92%). Complications included subclavian vein recurrent thrombosis in two patients (8%), and both underwent percutaneous mechanical thrombectomy, with restoration of patency in one patient. One-year primary and secondary patency rates were 92% and 96%, respectively, at life-table analysis. The authors state that subclavian vein stent placement is rarely indicated, and routine placement of subclavian vein stents in patients with venous thoracic outlet syndrome should be discouraged.

Professional Societies/Organizations: No professional society clinical guidelines or recommendations were found for venous thoracic outlet syndrome.

The Society for Vascular Surgery (SVS) published reporting standards for thoracic outlet syndrome (Illig, et al., 2016). Reporting standards for workup, treatment, and assessment of results are outlined, as are reporting standards for all phases of vTOS. Balloon venoplasty is mentioned as an adjunct measure that needs to be documented for treatment axillosubclavian venous thrombolysis. Stenting is contraindicated in this situation.

Other Indications

Venous angioplasty and/or stent placement has been proposed for use in a number of indications including, but not limited to, idiopathic intracranial hypertension (IIH), left iliac vein compression associated with pelvic congestion syndrome, Multiple Sclerosis, and chronic cerebrospinal venous insufficiency. Most of the evidence in the peer-reviewed literature for these indications consists of retrospective reviews and case series. The studies are limited by lack of a comparator and small sample size therefore conclusions about safety and efficacy cannot be made at this time.

Idiopathic Intracranial Hypertension (IIH): Idiopathic intracranial hypertension (IIH), also known as pseudotumor cerebri and benign intracranial hypertension, is a rare disorder characterized by increased intracranial pressure (ICP) without an intracranial mass. The incidence of IIH is approximately 1 per 100,000 persons. The disorder is primarily found in women during their childbearing and/or peak earning years. Obesity is a risk factor. The cause of this condition is not fully understood but it is associated with diminished resorption of cerebral spinal fluid (CSF). The most common symptoms are headache, visual disturbance, and tinnitus. Papilledema is present in at least 95% of the individuals. Diagnosis of IIH includes measurement of ICP, along with examination by a neuro-ophthalmologist for assessment for papilledema, visual acuity, optical coherence tomography, visual field testing, magnetic resonance venography and angiography. The first-line medical treatments for IIH are lifestyle and pharmacological interventions. The standard medical treatments include weight loss, acetazolamide, diuretics, and repeat high-volume lumbar punctures. Medical treatment generally consists of a combination of carbonic anhydrase inhibitors such as topiramate or acetazolamide, to decrease cerebral spinal fluid (CSF) production, and symptomatic treatment for headache. For medically refractory patients, standard surgical strategies include CSF diversion with ventriculoperitoneal or lumboperitoneal shunts (VPS or LPS) and optic nerve sheath fenestration (ONSF). At one-year and three-year follow-up, ONSF has failure rates of 34% and 45%, respectively. VPS and LPS carry significant infectious/revision rates of 30% and 60%, respectively. Although the underlying pathophysiology of IIH has yet to be fully defined, a number of recent investigations have implicated stenosis of the dural venous sinuses as a potential contributor to the syndrome of IIH in a subset of patients. It has been proposed that venous sinus stenting of the stenotic dural venous sinus may represent a therapeutic option for medically refractory IIH. Venous sinus stenting is a novel treatment and is not used as a first-line treatment; thus, the current data are in medically refractory IIH patients (Hayes, 2020; Daggubati, et al., 2019; Satti, et al., 2015; Fields, et al., 2011).

U.S. Food and Drug Administration (FDA): Currently, there are no stents that have obtained FDA clearance for intracranial venous stenting. However, there are several ongoing clinical trials aimed at evaluating the safety and efficacy of venous intracranial stenting for the treatment of IIH (ClinicalTrials.gov, 2024).

Literature Review: There are no randomized controlled clinical trials in which percutaneous angioplasty with or without stenting was compared to standard medical or surgical management of IIH. Current evidence in the peer-reviewed medical literature is limited to small prospective and retrospective reviews, case reports, and case series. Current data suggest high efficacy and safety of stent placement and lower repeat-procedure rates compared with optic nerve sheath fenestration (ONSF) and cerebral spinal fluid (CSF) shunting. In a cohort of patients, Patsalides et al. (2019) reports a decrease in cerebrospinal fluid opening pressure in patients with IIH three months after venous sinus stenting (VSS), independent of acetazolamide usage, or weight loss.

While the current evidence appears promising regarding VSS in a subset of patients with IIH, further studies are necessary comparing its efficacy to CSF diversion and ONSF, and establishing the best candidates for stent placement, thus creating specific best-practice guidelines for the treatment of medically refractory IIH. A search of the Clinical trials.gov database yielded active studies evaluating venous sinus stenting for the treatment of IIH (Azzam, et al., 2024;

Kabanovski, et al., 2022; Leishangthem, et al., 2019; Patsalides, et al., 2019; Giridharan, et al., 2018; Shazly, et al., 2018; Saber, et al., 2018; Dinkin, et al., 2017; Matloob, et al., 2017; Piper, et al., 2015; Starke, et al., 2015; Lai, et al., 2014).

In a retrospective meta-analysis of non-randomized trials and retrospective studies, Azzam, et al. (2024) concluded that VSS appears to be a safe and effective treatment option for individuals unresponsive to medical therapy. The authors reported a significant reduction of trans-stenotic gradient pressure and CSF opening pressure and improvements in tinnitus, papilledema, visual disturbances, and headache. Treatment failure rate (worsening symptoms and recurrence of IIH) was reported at 8.35%. The complication rate was 5.35% and included subdural hemorrhage, urinary tract infection, and stent thrombus formation. The authors noted that the analysis was limited by the retrospective methodology, the inclusion of non-randomized controlled trials, and heterogeneity of follow-up (3–49 months). An additional limitation was the small patient populations in the individual studies (n=6–101).

Lim et al. (2023) conducted a systematic review and meta-analysis of 24 retrospective single-center studies evaluating rates of re-stenosis and symptom recurrence in individuals who underwent VSS for the treatment of IIH. The total number of individuals included in the analysis was 694 with a total of 781 VSS procedures. The mean age was 33.9, 10.8% of the participants were male, and mean body mass index was 35.3 kg/m^2. Mean time from VSS to radiographic follow-up was 10.4 months and to clinical follow-up was 20.2 months. In the post-procedural period, 22.3% of individuals had persistence, worsening, and/or recurrence of original symptoms. Re-stenosis after VSS occurred in 17.7% of individuals. Improvement in symptoms (i.e., headache, visual problems, papilledema, tinnitus) occurred post-VSS in 77.7% of individuals. Intraprocedural complications occurred in 0.9% of individuals and included retroperitoneal hematoma and neck hematoma. Author noted limitations included the retrospective nature of included studies, heterogeneity of treatment parameters, and small patient populations.

Leishangthem et al. (2019) conducted a retrospective meta-analysis of 29 studies (n=1-52) and case reports to assess the success and complication rates associated with dural venous sinus stenting (DVSS) for idiopathic intracranial hypertension (IIH). There were a total of 419 patients with a mean age of 34.7 years. The intervention was DVSS to the right transverse sinus, left transverse sinus or bilateral sinuses. There were no comparators or controls. The mean follow-up time was 22.4 months. The analysis found that headache, papilledema, and visual acuity improved in 82%, 92%, and 78% of cases respectively. Post stenting mean pressure gradients improved from 18.1 mmHg (±9.5) to 2.8 mmHg. Major complications included intracranial hemorrhage, subdural hematoma, and subarachnoid hemorrhage and accounted for 1.5% of cases. Minor complications included retroperitoneal hemorrhage, retroperitoneal hematoma, femoral artery pseudo aneurysm, femoral vein thrombosis, neck hematoma, and transient hearing loss. These accounted for 3.4% of cases. Total complications accounted for 4.9% (20/410) of cases. Ten percent of patients required re-stenting. Ten patients needed to convert to a different treatment modality (i.e., cerebral spinal fluid diversion and optic nerve sheath fenestration) resulting in an overall treatment failure rate of 2.4%. Author noted limitations included the heterogeneity of treatment protocols. Additional limitations of the study include: short follow up time, small patient populations, and lack of comparator or control.

Nicholson et al. (2019) conducted a systematic review and meta-analysis evaluating the use of venous sinus stenting (VSS) in individuals with IIH. The systematic review included 20 studies from 18 centers with a total of 474 individuals. Of the 20 studies, 14 were retrospective and six were prospective observational with 6–52 participants. All of the studies were performed at a single center. Eighty-eight percent of the participants were female. The mean age of the patients was 35, and the mean body mass index (BMI) was 35 kg/m^2. The mean follow-up period was 18 months (range: <1 month to 198 months). The overall rate of improvement in papilledema was

93.7%. The overall rate of improvement or resolution of headache was 79.6%. The meta-analysis had positive results including an overall rate of recurrence of IIH symptoms after stenting of 9.8% (95% CI, 6.7% to 13%) and a rate of major complications of 1.9% (95% CI, 0.07% to 3.1%). The rate of recurrence of symptoms requiring a second invasive procedure was 12% after VSS. This appears to be much lower than the 43% re-treatment rate observed after CSF diversion procedures. These recurrences were treated with another stent in 72.8% of those patients, while a CSF diversion procedure was performed in 27.2%. The reported limitations to these results include small sample sizes, no comparator group or randomization in the included studies and no standardized tool for clinical evaluation of headache in the included studies.

Saber et al. (2018) conducted a systematic review and meta-analysis to determine clinical outcomes as well as stent survival and stent-adjacent stenosis rates in patients undergoing dural venous sinus stenosis (DVSS) for the management of medically refractory IIH. A total of 473 patients were included from 24 studies. Headache was present in 429 (91.8%) patients and resolved or improved in 319/413 (77.2%) after the procedure. Headache, papilledema, visual acuity, and tinnitus improved in 256/330 (77.6%), 247/288 (85.8%), 121/172 (70.3%), and 93/110 (84.5%) patients following DVSS at the final follow-up (mean of 18.3 months). In a meta-analysis of 395 patients with available follow-up data on stenting outcome (mean of 18.9 months), the stent survival and stent-adjacent stenosis rates were 84% (95% confidence interval [CI] 79-87%) and 14% (95% CI 11-18%), respectively. The rate of major neurological complications was less than 2%. Reported limitations included criteria for enrollment of eligible patients were not similar in all studies. Most included studies were case series or had a small number of participants. Publication bias is a major concern given the fact that series with less desirable surgical outcomes may be less likely to be reported and/or published. Additionally, most studies did not report CSF pressures after venous stenting or at follow-up visits.

Satti et al. (2015) conducted a meta-analysis of optic nerve sheath fenestration, CSF shunting, and dural venous sinus stenting for medically refractory IIH comparing these interventions with a focus on symptom improvement, complications, and the need for repeat procedures. The studies included in this meta-analysis comprised of case series and individual case reports. There are no prospective randomized controlled studies. Optic nerve sheath fenestration analysis included 712 patients. The mean follow-up period was 21 months (range, 0–160 months). Post-procedure, there was improvement of vision in 59%, headache in 44%, and papilledema in 80%; 14.8% of patients required a repeat procedure with major and minor complication rates of 1.5% and 16.4%, respectively. The CSF diversion procedure analysis included 435 patients. The mean follow-up time was 41 months (range, 1–278 months). Post-procedure, there was improvement of vision in 54%, headache in 80%, and papilledema in 70%; 43% of patients required at least one additional surgery. The major and minor complication rates were 7.6% and 32.9%, respectively. The dural venous sinus stenting analysis included 136 patients. The mean follow-up time was 22.9 months (range, 1–136 months). After intervention, there was improvement of vision in 78%, headache in 83%, and papilledema in 97% of patients. The major and minor complication rates were 2.9% and 4.4%, respectively. Fourteen additional procedures were performed with a repeat procedure rate of 10.3%. Three patients had contralateral stent placement, while eight had ipsilateral stent placement within or adjacent to the original stent. Only three patients required conversion to CSF diversion or 2.2% of patients with stents.

Piper et al. (2015) conducted an updated Cochrane review to assess interventions for idiopathic intracranial hypertension (IIH) that included randomized controlled trials in which any intervention used to treat IIH had been compared to placebo or another form of treatment. Stenting of the transverse intracerebral venous sinus was assessed as a treatment. The reviewers found no studies that met their inclusion criteria due to the lack of a control group for comparison. The review excluded five small case series, one retrospective review and two small clinical trials.

Lai et al. (2014) conducted a systematic review of various treatments for IIH. The reviewers found only case series studies, of which 30 had extractable data. A total of 88 of the 332 total patients had venous sinus stenting. The studies only reported secondary outcomes related to symptoms of visual acuity, headache, and papilledema. The primary outcome of increased intracranial pressure was not reported. The authors concluded that the evidence was insufficient to recommend for or against any treatment modalities for IIH.

Fargen et al. (2019) conducted a literature review to identify all reports of venous sinus stenting (VSS) in patients with IIH and to synthesize the literature into recommendations for the selection and treatment of patients with IIH with VSS. The authors state that VSS for patients with IIH with venous sinus stenosis is an established and effective treatment option. Venous sinus stenting has been associated with significant symptomatic improvement. Systematic reviews and meta-analyses have been conducted to evaluate symptom improvement in patients following venous sinus stenting. These studies demonstrated 78–83% improvement in headache, 87–97% improvement in papilledema, 74–85% improvement in visual symptoms, and 95% improvement in tinnitus following stenting. The reported complication rates associated with stenting vary in the literature but are low, with an overall complication rate of 1.4–7.4% (major complications 1.6–2.9% and minor complications 1.6–4.4%). Recurrence of symptoms and stent adjacent stenosis can occur following stenting. Two meta-analyses report repeat procedure rates of approximately 10%.Other studies suggest retreatment rates ranging from 0–20%.

Giridharan et al. (2018) published a proposed flow-chart algorithm for treatment and management of medically refractory IIH. For patients with IIH who do not tolerate or experience persistence of symptoms despite maximal medical management, several interventions exist. As part of the proposed initial workup for IIH, patients would have a magnetic resonance venography (MRV) to assess for venous sinus stenosis. For those patients who have evidence of venous sinus stenosis on MRV, persistent headaches, and elevated opening pressures objectively measured by lumbar puncture, with or without visual changes, the provider would consider consulting an endovascular expert to discuss the option of venous sinus stenting (VSS) as a treatment. If after VSS, the patient experiences resolution of headache and stable vision, then long-term follow-up can be continued. If the patient's vision continues to deteriorate, then cerebral spinal fluid (CSF) diversion should be considered as the next therapeutic option. For those patients who have no evidence of venous sinus stenosis on MRV and persistent headaches and high opening pressure, with or without vision changes, they recommend CSF flow diversion as the most appropriate surgical option. In all patients with acute visual changes and grade II papilledema, the recommendation is to proceed with optic nerve sheath fenestration (ONSF). If the patient's visual complaints remain stable, continued long-term follow-up is recommended. If visual complaints persist after ONSF for patients with evidence of venous sinus stenosis on MRV, practitioners should consider a trial of VSS. If VSS is selected as the therapeutic option and fails to control visual changes, CSF flow diversion can alternatively be offered to the patient for symptomatic relief. For those patients with acute visual changes whose symptoms are not relieved by ONSF and who have no evidence of venous sinus stenosis on MRV, the recommendation is CSF flow diversion. The authors state that although the current evidence appears promising regarding VSS in a subset of patients with IIH, additional studies are needed, with a focus on investigating the long-term outcomes for VSS, comparing its efficacy to CSF diversion and ONSF, and establishing the best candidates for stent placement, thus creating specific best-practice guidelines for the treatment of medically refractory IIH.

Textbook literature states that acetazolamide combined with a weight loss program is more efficacious for individuals with idiopathic intracranial hypertension and mild to moderate visual loss than is placebo. Any underlying secondary cause should also be treated (e.g., stopping an offending medication, treatment of sleep apnea). Weight loss is beneficial in obese patients. If visual loss progresses, surgical procedures are considered. Optic nerve sheath fenestration allows

cerebral spinal fluid to escape through slits or windows in the orbit; sometimes the treatment of one side decreases the optic disc swelling on the other side as well. Complications include visual loss or diplopia. Visual fields are followed carefully to anticipate and prevent visual loss. Lumbar or ventricular peritoneal diversion procedures also reduce intracranial pressure. Their complications include infection and shunt obstruction. Venous sinus stenting has occasionally been used for fixed stenosis (Digre, 2020).

Professional Societies/Organizations: No professional society clinical guidelines or recommendations were found for venous sinus stenting in patients with IIH.

Use Outside of the US: A 2018 international consensus guideline on management of idiopathic intracranial hypertension (IIH) in adults states there is uncertainty for the role of neurovascular stenting in acute IIH to prevent loss of vision. The literature consists of observational and case series studies. There is no long-term data regarding efficacy and safety. The role of neurovascular stenting in IIH to preserve rapidly deteriorating vision is not yet established due to a paucity of quality data in this area. It may be useful for highly selected patients with IIH with venous sinus stenosis with an elevated pressure gradient and elevated intracranial pressure in whom traditional therapies have not worked. The consensus guideline states that neurovascular stenting is not currently a treatment for headache in IIH. The literature detailing stenting does not clearly separate the cohorts of IIH into those with visual loss, those with headaches alone and those with both. The literature does not separate those with acute IIH, those with chronic IIH and those with IIH in ocular remission. Another major limitation is that case series are non-randomized; typically, they do not detail morphological stenosis type; they tend to be small in size with selection bias, and there is a lack of long-term follow-up (Mollan, et al., 2018).

Left Iliac or left renal Vein Compression Associated with Pelvic Congestion Syndrome (PCS): PCS may be a cause of chronic pelvic pain and results from incompetent valves in the ovarian veins resulting in reflux into pelvic veins, which dilate and become tortuous, forming pelvic varices. Venous obstruction, such as a retroaortic left renal vein, compression of the left renal vein by the superior mesenteric artery (nutcracker syndrome) or left iliac vein compression by the right internal iliac artery (May-Thurner syndrome), as well as hormonal factors may contribute to the development of painful pelvic varicosities. Patients most commonly present between the ages of 20 and 40 years with dull pelvic pain, ache, pressure, or heaviness made worse after prolonged periods of standing, while lifting, or during the premenstrual period. Other risk factors include multiparity, retroverted uterus, and pelvic surgery. Sonography is the first-line imaging choice for assessment of chronic pelvic pain, and PCS may be considered if other more common causes such as endometriosis and leiomyomas have been ruled out. Sonographic findings include multiple dilated veins adjacent to the ovaries and uterus, measuring greater than 5 mm in diameter, and dilated (>5 mm) arcuate veins (especially if observed to cross the myometrium and connect to the pelvic varicosities). Dilatation of the ovarian veins more than 6 mm with retrograde flow is a more specific finding. Stent placement may be performed for obstructing anatomic abnormalities. Endovascular approaches to primary ovarian and internal iliac venous reflux have largely supplanted medical and surgical approach (Meissner, et al., 2019; Bennett, 2017).

There is insufficient evidence in the peer reviewed published literature regarding the long-term outcomes, safety and efficacy of stent placement performed to relieve left iliac or left renal vein compression associated with pelvic congestion syndrome. Available studies have primarily been in the form of retrospective reviews and case series with small patient population and short-term follow-up (Avgerinos, et al., 2019; Huang, et al., 2018; Velasquez, et al., 2018; Ananthan, et al., 2017; Daugherty, et al., 2015; O'Brien, et al., 2015; Sadek, et al., 2015; Quevedo, et al., 2014; Feng, et al., 2013; Wang, et al., 2012; Chen, et al., 2011; Asciutto, et al., 2009; Hartung, et al., 2009; Venbrux, et al., 2002).

Multiple Sclerosis or Chronic Cerebrospinal Venous Insufficiency: Venous angioplasty and stent placement have been proposed as a treatment for chronic cerebrospinal venous insufficiency (CCSVI), a controversial condition, largely disproven, characterized by assumed anomalies of cerebrospinal veins that interfere with venous drainage from the brain. It has been reported that invasive treatments for CCSVI are not beneficial, and there are reports of harm with such treatments. Evidence in the peer-reviewed literature states that endovascular venoplasty or stenting procedures to treat patients with multiple sclerosis for presumed CCSVI is not recommended (Jagannath, et al., 2019; Olek, 2019; Siddiqui, et al., 2014; Zamboni, et al., 2012; Vedantham, et al., 2010).

U.S. Food and Drug Administration (FDA): A Food and Drug Administration (FDA) alert issued in May 2012 reported the potential for adverse events following endovascular interventions for Multiple Sclerosis. Reports of adverse events obtained by FDA included death, stroke, detachment and/or migration of stents, vein damage, thrombosis, cranial nerve damage, and abdominal bleeding. This alert included the caveat that clinical trials of this procedure require FDA approval and an investigational device exemption because of the potential for harms.

Pulsatile Tinnitus: Pulsatile tinnitus, that is not a symptom of Idiopathic Intracranial Hypertension and has a normal ear exam, is most often attributable to venous abnormalities such as signmoid sinus and jugular bulb anomalies, dilated mastoid or condylar emissary veins, or dural sinus stenosis. It accounts for approximately 11% of tinnitus referrals and is often described as hearing a heartbeat or "whooshing" sound. Because the differential is broad, radiographic imaging is necessary to aid in proper diagnosis however, the underlying etiology remains undiagnosed in 28–71% of cases. When diagnosis is possible, treatment should be aimed at correcting the underlying diagnosis (Worral and Cosett, 2021).

Literature Review: Stent placement has been proposed as a treatment for pulsatile tinnitus. Evidence in the peer-reviewed literature is limited to one non-randomized prospective trial (n=42) and literature review articles. There is insufficient evidence in the peer-reviewed literature regarding the long-term outcomes, safety, efficacy of stenting for the treatment of pulsatile tinnitus (Essibayi, et al., 2021; Patsalides, et al., 2021; Yang, et al., 2019).

Professional Societies/Organizations: No professional society clinical guidelines or recommendations were found for stenting or angioplasty in patients with pulsatile tinnitus.

Medicare Coverage Determinations

	Contractor	Determination Name/Number	Revision Effective Date
NCD		No National Coverage Determination found	
LCD	Novitas Solutions, Inc.	Endovenous Stenting/L37893	11/21/2019
LCD	First Coast Services	Endovenous Stenting/L38231	12/30/2019
LCD	Wisconsin Physician Services	Non-Coronary Vascular Stents/L35998	8/7/2020
LCD	National Government Services	Venous Angioplasty with or without Stent Placement for the Treatment of Chronic Cerebrospinal Venous Insufficiency/L35028	11/14/2019

Note: Please review the current Medicare Policy for the most up-to-date information.
(NCD = National Coverage Determination; LCD = Local Coverage Determination)

Coding Information

Notes:

1. This list of codes may not be all-inclusive since the American Medical Association (AMA) and Centers for Medicare and Medicaid Services (CMS) code updates may occur more frequently than policy updates.
2. Deleted codes and codes which are not effective at the time the service is rendered may not be eligible for reimbursement.

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT®* Codes	Description
37238	Transcatheter placement of an intravascular stent(s), open or percutaneous, including radiological supervision and interpretation and including angioplasty within the same vessel, when performed; initial vein
37239	Transcatheter placement of an intravascular stent(s), open or percutaneous, including radiological supervision and interpretation and including angioplasty within the same vessel, when performed; each additional vein (List separately in addition to code for primary procedure)
37248	Transluminal balloon angioplasty (except dialysis circuit), open or percutaneous, including all imaging and radiological supervision and interpretation necessary to perform the angioplasty within the same vein; initial vein
37249	Transluminal balloon angioplasty (except dialysis circuit), open or percutaneous, including all imaging and radiological supervision and interpretation necessary to perform the angioplasty within the same vein; each additional vein (List separately in addition to code for primary procedure)
37252	Intravascular ultrasound (noncoronary vessel) during diagnostic evaluation and/or therapeutic intervention, including radiological supervision and interpretation; initial noncoronary vessel (List separately in addition to code for primary procedure)
37253	Intravascular ultrasound (noncoronary vessel) during diagnostic evaluation and/or therapeutic intervention, including radiological supervision and interpretation; each additional noncoronary vessel (List separately in addition to code for primary procedure)

Considered Not Medically Necessary when used to report stenting for venous thoracic outlet syndrome; venous angioplasty and/or stenting for Idiopathic Intracranial Hypertension (IIH), pulsatile tinnitus, Left Iliac or left renal Vein Compression Associated with Pelvic Congestion Syndrome (PCS):

CPT®* Codes	Description
37238	Transcatheter placement of an intravascular stent(s), open or percutaneous, including radiological supervision and interpretation and including angioplasty within the same vessel, when performed; initial vein
37239	Transcatheter placement of an intravascular stent(s), open or percutaneous, including radiological supervision and interpretation and including angioplasty

CPT®* Codes	Description
	within the same vessel, when performed; each additional vein (List separately in addition to code for primary procedure)
37248	Transluminal balloon angioplasty (except dialysis circuit), open or percutaneous, including all imaging and radiological supervision and interpretation necessary to perform the angioplasty within the same vein; initial vein
37249	Transluminal balloon angioplasty (except dialysis circuit), open or percutaneous, including all imaging and radiological supervision and interpretation necessary to perform the angioplasty within the same vein; each additional vein (List separately in addition to code for primary procedure)
37252	Intravascular ultrasound (noncoronary vessel) during diagnostic evaluation and/or therapeutic intervention, including radiological supervision and interpretation; initial noncoronary vessel (List separately in addition to code for primary procedure)
37253	Intravascular ultrasound (noncoronary vessel) during diagnostic evaluation and/or therapeutic intervention, including radiological supervision and interpretation; each additional noncoronary vessel (List separately in addition to code for primary procedure)
61630	Balloon angioplasty, intracranial (e.g., atherosclerotic stenosis), percutaneous
61635	Transcatheter placement of intravascular stent(s), intracranial (e.g., atherosclerotic stenosis), including balloon angioplasty, if performed

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Revision Details

Type of Revision	Summary of Changes	Date
Annual Review	No clinical policy statement changes.	6/15/2024

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