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A Comprehensive Review of May-Thurner Syndrome: Pathophysiology, Clinical Manifestations, and Advanced Therapeutic Approaches

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ABSTRACT

May-Thurner Syndrome (MTS), also referred to as iliac vein compression syndrome, is an underrecognized vascular condition characterized by the extrinsic compression of the left common iliac vein by the overlying right common iliac artery. This mechanical obstruction predisposes patients to venous stasis, significantly increasing the risk of deep vein thrombosis (DVT) and chronic venous insufficiency. Although the precise prevalence of MTS remains uncertain due to its often asymptomatic presentation, the condition accounts for a considerable proportion of DVT cases in younger individuals, particularly women. This review aims to elucidate the pathophysiological mechanisms underpinning MTS, its clinical manifestations, diagnostic strategies including advanced imaging modalities, and both traditional and evolving therapeutic options. Emphasis will be placed on the use of endovascular techniques, such as stenting and catheter-directed thrombolysis, as well as the role of conservative management. Through a thorough analysis of current literature, this article will explore the long-term outcomes associated with different treatment approaches and the emerging role of precision medicine in tailoring therapies for patients with MTS.

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INTRODUCTION

May-Thurner Syndrome (MTS) is a venous compression disorder that arises when the left common iliac vein is compressed between the right common iliac artery and the underlying lumbar vertebrae, leading to impaired venous outflow. This extrinsic mechanical compression results in venous stasis, which increases the likelihood of thrombus formation within the affected venous segment, predisposing patients to deep vein thrombosis (DVT) and chronic venous insufficiency. First described by May and Thurner in the 1950s, the syndrome has since been recognized as a contributing factor in approximately 2-5% of all cases of DVT, though its true incidence remains elusive due to frequent underdiagnosis.1,2

The pathophysiological hallmark of MTS is the formation of intraluminal spurs within the left common iliac vein, secondary to the chronic pulsatile arterial pressure exerted by the right common iliac artery. This repetitive trauma disrupts the venous endothelium, promoting local thrombogenesis. While MTS can present as an isolated entity, it often remains asymptomatic until compounded by additional risk factors such as prolonged immobility, hypercoagulability, or trauma, which collectively precipitate the clinical manifestations.1,2

Despite advancements in vascular imaging techniques such as Doppler ultrasonography, computed tomography venography (CTV), and magnetic resonance venography (MRV), MTS remains a diagnostic challenge due to its nonspecific symptomatology. A high index of suspicion is required, particularly in younger patients presenting with left-sided DVT or unexplained lower limb swelling. Traditional therapeutic strategies have centered on anticoagulation and mechanical thrombectomy; however, the advent of endovascular approaches, including venous stenting and catheter-directed thrombolysis, has revolutionized the management of MTS, offering improved long-term outcomes.1,2

This article aims to provide a detailed overview of the pathogenesis, clinical presentation, diagnostic methods, and

treatment options for May-Thurner Syndrome, with a focus on emerging trends in minimally invasive therapies. Furthermore, it will address the role of personalized medicine in optimizing treatment protocols for individuals with this condition, ultimately improving patient prognosis.1,2,3

Epidemiology of May-Thurner Syndrome (MTS):

May-Thurner Syndrome (MTS), also known as iliac vein compression syndrome, is considered a relatively rare vascular disorder. However, its true epidemiological footprint is likely underestimated due to its frequent underdiagnosis and asymptomatic nature in many patients. The syndrome predominantly affects the left common iliac vein, resulting from mechanical compression by the overlying right common iliac artery, which predisposes the individual to the development of deep vein thrombosis (DVT) in the lower extremities.2,3

The precise prevalence of MTS is difficult to ascertain, as many patients remain asymptomatic or are misdiagnosed with idiopathic deep vein thrombosis. Estimates suggest that MTS could be responsible for 2-5% of all DVT cases, with a more significant proportion seen in younger individuals. Some studies report an incidence of up to 20-30% among patients presenting with unprovoked, isolated left-sided DVT, emphasizing the syndrome's clinical relevance in specific subpopulations. The condition is most frequently diagnosed in individuals aged 20 to 40, particularly in young women, with a female-to-male ratio estimated to be between 3:1 and 5:1. This gender disparity is believed to be associated with hormonal influences, including pregnancy and the use of oral contraceptives, which further enhance the risk of venous thromboembolism in susceptible individuals.2,3

Several factors contribute to the underdiagnosis of MTS. The asymptomatic phase of the disease, particularly in patients without thrombotic events, often leads to its being overlooked. Additionally, conventional diagnostic methods may fail to identify the condition, as traditional DVT workups do not routinely evaluate iliac vein compression. The growing use of advanced imaging modalities, such as computed tomography venography (CTV) and magnetic resonance venography (MRV), has improved the identification of MTS in recent years, suggesting that the prevalence might be significantly higher than previously thought.2,3

Ethnic and geographic variations in the prevalence of MTS are not well-established, as large-scale epidemiological studies focusing on this condition remain sparse. However, it is believed that the anatomical predisposition to iliac vein compression may be consistent across different populations, though further research is necessary to confirm this assumption. Limited data suggest that the syndrome might be more commonly diagnosed in Caucasian populations, but this could be a reflection of access to healthcare resources and diagnostic technologies, rather than a true disparity in incidence.3,4

Additionally, certain risk factors increase the likelihood of MTS development. These include prolonged immobilization, which exacerbates venous stasis, trauma, particularly pelvic fractures, hypercoagulable states, and iatrogenic factors such as central venous catheterization. Pregnancy is a well-established risk factor, as the gravid uterus can further compress the pelvic vasculature, exacerbating the mechanical obstruction of the iliac vein. Postpartum women are also at increased risk due to a combination of hormonal changes and increased venous pressure during pregnancy. The combination of these factors leads to an elevated risk of thromboembolic events in women during their reproductive years.4,5

In conclusion, although the epidemiology of May-Thurner Syndrome remains incompletely defined, available evidence highlights its significant contribution to the development of left-sided DVT, particularly in younger women. The syndrome is likely underreported, and the growing use of advanced diagnostic imaging has the potential to redefine its true prevalence. Further population-based studies are required to better understand the incidence, demographic distribution, and risk factors associated with MTS, which could facilitate earlier detection and targeted interventions in high-risk groups.4,5

Clinical Manifestations of May-Thurner Syndrome (MTS):

May-Thurner Syndrome (MTS), also known as iliac vein compression syndrome, manifests due to the chronic compression of the left common iliac vein by the overlying right common iliac artery. This extrinsic venous compression leads to varying degrees of venous stasis, resulting in a spectrum of clinical manifestations that range from asymptomatic presentation to severe complications such as deep vein thrombosis (DVT) and chronic venous insufficiency (CVI). The clinical presentation of MTS is often nuanced and may vary depending on the extent of venous obstruction, the presence of collateral venous circulation, and the development of secondary thrombotic events.4,5

Asymptomatic Phase:

Many individuals with MTS remain asymptomatic for prolonged periods, particularly in cases where collateral venous channels have developed to compensate for the impaired venous outflow. In these cases, the condition may be discovered incidentally during imaging studies performed for unrelated reasons, such as during the evaluation of pelvic pain or during workup for other vascular disorders. However, despite the absence of overt symptoms, individuals in the asymptomatic phase remain at an elevated risk for venous thromboembolism (VTE), especially when exposed to additional thrombotic risk factors such as immobilization, pregnancy, or hypercoagulable states.4,5

Symptomatic Phase:

When symptoms do manifest, they often arise from the gradual development of venous hypertension and stasis due

to impaired venous drainage. The most common clinical manifestations of symptomatic MTS include:

1. Lower Extremity Edema: Unilateral swelling of the left leg is a hallmark feature of MTS and may vary from mild, intermittent edema to significant, persistent swelling. This swelling is typically more pronounced in the distal leg (below the knee), although it may extend proximally in more severe cases. The edema is often exacerbated by prolonged standing or walking, and patients may experience relief with leg elevation.4,5
2. Pain and Discomfort: Patients with MTS often report a sensation of heaviness, aching, or throbbing in the affected leg. The pain is typically dull and exacerbated by prolonged periods of immobility or standing, mirroring the effects of venous congestion. In some cases, the discomfort may intensify over time, especially as venous outflow becomes increasingly compromised.4,5
3. Varicose Veins: In more chronic cases, patients may develop superficial varicosities, particularly along the medial aspect of the lower leg. This is the result of increased venous pressure leading to the dilation of superficial veins as collateral circulation attempts to compensate for the impaired flow through the compressed iliac vein.4,5
4. Chronic Venous Insufficiency (CVI): In cases where MTS remains untreated or undiagnosed for an extended period, patients may develop signs of chronic venous insufficiency. These signs include hyperpigmentation of the skin, particularly around the ankles, venous eczema, and lipodermatosclerosis, characterized by the thickening and hardening of the skin due to chronic venous hypertension. In severe cases, patients may develop venous ulcers, which are difficult to heal and often recurrent.4,5

Thrombotic Complications:

One of the most significant clinical sequelae of MTS is the development of deep vein thrombosis (DVT), particularly in the left lower extremity. DVT is the most common and severe manifestation of MTS, often serving as the presenting symptom in previously asymptomatic patients. The classic presentation of DVT in the context of MTS includes:

1. Sudden Onset of Pain and Swelling: The hallmark of DVT in MTS is the acute onset of pain, swelling, and erythema in the left leg, often accompanied by tenderness along the course of the deep veins. The leg may feel warm to the touch, and there may be associated cyanosis, depending on the degree of venous obstruction.4,5
2. Phlegmasia Cerulea Dolens: In rare and extreme cases, MTS may precipitate the development of phlegmasia cerulea dolens, a life-threatening form of massive venous thrombosis characterized by extreme swelling, severe pain, cyanosis, and compromised arterial perfusion. This condition represents a vascular emergency and requires immediate intervention to prevent tissue necrosis and limb loss.4,5
3. Pulmonary Embolism (PE): Thrombi that develop in the context of MTS carry a significant risk of embolization to the lungs, leading to pulmonary embolism (PE). Although the incidence of PE in MTS is not well-defined, it remains a serious potential complication, particularly in patients with extensive or recurrent DVT. Symptoms of PE include sudden-onset dyspnea, chest pain, tachycardia, and, in severe cases, hemodynamic instability.6,7

Diagnostic Delay and Misdiagnosis:

The clinical presentation of MTS is often nonspecific, leading to diagnostic delays and misdiagnosis in many cases. Patients presenting with left-sided DVT or chronic venous insufficiency may be treated for their acute thrombotic event without further investigation into the underlying etiology. As a result, MTS remains frequently underdiagnosed, and a high index of suspicion is necessary, particularly in young patients presenting with recurrent or unprovoked DVT. Women, in particular, are at increased risk, especially during pregnancy or when using hormonal contraceptives, as these factors further exacerbate venous stasis and thrombotic risk.6,7

The clinical manifestations of May-Thurner Syndrome range from asymptomatic venous compression to severe complications such as deep vein thrombosis, chronic venous insufficiency, and, in rare cases, life-threatening thrombotic events like phlegmasia cerulea dolens and pulmonary embolism. The variable nature of its presentation necessitates a thorough understanding of the condition, as early recognition and appropriate intervention can significantly improve patient outcomes. As diagnostic modalities evolve and awareness of MTS increases, clinicians are better equipped to identify and manage this often-overlooked vascular disorder.6,7

Diagnostic Methods for May-Thurner Syndrome (MTS):

Diagnosing May-Thurner Syndrome (MTS), also known as iliac vein compression syndrome, requires a thorough understanding of its pathophysiology, clinical presentation, and the utilization of advanced imaging modalities. MTS arises from the chronic compression of the left common iliac vein by the overlying right common iliac artery, leading to venous stasis and an increased risk for deep vein thrombosis (DVT) and chronic venous insufficiency (CVI). Since MTS often presents with nonspecific symptoms, such as unilateral leg swelling, pain, or recurrent DVT, a high index of suspicion is essential for accurate diagnosis.6,7

The diagnostic process typically involves a combination of clinical assessment, laboratory testing for thrombotic risk

factors, and advanced imaging techniques to confirm the presence of iliac vein compression and assess its hemodynamic consequences. Below is a detailed discussion of the diagnostic methods used for MTS:

1. Clinical Assessment:

The diagnostic workup for MTS often begins with a comprehensive clinical evaluation. Key elements of the clinical assessment include:6,7

- History and Physical Examination: A detailed patient history should include questions about unilateral leg swelling, pain, or discomfort, particularly involving the left leg. Patients with a history of recurrent, unprovoked DVT or chronic venous insufficiency, especially in the absence of other risk factors, should raise suspicion for MTS. Special attention should be paid to risk factors such as prolonged immobilization, trauma, pregnancy, oral contraceptive use, or hypercoagulable states, all of which may exacerbate the clinical manifestations of MTS.6,7
- Physical Examination: The physical exam may reveal unilateral leg swelling, tenderness, and dilated superficial veins, especially on the medial aspect of the thigh or calf. In chronic cases, signs of venous insufficiency, such as skin hyperpigmentation or lipodermatosclerosis, may be present. However, clinical findings alone are not sufficient to establish the diagnosis, necessitating further imaging.6,7

2. Laboratory Testing:

Although there are no specific laboratory tests to diagnose MTS, patients presenting with DVT should undergo laboratory evaluation to assess for underlying thrombophilias or hypercoagulable states. These tests include:6,7

- D-dimer Testing: Elevated D-dimer levels may suggest the presence of an active thrombotic process, such as DVT, in patients with MTS. However, D-dimer testing is nonspecific and must be interpreted in the context of clinical and imaging findings.
- Hypercoagulability Panel: Patients with recurrent or unexplained DVT should be evaluated for genetic and acquired thrombophilias, such as factor V Leiden mutation, prothrombin gene mutation, protein C and S deficiency, and antiphospholipid syndrome. Identifying an underlying hypercoagulable state may guide long-term management strategies.6,7

3. Non-invasive Imaging:

The cornerstone of MTS diagnosis lies in imaging studies that can directly visualize the compression of the left iliac vein and assess the presence of venous obstruction or thrombosis. Non-invasive imaging techniques play a pivotal role in initial evaluation and diagnosis.6,7

- Doppler Ultrasonography: Doppler ultrasonography is often the first-line imaging modality used to evaluate patients presenting with symptoms of DVT or venous insufficiency. It is non-invasive, widely available, and can identify venous thrombi in the lower extremities. However, Doppler ultrasound has limited sensitivity in detecting iliac vein compression because it is less effective at visualizing the deep pelvic veins. 8,9
- Nonetheless, it can identify indirect signs of MTS, such as reduced flow velocity in the left iliac vein or the presence of collateral venous pathways. In patients with suspected MTS, ultrasound may be useful for ruling out more distal DVT, but it typically requires confirmation with more advanced imaging.8
- Computed Tomography Venography (CTV): Computed tomography venography (CTV) is a highly sensitive and specific imaging technique used to diagnose MTS. CTV provides detailed cross-sectional images of the pelvic vasculature, allowing for the visualization of the left iliac vein and its relationship with the overlying right iliac artery. This modality can accurately demonstrate the degree of venous compression and identify any associated thrombus within the compressed vein. CTV is particularly useful for assessing venous anatomy, identifying intraluminal spurs, and evaluating the presence of collateral circulation. The widespread availability and relatively rapid acquisition of images make CTV a preferred choice for many clinicians.9,10
- Magnetic Resonance Venography (MRV): Magnetic resonance venography (MRV) is another non-invasive imaging modality that can be used to diagnose MTS. MRV provides excellent soft tissue contrast, enabling detailed visualization of the iliac vein and its surrounding structures without the need for ionizing radiation. This is particularly advantageous in younger patients and those requiring serial imaging. MRV can effectively identify iliac vein compression, intraluminal spurs, and associated thrombus, as well as evaluate collateral venous flow. Furthermore, MRV allows for dynamic imaging to assess changes in venous flow during different phases of the cardiac cycle. Despite its advantages, MRV is less commonly used than CTV due to higher cost and limited availability in some settings.9,10

4. Invasive Imaging:

In cases where non-invasive imaging is inconclusive or when endovascular intervention is being considered, invasive imaging techniques such as catheter-based venography and

intravascular ultrasound (IVUS) provide definitive diagnostic information.

- Conventional Venography: Conventional catheter-based venography remains the gold standard for diagnosing MTS. During this procedure, contrast dye is injected into the venous system, and real-time fluoroscopic images are obtained to visualize the iliac veins. Venography provides direct evidence of left iliac vein compression and allows for precise measurement of the degree of stenosis. It also enables the identification of collateral veins and can guide therapeutic interventions, such as balloon angioplasty or stenting. However, venography is an invasive procedure that requires iodinated contrast and exposes the patient to ionizing radiation, limiting its use primarily to cases where intervention is planned.11
- Intravascular Ultrasound (IVUS): Intravascular ultrasound (IVUS) has emerged as a valuable adjunct to venography in the diagnosis and treatment of MTS. IVUS involves the insertion of a small ultrasound probe into the vein, providing real-time, high-resolution images of the venous lumen and wall. This allows for precise assessment of the degree and length of venous compression, as well as the identification of intraluminal spurs or thrombus. IVUS can detect subtle venous stenosis that may be missed on venography, making it an essential tool in guiding endovascular interventions. Its ability to assess venous anatomy and function intraoperatively makes it particularly useful in optimizing stent placement during treatment for MTS.11

5. Hemodynamic Assessment:

In some cases, hemodynamic studies may be performed to assess the functional impact of iliac vein compression. These studies measure venous pressure gradients across the site of compression to quantify the degree of outflow obstruction.11

- Pressure Gradient Measurement: During venography, pressure measurements can be obtained across the compressed segment of the iliac vein to assess the hemodynamic significance of the stenosis. A pressure gradient greater than 2 mmHg is considered indicative of significant venous outflow obstruction. Pressure measurements can help guide therapeutic decision-making, particularly in cases where the degree of stenosis is borderline.11

The diagnostic approach to May-Thurner Syndrome is multifaceted, involving a combination of clinical evaluation, laboratory testing, and advanced imaging techniques. Non-invasive modalities such as Doppler ultrasonography, computed tomography venography (CTV), and magnetic resonance venography (MRV) play critical roles in the initial diagnosis. However, catheter-based venography and intravascular ultrasound (IVUS) remain the gold standards for confirming the diagnosis and guiding therapeutic interventions. Early and accurate diagnosis of MTS is essential to prevent complications such as deep vein thrombosis and chronic venous insufficiency, and advancements in imaging techniques continue to enhance clinicians' ability to identify and treat this often underrecognized condition.12

Current Treatment for May-Thurner Syndrome (MTS):

The management of May-Thurner Syndrome (MTS), also known as iliac vein compression syndrome, is focused on relieving venous obstruction, preventing thrombotic complications, and restoring normal venous blood flow. Treatment strategies are typically guided by the severity of the patient's symptoms, the presence of venous thromboembolism (VTE), and the degree of iliac vein compression. While many patients may remain asymptomatic or experience mild symptoms that can be managed conservatively, others may present with severe complications, such as deep vein thrombosis (DVT) or chronic venous insufficiency (CVI), requiring more aggressive interventions.12

Treatment modalities for MTS have evolved over time, with endovascular techniques becoming the mainstay of management due to their minimally invasive nature and favorable outcomes. Below is a comprehensive discussion of the current treatment approaches for MTS.12

1. Conservative Management:

Conservative treatment may be appropriate for patients with mild, non-thrombotic symptoms, such as intermittent leg swelling or discomfort, and for those without significant venous outflow obstruction. Conservative management typically includes:

- Compression Therapy: Graduated compression stockings are often prescribed to reduce venous stasis and alleviate symptoms of leg swelling and discomfort. Compression stockings improve venous return by applying external pressure to the lower extremity, thereby reducing venous hypertension and preventing further progression of symptoms. This is particularly useful in patients with mild venous insufficiency or those who are not candidates for invasive treatment.12
- Leg Elevation and Exercise: Elevating the legs above the level of the heart during rest can help promote venous drainage and reduce edema. Patients are also encouraged to engage in regular physical activity, as exercise helps improve calf muscle pump function, promoting venous return and reducing venous stasis.12
- Medical Therapy: In cases where venous insufficiency is mild and there is no thrombus formation, the use of anticoagulants is generally not necessary. However, if a patient presents with DVT

or is at high risk of thrombosis, anticoagulation may be initiated (discussed in further detail below).13

While conservative management may provide temporary relief for some patients, it does not address the underlying anatomical compression of the left iliac vein, and many patients eventually require more definitive treatment.14

2. Pharmacologic Therapy:

- Anticoagulation: Anticoagulation therapy is the cornerstone of treatment in patients with MTS who present with DVT. The goals of anticoagulation are to prevent thrombus propagation, reduce the risk of pulmonary embolism (PE), and prevent post-thrombotic syndrome (PTS). Standard anticoagulant options include:
    - Low Molecular Weight Heparin (LMWH): LMWH is often used as the initial treatment in the acute phase of DVT due to its rapid onset of action, ease of dosing, and lower risk of bleeding compared to unfractionated heparin. LMWH is commonly used as a bridge to oral anticoagulation in patients with newly diagnosed DVT.14
    - Direct Oral Anticoagulants (DOACs): DOACs, such as rivaroxaban, apixaban, and dabigatran, have become increasingly preferred for long-term anticoagulation due to their fixed dosing, lack of need for routine monitoring, and comparable efficacy to vitamin K antagonists (e.g., warfarin). DOACs are suitable for most patients with MTS-associated DVT and are favored in patients without contraindications, such as severe renal impairment.14
    - Vitamin K Antagonists (Warfarin): Warfarin remains an option for long-term anticoagulation, particularly in patients who cannot tolerate DOACs. However, warfarin requires regular monitoring of the international normalized ratio (INR) and dose adjustments, making it less convenient than newer agents.
- The duration of anticoagulation therapy depends on the severity of the thrombotic event and the presence of risk factors for recurrent DVT. For patients with MTS, long-term anticoagulation may be necessary to prevent recurrent thrombosis, particularly if the underlying venous obstruction has not been addressed.14
- Thrombolytic Therapy: Thrombolysis, also known as clot-busting therapy, is used in select cases to rapidly dissolve acute DVT. This approach is particularly indicated in patients with extensive, symptomatic iliofemoral DVT, where rapid restoration of venous patency is necessary to reduce the risk of post-thrombotic syndrome. Thrombolytic agents, such as tissue plasminogen activator (tPA), are administered either systemically or via catheter-directed techniques to lyse the thrombus. Catheter-directed thrombolysis (CDT) is often preferred in MTS because it allows for localized delivery of the thrombolytic agent directly to the site of the clot, minimizing systemic exposure and reducing the risk of bleeding complications.14

3. Endovascular Interventions:

Endovascular therapy has become the standard treatment for patients with symptomatic MTS, particularly those with significant iliac vein compression or those presenting with DVT. The primary goal of endovascular intervention is to relieve venous obstruction and restore normal venous flow, thus preventing recurrent thrombosis and alleviating chronic venous insufficiency.

- Balloon Angioplasty: Balloon angioplasty involves the insertion of a catheter with a balloon at its tip into the affected iliac vein. The balloon is inflated at the site of compression to widen the vein and relieve the obstruction. Although balloon angioplasty alone may provide temporary relief, it is often insufficient for long-term management of MTS due to the elastic recoil of the vein and the risk of restenosis. For this reason, balloon angioplasty is typically followed by stenting.14
- Stenting: Venous stenting is the most definitive endovascular treatment for MTS and is performed in conjunction with balloon angioplasty. After angioplasty, a self-expanding metallic stent is deployed in the compressed segment of the left iliac vein to keep it open and prevent recurrent stenosis. Stenting effectively restores venous flow and significantly reduces the risk of recurrent DVT and post-thrombotic syndrome. The use of stents is particularly advantageous in cases where the vein has developed intraluminal spurs or where chronic fibrotic changes have occurred due to long-standing compression.15
    - Type of Stents: The most commonly used stents in MTS are self-expanding nitinol stents, which are flexible and able to conform to the anatomical curvature of the iliac vein. These stents are typically sized to match the diameter of the adjacent non-compressed vein, ensuring adequate luminal expansion.
    - Outcomes: Endovascular stenting has been associated with high technical success rates and excellent long-term patency. Studies have shown that most patients experience

significant symptomatic improvement after stenting, with reductions in leg swelling, pain, and the risk of recurrent DVT. Long-term follow-up demonstrates good stent patency rates, although periodic surveillance with Doppler ultrasonography or venography may be required to monitor for stent restenosis or thrombosis.16

4. Surgical Interventions:

Although endovascular techniques are the preferred treatment for MTS, surgical intervention may be necessary in rare cases where endovascular therapy is contraindicated, unsuccessful, or in cases of complex anatomy. Surgical options include:

- Iliac Vein Bypass: Iliac vein bypass surgery involves the creation of a new venous conduit to bypass the area of compression. This is typically reserved for cases where endovascular stenting has failed or is technically challenging due to severe fibrosis or scarring. The bypass can be created using autologous vein grafts or synthetic materials. However, this procedure is associated with higher morbidity compared to endovascular techniques and is rarely performed in modern practice.17
- Thrombectomy: Surgical thrombectomy may be considered in patients with acute iliofemoral DVT who have contraindications to thrombolysis or in cases where thrombolytic therapy has been ineffective. Surgical thrombectomy involves the removal of the thrombus from the iliac vein, followed by decompression of the vein to relieve the underlying obstruction.17

5. Long-Term Management and Follow-Up:

Long-term follow-up is essential for patients with MTS, particularly those who have undergone endovascular stenting. Surveillance with Doppler ultrasonography is typically recommended to monitor stent patency and detect any evidence of restenosis. Patients who have undergone stenting may require lifelong anticoagulation therapy, especially if they have had a history of DVT or if there are persistent risk factors for thrombosis. Additionally, patients are advised to continue wearing compression stockings to reduce the risk of chronic venous insufficiency and post-thrombotic syndrome.18

The treatment of May-Thurner Syndrome has evolved significantly, with endovascular techniques such as balloon angioplasty and stenting now serving as the mainstay of management for symptomatic patients. Early intervention is crucial to prevent complications such as deep vein thrombosis and chronic venous insufficiency, which can significantly impact a patient's quality of life. Conservative management, pharmacologic therapy, and endovascular interventions are all employed based on the severity of the disease and the presence of thrombotic complications. While surgical treatment is rarely required, it remains an option in complex or refractory cases. Long-term follow-up is essential to ensure optimal outcomes, and ongoing advancements in stent technology and endovascular techniques continue to improve the prognosis for patients with MTS.19

CONCLUSION

May-Thurner Syndrome (MTS), also referred to as iliac vein compression syndrome, represents a clinically significant but often underdiagnosed condition characterized by the compression of the left common iliac vein by the right common iliac artery. The resultant venous outflow obstruction predisposes patients to chronic venous insufficiency and an increased risk of deep vein thrombosis (DVT). As our understanding of the pathophysiology of MTS evolves, it has become clear that both mechanical and hemodynamic factors contribute to the development of symptoms, which may range from asymptomatic venous compression to life-threatening venous thromboembolism.

Current diagnostic modalities for MTS, including duplex ultrasonography, computed tomography venography (CTV), magnetic resonance venography (MRV), and intravascular ultrasound (IVUS), have significantly improved the accuracy of diagnosis, allowing for early identification and appropriate management. IVUS, in particular, has emerged as a key tool in the assessment of intraluminal changes and degree of venous compression, offering real-time, high-resolution imaging that has proven invaluable in both diagnosis and therapeutic planning.

The advent of endovascular therapies has revolutionized the treatment landscape for MTS. Endovascular stenting, following balloon angioplasty, has become the preferred intervention for symptomatic patients due to its minimally invasive nature, high technical success rates, and favorable long-term outcomes. Stenting of the left iliac vein effectively alleviates venous obstruction, restores normal venous flow, and prevents recurrence of thrombotic events. The ability to offer rapid symptom relief and prevent complications such as post-thrombotic syndrome (PTS) has positioned endovascular stenting as the gold standard of care for MTS management.

Pharmacologic therapies, particularly anticoagulation, play a crucial role in the management of patients presenting with DVT secondary to MTS. The timely initiation of anticoagulants, such as low molecular weight heparin (LMWH) or direct oral anticoagulants (DOACs), remains essential in the prevention of clot propagation, pulmonary embolism, and post-thrombotic complications. For patients with extensive thrombosis, catheter-directed thrombolysis (CDT) is a valuable adjunct to anticoagulation, facilitating the rapid dissolution of clots and reducing the risk of long-term venous dysfunction.

Despite the significant advances in endovascular treatment, patient outcomes hinge on the careful consideration of long-term management strategies. Lifelong anticoagulation may

be warranted in individuals with recurrent DVT or persistent risk factors, while regular follow-up with duplex ultrasonography or venography is recommended to monitor stent patency and detect restenosis. Furthermore, the use of compression therapy and lifestyle modifications, such as leg elevation and exercise, are critical to preventing venous stasis and mitigating chronic venous symptoms.

While most patients experience significant symptomatic relief following stenting, challenges remain in the management of complex cases, particularly those with extensive thrombosis, chronic venous occlusion, or recurrent compression. In such cases, surgical options, such as iliac vein bypass, though less commonly utilized, may offer an alternative when endovascular approaches fail.

Looking to the future, ongoing advancements in stent technology, including the development of drug-eluting stents and bioresorbable scaffolds, hold promise for improving long-term outcomes and reducing the incidence of restenosis. Additionally, increased awareness of MTS among clinicians is paramount to ensure early diagnosis and timely intervention, ultimately improving patient prognosis and reducing the morbidity associated with chronic venous insufficiency and recurrent venous thromboembolism.

In conclusion, May-Thurner Syndrome is a multifaceted vascular disorder with significant implications for venous health. The combination of accurate diagnostic techniques, tailored endovascular interventions, and vigilant long-term management has led to significant improvements in the quality of life and outcomes for affected individuals. Continued research, innovation in treatment modalities, and patient education remain essential to advancing the standard of care and ensuring optimal management of this complex condition.

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