

# Interventional Radiology GRAND ROUNDS

## Topic: New Treatment Option for DVT

Despite recent advances in non invasive imaging that have increased the detection of deep vein thrombosis (DVT), management of the disorder remains a clinical challenge for physicians.

Traditional treatment regimens including anticoagulation, venous compression stockings and leg elevation often are insufficient for patients with significant pain and swelling from extensive venous thrombosis. Recent breakthroughs in minimally invasive interventional radiology techniques, however, are improving the prognosis of DVT. These

### Case History

A 24-year-old woman with a left iliofemoral DVT experienced worsening edema and pain despite therapeutic anticoagulation. The initial venogram demonstrated clot-filled femoral (**Fig 2.1**) and iliac veins (**Fig 2.2**). Following overnight catheter-directed thrombolysis and iliac vein stent placement, patency of the vein was restored (**Fig 2.3**) with immediate relief of leg swelling and pain (**Fig 2.4**). The patient was placed on warfarin for 6 months and has remained asymptomatic.



Figure 2.1



Figure 2.2



Figure 2.4

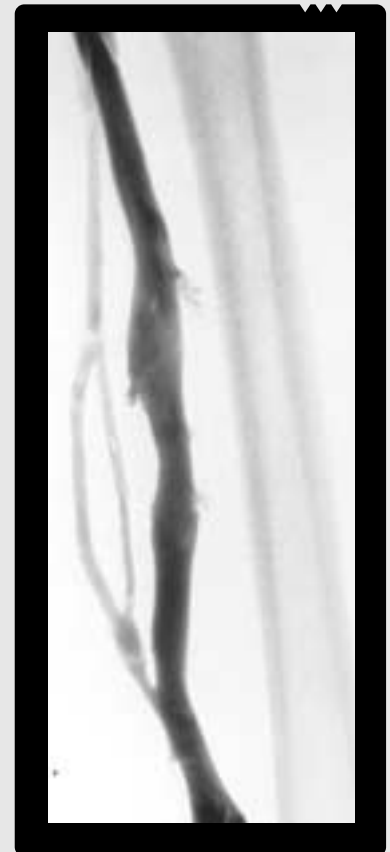


Figure 2.3

therapies can rapidly reduce limb swelling, restore blood flow through the vein and potentially reduce the long-term complication of post-thrombotic syndrome, particularly when therapy is initiated within seven to 10 days of onset of symptoms.

### Incidence and Pathophysiology

The incidence of deep vein thrombosis (DVT) ranges from 60 to 180 cases per 100,000 population annually. In the United States alone, 300,000 new cases are diagnosed each year.<sup>1</sup> The pathophysiology of DVT, described by Rudolf Virchow in 1851, is characterized by the classic triad of: 1) endothelial injury, 2) stasis of blood flow, and 3) hypercoagulable states.

Clinical presentation of DVT includes leg pain, swelling, prominent superficial veins, discoloration (cyanosis), tenderness, and the presence of a palpable cord (thrombosed vein). Symptoms are often non specific, and as many as 50 percent of patients with venous thrombus may present without any objective findings at the bedside.

### Origins of DVT

Venous thrombi usually originate in the deep veins of the calf muscles and, if left untreated, will propagate to involve the deep veins at the knee and thigh in approximately 20 percent of cases.

In a distinct subset of patients, thrombus originates in the iliac veins of the pelvis and propagates down the leg (iliofemoral thrombosis) (Fig. 1). The majority of cases (75 percent) occur in the left leg. Patients with iliofemoral DVT tend to have marked pain and swelling and 50 percent experience pulmonary emboli.

Chronic sequelae of DVT, known as post-thrombotic syndrome, can occur in as many as 60 percent to 70 percent of patients.<sup>2,3</sup> This may be indistinguishable from recurrent DVT and is the result of chronic venous hypertension from valvular injury and venous obstruction. The constellation of chronic symptoms includes pain, edema, hyperpigmentation and venous stasis ulcers.

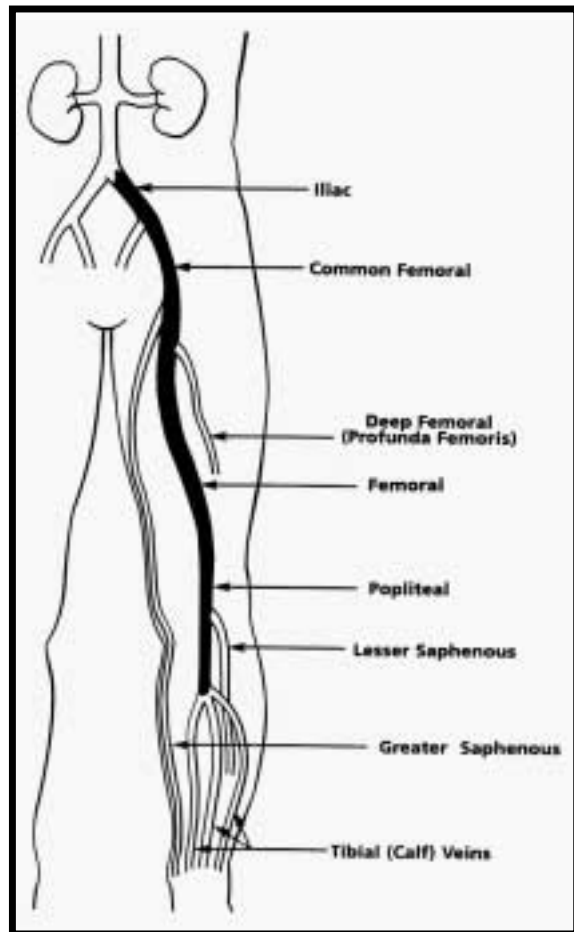
### Diagnosis

Venography remains the gold standard in the detection of DVT, but it is invasive, time consuming, and requires considerable operator experience to interpret adequately. Consequently, the current standard of care is ultrasound; the sensitivity and specificity of Doppler ultrasound in detecting DVT in the lower extremities is greater than 95 percent.<sup>4</sup>

### Treatment

#### Anticoagulation

The rationale for anticoagulation is to prevent thrombus propagation, decrease the risk of recurrent DVT, and prevent pulmonary emboli. Traditional treatment protocols include continuous intravenous unfractionated heparin combined with long-term oral warfarin sodium. The optimal duration of anticoagulation therapy remains in question, but for



**Figure 1**  
Ilio-femoral Deep Vein Thrombosis

### Risk Factors for Deep Vein Thrombosis

- Prior history of DVT
- Immobilization
- Post-operative state
- Age > 40 years
- Malignancy
- Associated cardiac and neurologic disease
- Limb trauma and/or orthopedic procedures
- Coagulation abnormalities (hypercoagulable states)
- Hormonal therapy
- Pregnancy and post-partum state
- Obesity

patients with a first episode of venous thrombosis or pulmonary embolism, three to six months of warfarin treatment is generally recommended.

Recently introduced injectable low-molecular weight heparinoids (enoxaparin, fragmin) are currently indicated for prevention of DVT and soon will be available for treating documented venous thrombosis.<sup>5</sup> Low-molecular weight heparins potentially provide significant cost-savings since patients do not require laboratory testing for PTT and may not require hospitalization.

Unfortunately, anticoagulation has not reduced the incidence or severity of the post-thrombotic syndrome.<sup>2,3</sup>

#### *Limitations of Anticoagulation Therapy*

Contrary to popular belief, heparin and warfarin therapy do not actively dissolve thrombus. Veins have a limited capacity to break down clot naturally, and in patients with symptomatic DVT, anticoagulation alone cannot remove the offending thrombus, reduce limb swelling, or alleviate pain. With extensive DVT involving the larger veins in the thigh and pelvis, the inherent thrombolytic process is overwhelmed and the patency and function of the involved veins rarely return to their normal state. Spontaneous thrombolysis of DVT after anticoagulation therapy will occur in fewer than 10

percent of patients, and 40 percent of patients will continue to propagate thrombus despite therapeutic levels of heparin.<sup>6,7</sup> The usual consequence is transformation of the clot into fibrous web-like bands within the vein, valvular damage, and/or permanent vein occlusion, and development of symptoms of post-thrombotic syndrome.

#### *Catheter-Directed Thrombolysis*

Catheter-directed thrombolysis is an emerging treatment alternative for selected patients with extensive, symptomatic DVT.<sup>8</sup> The procedure, which is performed in a hospital catheterization suite, is designed to rapidly remove the clot, restore flow within the vein, and potentially preserve valve function to minimize the risk of post-thrombotic syndrome. The interventional radiologist inserts a catheter into the popliteal or other leg vein and threads it into the vein containing the clot. The catheter tip is placed into the clot and urokinase is infused directly to the thrombus. The fresher the clot, the faster it dissolves — usually in one to two days. Any narrowing in the vein that might lead to future clot formation can be identified by venography and treated with balloon angioplasty or stent placement. Clinical resolution of pain and swelling and restoration of blood flow in the vein is greater than 85 percent using the technique.<sup>8-10</sup>

Indications for catheter-directed thrombolysis include patients with acute iliofemoral DVT, multi-level DVT (e.g., calf, popliteal, and femoral vein), or massive DVT (phlegmasia cerulea dolens).

#### Contraindications to anticoagulation therapy:

- bleeding disorders
- history of hemorrhagic stroke
- metastatic disease involving the central nervous system
- pregnancy or immediate post-partum state
- major abdominal or orthopedic surgery within seven days
- gastrointestinal bleeding

Optimal candidates are otherwise active, healthy patients with spontaneous DVT who seek therapy within seven to 10 days from the onset of symptoms. DVT that is several weeks old typically does not dissolve easily with catheter-directed techniques since the soft clot has transformed into firm scar tissue.

The most frequent minor complication of catheter-directed thrombolysis is hematoma at the site of catheter placement, which occurs in 5 percent of cases. The risk of a major life-threatening complication (major bleed or pulmonary embolus) is less than 0.1 percent and routine placement of inferior vena cava filters during catheter-directed thrombolysis is not generally recommended.<sup>10</sup>

## References

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