Diagnosis of chronic venous insufficiency

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In recent years a flurry of attention has been given to diagnosis of acute deep venous thrombosis but only a few studies have drawn attention to an organized approach to the diagnosis of chronic venous insufficiency.[1,2] Historically, the venous system has not been regarded as worthy of detailed evaluation because so little could be done to repair the problems the system harbors. This has changed since surgical procedures are available for saphenous, perforator, and deep venous problems. There are specific operations for valve incompetence in each of these divisions of the lower extremity veins, and bypass procedures exist for occlusion in various segments. The challenge now is to learn to diagnose the specific defects that are causing a patient's problem and to select appropriate patients for a given operation. We will never be able to compare treatments until we learn to identify accurately disease states. At the present time there is confusion about basic problems, such as how to diagnose incompetent perforator veins, what constitutes valve incompetence in the deep venous system, and whether postthrombotic deep vein recanalization helps or hurts the patient.[3]

To treat chronic venous insufficiency well, we need to be precise about the diagnosis and study all of the problems objectively. Historically, we have tended to lump perforator problems with deep vein problems, have failed to differentiate deep vein obstruction from incompetence, and only rarely have separated primary valve incompetence from postthrombotic valve destruction.[4] No method has been agreed on to diagnose perforator incompetence, so it is difficult for physicians to compare methods of treating perforator disease when they may not be treating the same conditions.

Pathologically, two events occur in the veins—obstruction and incompetence. Obstruction is an acute event caused by phlebitis, tumor, or trauma that is followed by compensatory collateralization. Incompetence is a slowly developing process that seems to gradually erode the compensatory mechanisms and leads to insufficiency in the venous return. The pathologic processes that need analysis in the patient who presents with chronic venous insufficiency are the degrees of incompetence and obstruction in each of the three anatomic divisions in the extremity—the saphenous, perforator, and deep veins.

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DIAGNOSTIC PROCESS

Accurate diagnosis of chronic insufficiency states can be done in three phases, the office, the vascular laboratory, and phlebographic studies.

Office evaluation. The office evaluation consists of a thorough history and physical examination of the venous system and venous Doppler interrogation.

History. Important elements of the history are the presence and degree of pain and swelling, presence of varicose veins, or history of deep venous thrombosis, and any history of induration or ulceration of the extremity from venous disease.

The severity of swelling and pain is graded. Those who experience severe swelling within 2 to 4 hours of standing are distinguished as having a much more serious degree of venous insufficiency than those who have lesser amounts of swelling noticed only at the end of the day. Pain, which is usually described as heaviness or aching in the extremity in the thigh or calf, can be severe enough to limit the patient's ability to carry out his normal occupation in life or can be a simple nagging discomfort. Venous claudication is a deep discomfort that limits the patient's walking distance and requires that the patient be off his feet to obtain full relief of the symptom. A history of previous deep venous thrombosis is noted but is not necessarily believed unless it has been confirmed by phlebographic study in the past.

Physical examination. Particular attention is given to the relative differences between the involved leg and the other leg. Enlargement in the calf of more than 1 cm is considered a significant difference in size. A chronic difference of 2 cm or more suggests previous phlebitis in the larger leg unless another explanation is present. Varicose veins are checked with the patient in a standing position. Evidence of

incompetent perforators is sought by palpation and Trendelenburg testing. Distribution and degree of stasis changes including discoloration and indurative changes are noted. The presence of ulceration or the telltale signs of healed previous ulceration are also noted. A distinction in the degree of severity is made between the patient who has his first small ulcer and the patient who has recurrent severe huge ulcer formation.

Venous Doppler examination. Doppler ultrasonography is performed in the office at the posterior tibial, popliteal, superficial femoral, and common femoral locations and also along the course of the greater saphenous vein. In each location the vein is checked for patency and valvular competence. Valvular competence is observed both with the Valsalva maneuver and with local compression maneuvers proximal to the site that is being interrogated.

When this office phase of the workup has been completed, it will have been determined whether the patient has a significant problem in the lower extremity and the clinical severity of this problem can be graded. When further workup is indicated by the initial evaluation, the next step in screening is carried out in the vascular laboratory where pressure, volume, and flow studies are performed.

Vascular laboratory examination. The examinations that can be carried out in the vascular laboratory are a complete venous Doppler examination if this has not been done in the office, phleborheography to separate those with severe obstructive disease from those without severe obstruction, venous pressure testing, and venous volume testing.

The phleborheograph is used to determine whether obstruction plays a major role in the patient's overall clinical condition. In the chronic state, a grossly abnormal phleborheograph indicates an advanced degree of obstruction in the outflow vessels of the leg.

The venous pressure examination is simple in concept but requires care in its performance to avoid technical pitfalls. It can be carried out in three phases. In the first phase, the venous pressure dynamics are observed while the examiner squeezes the calf muscle several times. This tests the ability of the venous system to empty the leg independent of the calf muscle pump.

In the second phase, venous pressure is determined in a more conventional manner with the patient in the standing position performing multiple tiptoe exercises until the venous pressure falls to its maximal degree. At this point the exercise is stopped and the time that it takes for the venous pressure to return to baseline levels is recorded. This tests venous emptying and refill with the muscle pump used as the driving force.

In the third phase, the patient performs active exercise as described above but with tourniquets placed first at the knee and then at the ankle. The tourniquet at the knee removes the greater saphenous system from the determination and the tourniquet at the ankle removes the perforator veins as well as the superficial veins from the determination.

Volume changes can be observed in the extremity in a fashion similar to the venous pressure test and can be accomplished with strain-gauge plethysmography, photoplethysmography, or the foot volumeter.

When the office evaluation and the hemodynamic evaluation suggest a complicated problem, the next step in workup is phlebography. Phlebographic evaluation is begun with an ascending phlebogram.

Ascending phlebography. The ascending phlebogram for chronic venous insufficiency is designed to show anatomic patency of the veins throughout the lower extremity and to demonstrate the degree of competence of the perforator veins, especially in the calf. This procedure is carried out with the patient in the 45-degree foot-down position with a thin ankle tourniquet set at 120 to 140 mm Hg. During the initial injection of contrast material, the flow of contrast medium is monitored by fluoroscopy. Under normal conditions the contrast material will be forced by the tourniquet to flow into the deep veins of the calf and there will be no filling of the saphenous system through the competent perforating veins. This can only be monitored as the contrast material is initially injected. If the fluoroscopist observes contrast medium flowing out of the deep calf veins into the superficial veins by way of incompetent perforators, this is accepted as the true test of perforator incompetence. The degree of incompetence can be graded by the size and the number of perforators observed.

The tourniquet is released from the ankle and the remainder of the examination is carried out as in the technique of Rabinov and Paulin[5] for ascending phlebography.

At the conclusion of the ascending phlebogram the patient is given 5000 units of heparin intravenously and the contrast agent in the leg veins is washed out by 250 ml of saline solution.

The information gained from the ascending phlebogram is the degree of patency of the tibial, popliteal, superficial femoral, common femoral, and the iliac veins and the presence of incompetent perfor-

ors. Venous anomalies and collateral pathways are demonstrated. The saphenous system is also filled and ideas of its morphology can be inferred by the size of the vein.

The patient who has a patent deep venous system as seen on ascending phlebography and who has a severe clinical syndrome of venous insufficiency will next be studied by descending phlebography to learn the function of the valves in the superficial femoral, deep femoral, and greater saphenous veins.

Descending phlebography. This procedure involves placing a catheter into the common femoral vein either by percutaneous puncture of the femoral vein with the patient lying supine or by passage of a catheter from the arm down through the vena cava and into the femoral venous system of the side to be examined. The dynamics observed by injecting the contrast material either by way of percutaneous common femoral vein catheter or by a catheter passed from the arm are similar in our experience.

The x-ray table is tilted to the 60-degree foot-down position and the weight is borne by the contralateral leg. Contrast medium is injected in a steady stream into the femoral vein and its flow is observed under the fluoroscopy screen. The examination is videotaped for later replay and study.

The dynamics of flow are observed first with the patient breathing normally and, second, with a forced Valsalva maneuver. Under the stress of a forced Valsalva maneuver, the true functional capacity of the venous valve is brought out. In the patient who has structural incompetence of the valves, the Valsalva maneuver causes reflux to increase dramatically, whereas in a normal valve the forced Valsalva causes the valve leaflets to snap shut and create a competent valve.

In interpreting the results of descending phlebography, any competent valve existing between the popliteal vein and the common femoral vein is sufficient to provide competence to the femoropopliteal system and protect the calf from the effects of a totally incompetent proximal venous tree. The grading of the results is done according to the criteria in Table I.

Summary of diagnostic workup. This evaluation can readily be completed in two separate visits by the patient. On the first day, office evaluation, vascular laboratory, and ascending phlebography is done. On the second day, descending phlebography is accomplished. When the workup is finished the clinical condition will have been accurately assessed, the functional capacity of the extremity will be known from hemodynamic studies, and anatomic patency will have been established by ascending venography. Valvular competence in the perforators is determined by ascending phlebography and competence in the superficial femoral, deep femoral, and saphenous systems is accurately assessed by descending phlebography. This information provides an objective understanding of the abnormalities in the veins of the leg and thigh and permits the design of a surgical approach tailored to the patient's specific problem. It also provides the basis for exact diagnosis that will allow physicians to relate experiences with specific problems and compare treatment modalities.

Table I. Interpretation of descending phlebography

Complete competence
Does not leak under full Valsalva
Satisfactory competence
Mild leakage limited to thigh with Valsalva
Moderate incompetence
Prominent leakage into calf with Valsalva
Retains prograde flow in iliac vein
Severe incompetence
Cascading retrograde flow with Valsalva
Reflux into calf perforators

SUMMARY

An orderly diagnostic approach is needed to establish specific anatomic and etiologic diagnoses in patients with chronic venous insufficiency. It begins with the history and physical examination, including Doppler examination of the veins, in the office. When the severity of the problem warrants further investigation, the vascular laboratory can be used to assess the degree of physiologic change via pressure, volume, and flow studies. Diagnosis of obstructive and incompetent states can be established, and the one distinguished from the other. Ascending phlebography is used to demonstrate the anatomy of the veins, competence of the perforators, and the presence of postthrombotic deep vein changes. Descending phlebography is used in selected cases to diagnose specific incompetence of the valves in the superficial femoral, deep femoral, and greater saphenous veins.

A complete venous evaluation defines which veins are patent, where the valves are located and if they are competent, and provides physiologic pressure and volume studies to correlate with the clinical state. Problems caused by primary valve incompetence are separated from those caused by postthrombotic recanalization or occlusion. On the basis of these findings, specific therapy can be tailored to the problem at hand.

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