As detailed throughout this volume, venous ulceration of the leg is a severe and debilitating outcome of chronic venous insufficiency. While it has been termed the post-thrombotic syndrome, it is now known that primary valvular dysfunction, not just prior thrombosis, is an important cause of leg ulcer. This is important because primary valvular dysfunction is eminently treatable while post-thrombotic dysfunction is not.

Primary venous dysfunction develops upon an hereditary hormonal substrate and is promulgated by gravitational venous hypertension and pressure from muscular contraction transmitted through failed perforating vein-valves. It is assumed that repeated pulses of high venous pressure generated by muscular contraction apparently drive leukocytes into the expanded endothelium of unsupported subcutaneous and intracutaneous postcapillary venules. There, activation occurs and free oxygen radicals and other toxic products are released. The result is an inflammatory reaction which leads to the clinical manifestations of chronic venous insufficiency. Clinical diagnosis is confirmed by ultrasound examination and treatment can be applied through compression therapy assisted by pharmacologic management and surgery. Compression reduces existing edema and decreases tendency for edema formation. Pharmacologic manipulations are designed to increase noradrenaline activity and improve stimulation of lymphatic contraction. However, no such agents are available in the United States. Surgery is targeted at eliminating superficial reflux and high-pressure perforating vein outflow. The latter is markedly enhanced by minimally invasive endoscopic techniques which may be performed on an outpatient basis.

As early as the 1930s, perforating veins with outward flow were implicated in the pathogenesis of this condition. Recognition that such outward flow promotes leukocyte adhesion and activation as the principal microcirculatory cause for cutaneous changes has explained the importance of perforating vein interruption. Because of disability of chronic venous insufficiency in the past, surgeons and patients reluctantly tolerated the open operation with its morbid knee-to-ankle incision because of the efficacy of the procedure. Modifications done to reduce the morbidity of the procedure at first eliminated two of the three incisions used in the explorations of the 1930s. Other modifications followed. However, the most significant modern alteration was to utilize endoscopic techniques introduced by Fischer and Hauer (Fig. 12.1). Very quickly it was learned that this technique minimized postoperative complications. Application of endoscopic perforator interruption to varicose vein surgery validated the safety of the procedure but did not contribute to knowledge about treating chronic venous insufficiency.

From the beginning of our experience in July 1993, we have worked toward the development of a single-port, open-scope approach (Fig. 12.2).
Simultaneously, another approach using multiple ports, gas insufflation, and disposable equipment was developed by Gloviczki, Conrad, and others\textsuperscript{13-15} (Fig. 12.3). These procedures, using single or multiple ports, had the same objective; that is, elimination of perforator vein outflow. This was to minimize leukocyte adherence and activation in the enlarged subdermal endothelial pool.\textsuperscript{16}

**Perforating Veins**

Medial calf perforating veins have been the subject of considerable research. In the study by the Middlesex group, direction of blood flow within medical calf perforator veins was seen to be both inward and outward, even in limbs without evidence of venous disease.\textsuperscript{17} Outward flow could be demonstrated in 21\% of perforators in normal limbs. However, only limbs with superficial or deep venous insufficiency demonstrated flow in the perforating veins during the relaxation phase after distal compression. When compression was applied proximal to the perforating vein being observed by ultrasound, a significant number of perforating veins demonstrated outward flow, particularly those limbs with deep venous insufficiency. Comparison of the number of perforators allowing inward flow and outflow during compression and relaxation showed a statistical difference between the results after proximal and distal compression.

Careful observation of the location of perforating veins seen through the endoscope was documented by Fischer.\textsuperscript{18} His careful study measured the location of perforating veins according to the distance from the sole of the foot. This is commonly done when referring to the clinical location of Cockett perforating veins. His conclusion was:

"in contrast to reports of the authors mentioned (Cockett, Haeger, Kubik, and May), we did not find any predilection levels even when the perforator heights found by means of the lower leg length (radiological patients) or the height (surgical patients) were corrected or made relative."