Ambulatory Conservative Hemodynamic Management of Varicose Veins: Critical Analysis of Results at 3 Years

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This report describes the results of our 3-year experience using ambulatory conservative hemodynamic management (ACHM) for lower extremity venous insufficiency involving the greater saphenous vein (GSV), with specific analysis of recurrence due to neoformation of vessels. We performed 289 ACHM procedures in 259 consecutive patients with GSV-related varicose veins. Follow-up clinical examination and Doppler ultrasound imaging was carried out at 3, 6, 12, 24, and 36 months in all cases to assess formation of neovessels supplied either by the superficial (A) or deep (B) venous system. Our data showed that ACHM achieved excellent improvement, with complete disappearance of varicose veins in 41.2% of cases, good improvement in 43%, fair improvement in 14.1%, and no improvement in 1.7%. The only predictor of outcome was the quality of drainage from the GSV vein. Poor drainage leads to neoformation of vessels supplied by the superficial (A) venous system. In about 50% of cases, drainage appeared spontaneously within 1 year, with a subsequent reduction in formation of neovessels. Neoformation of vessels supplied by the deep (B) venous system (10%) was independent of the quality drainage. This finding suggests that formation of these neovesseis is unrelated to the surgical method used to treat varicose veins. In patients with poor drainage of the saphenous network, neoformation of vessels supplied by the superficial (A) venous system is predictable with regard to both topography and delay. ACHM is a good tool for treatment of varicose veins, as reliable statistical prediction of mid-term results is possible using available models. (Ann Vasc Surg 2000;14:376-384.)
DOI: 10.1007/s100169910064

INTRODUCTION

For many years, saphenous vein stripping was considered to be the method of choice for treatment of varicose veins of the lower extremities.[1-4] In 1988, Franceschi[5] described a new method called *ambulatory conservative hemodynamic management* (ACHM), which consists of minimally invasive surgical procedures under local anesthesia that are based on the findings of careful hemodynamic analysis of the venous network of the lower limb using pulsed Doppler ultrasound. We have performed over 600 ACHM procedures. In the present study, we describe the outcome of 289 of these procedures in 259 consecutive patients. Outcome is based on assessment of neoformation of vessels by clinical examination and Doppler ultrasonography.

PATIENTS AND METHODS

Principles of ACHM

The goal of ACHM for superficial venous insufficiency (SVI) is to relieve the hydrostatic pressure

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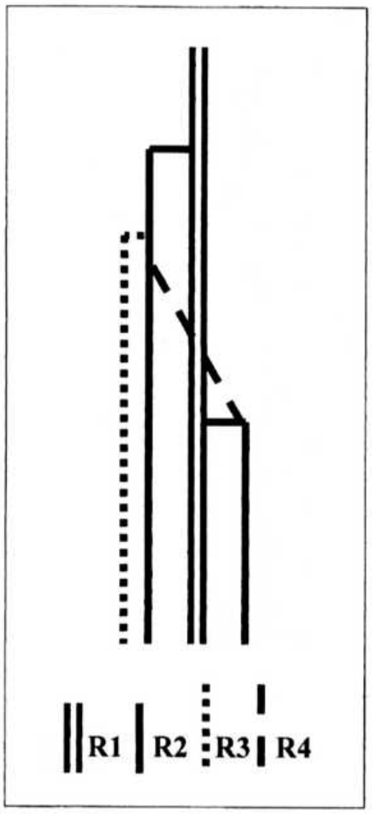

Fig. 1. Drawing representing the four venous networks of the lower extremities. *R1*, deep venous network, including veins located beneath the fascia. *R2*, superficial venous network, including veins located between superficial fascia layers (saphenous veins, Giacomini vein). *R3*, saphenous vein collaterals located above the superficial fascia with no connection to any vessel in the R2 network. *R4*, saphenous vein collaterals located above the superficial fascia with connection to a vessel in the R2 network, either at the origin (longitudinal R4L) or otherwise (transverse R4T).

column by deleting venovenous shunts without removal of the saphenous vein or disruption of drainage of superficial tissue. Hemodynamic studies of patients with SVI have demosntrated four main shunt patterns, depending on communication between four venous networks: R1 (deep vein), R2 (subfascial saphenous veins and Giacomini vein), R3 (branches of the suprafascial saphenous veins), and R4 (saphenous branches between saphenous veins) (Fig. 1). As a result of muscle contraction, many incompetent saphenous veins empty in anterograde fashion via the saphenofemoral junction. When muscles relax, these saphenous veins refill by reflux via the saphenofemoral junction and empty in a retrograde fashion into one or more distal perforators, which act as reentry points. These reentry points can be located on the saphenous vein (P/PR2) or its collaterals (P/PR3). Both anterograde and retrograde flow drain into the deep venous network. Thus flow can be stopped by suppressing the drainage route. Since the saphenofemoral junction usually constitutes the point of reentry of anterograde flow, crossectomy leads to disappearance of anterograde flow but does not affect retrograde flow. Conversely, since the distal perforating veins constitute the point of reentry for retrograde flow, their disruption leads to disappearance of retrograde flow without affecting anterograde flow. In both cases, flow continues in the saphenous vein during either muscle relaxation or contraction, thus ensuring drainage into the deep venous system. By preventing reentry of either anterograde or retrograde flow, we obtain a draining saphenous system, i.e., a system able to empty in either the retrograde or anterograde direction, respectively. Conversely, if both anterograde and retrograde flow are prevented, we obtain a non-draining saphenous system in which no emptying occurs at velocities detectable by Doppler ultrasound.

Thus saphenous vein hemodynamics can be manipulated by performing one or more surgical procedures to adjust reentry of anterograde flow, which is usually also the point of reflux and/or reentry of retrograde flow, depending on the type of venovenous shunt[6] (Fig. 2). A variety of procedures are possible and together constitute the basis for ACHM of varicose veins (Figs. 3 and 4). The characteristic feature of ACHM is to be not only conservative but also hemodynamic.

Assuming that any treatment for varicose veins must eliminate venovenous shunting, preservation of the saphenous vein becomes a necessary but insufficient criterion for ACHM. Two other criteria are required to qualify as an ACHM procedure. The first is that the preserved saphenous system must empty in one direction at a sufficient velocity to allow drainage of cutaneous and subcutaneous circulation into the deep vein network. The emptying direction depends on the therapeutic procedure used and emptying velocity depends on the choice of reentry points. The second requirement for qualification as an ACHM procedure is reduction in filling pressure. This depends on both prevention of reflux and proper adjustment of emptying velocity.

It would be illogical to define ACHM as a procedure resulting in a nondraining saphenous system in which anterograde flow has been stopped but no retrograde flow is detectable. Absence of retrograde saphenous flow is not related to reestab-

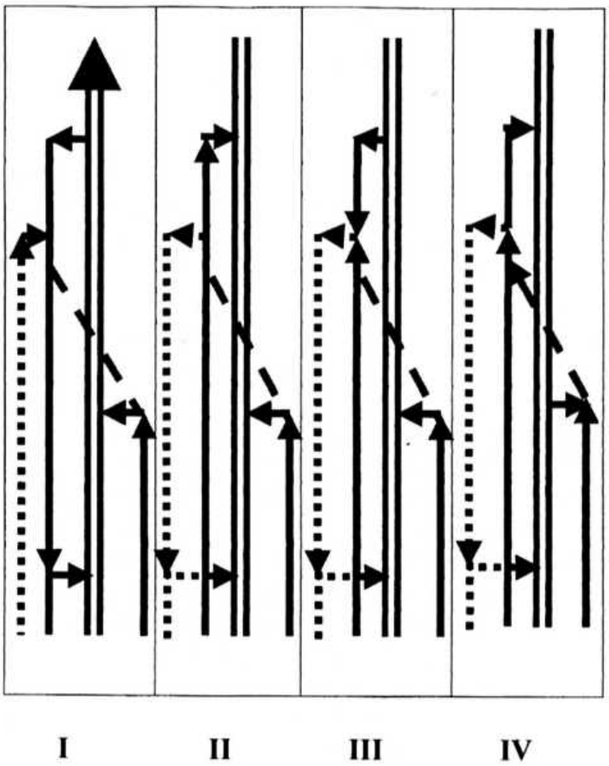

Fig. 2. Different venovenous shunts that may be observed during Doppler ultrasound examination as defined by Franceschi.[5] *Type I,* reflux from the saphenous vein with reentry through a perforating vein located on the saphenous vein (P/R2). *Type II,* reflux from a saphenous vein collateral (R3) with a competent saphenous vein. *Type III,* reflux from the saphenous vein with reentering perforating vein from the collateral vein (P/R3). There can be several types, depending mainly on the length of the refluxing saphenous segment. The shared feature is the disappearance of saphenous reflux during diastole when the origin of the collateral giving rise to the reentry vein is compressed. *Type IV,* any type of shunt other than those described above.

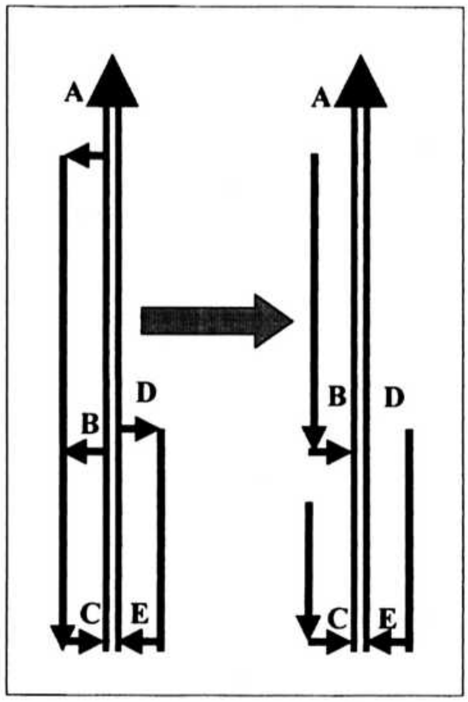

Fig. 3. Example illustrating the principles of ACHM for type I venovenous shunts. The internal and external saphenous veins show reflux through junctions *A* and *D,* respectively, and through perforating vein *B* with reentry points through distal perforating veins (terminals) *C* and *E.* Crossectomy of junction *A* eliminates saphenofemoral reflux and relieves the hydrostatic pressure column. Termination may (as here) or may not be associated with division/ligation of the saphenous vein below the refluxing perforating vein which thus becomes the new reentry vein. This type of termination should be used only if the perforating vein can accommodate sufficient flow for efficient drainage. Crossectomy of junction *D* (preferentially below the origin of the Giacomini vein) has the same effect.

lishment of valve competence due to reduction in the diameter of the saphenous vein lumen, as reported by several authors,[7] but rather to inadequate reentry flow due to poor preoperative evaluation; retrograde flow was always observed in draining saphenous systems despite the same reduction in GSV diameter as in nondraining systems.

In our experience, we were not always able to obtain draining saphenous systems for two reasons. The first was poor hemodynamic significance of the perforating veins used for reentry. The second involves special anatomophysiological features of the varicose venous system, which will be discussed below. The purpose of this study was to determine if the course of varicose disease was influenced more favorably by a draining saphenous system than a nondraining saphenous system.

Patients

All patients with incompetence of the greater saphenous vein (GSV) were considered candidates for ACHM. From January 1990 to July 1994, we performed 289 ACHM procedures on 259 consecutive patients, including 60 men and 199 women, presenting varices in the region of the GSV. Mean age was 49.1 ± 12.4 years (range, 20 to 79 years). Pulsed Doppler ultrasound was performed in all cases for careful preoperative evaluation of the whole venous network of the lower extremities.

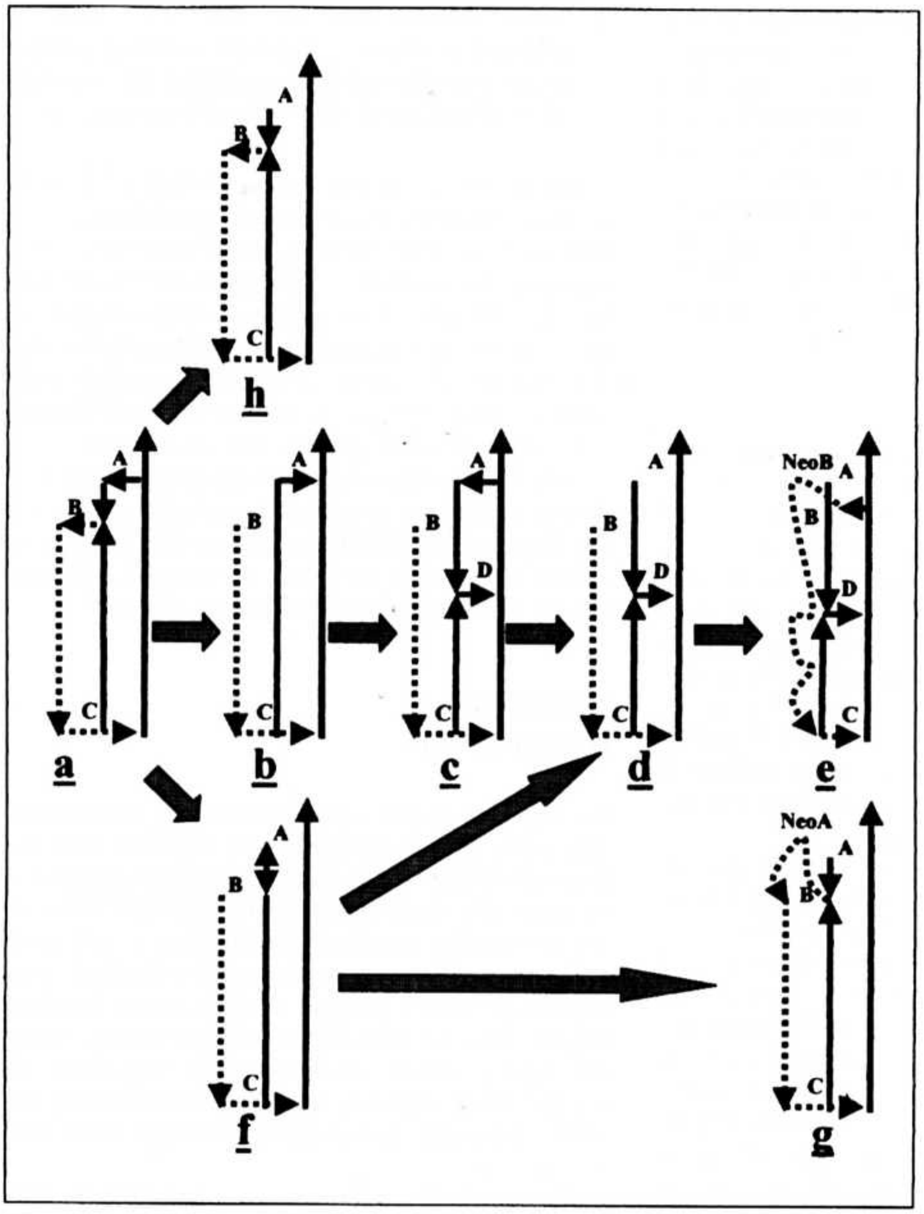

Fig. 4. Examples illustrating the principles of ACHM for type III venovenous shunts and analysis of recurrences due to formation of type A or type B neovessels, depending on whether a draining saphenous system was achieved. **a** Type III shunt, **b** Stage I of ACHM-2 preventing reflux at point B and preserving drainage through junction A. **c** Progression to a type III shunt after development of the reentering perforating vein D. **d** Stage II of ACHM-2 with crossectomy of junction B. **e** Development of neovessels supplied by the deep network (type B) is not correlated with the procedure itself. Development of type B neovessels is probably related to either the presence of a undetected perforating vein or unexplained development of a secondary opening. **f** ACHM-1+2 with division/ligation at point B and crossectomy of junction A. This procedure cannot be considered a true ACHM procedure since it results in a nondraining saphenous system with stasis between A and B. However, this nondraining ACHM can be transformed into a draining ACHM (d) secondarily by development of a perforating vein under the effect of residual pressure. **g** If this transformation does not occur, residual pressure in the nondraining segment will lead to development of a type A neovessel bridging the division ligation at point B, causing recurrence without reflux from the deep venous system. **h** Isolated crossectomy of junction A achieves a draining system without deep reflux. This system meets the hemodynamic requirements of management but leaves a superficial type II shunt that may cause a small but uncosmetic R3 network.