Venous Reconstruction Techniques

Since the original description of the internal valvuloplasty technique by Kistner in 1968, other technical options for venous valve repair have evolved. This has broadened the technical armamentarium and allows a more discriminate choice of technique based on individual circumstances.

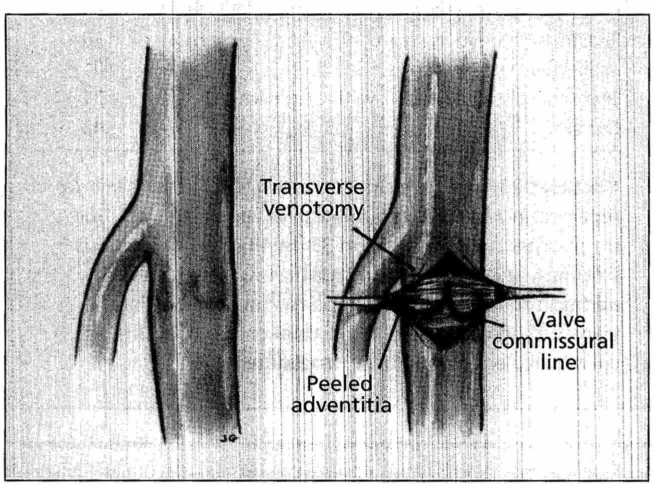


Figure 1 – Exposure of valve attachment lines by adventitial dissection is an important initial step in most valve reconstruction techniques. Careful peeling/excision of the adventitial covering with loop magnification will expose portions of the valve attachment lines, which then should be followed to expose the lines in their entirety.

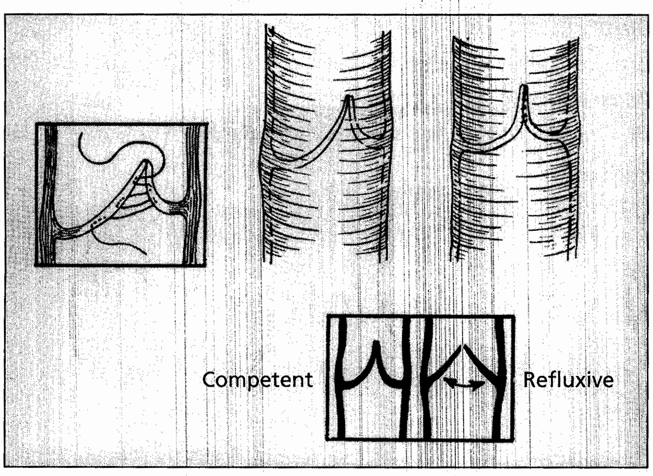


Figure 2 – External valvuloplasty: the commissural valve angle is normally acute in competent valves. The valve angle is widened when the valve is refluxive (inset, bottom). The object of external valvuloplasty is to close the valve angle by transmural sutures, bringing the two valve attachment lines together. The horizontal mattress suture technique allows coaptation of unequal valve attachment lines (inset, top).

Five hundred and eighty-two valve segments were reconstructed in 347 limbs using a variety of techniques. Some of these are shown in figures 1-8. Individual techniques used in 347 limbs are listed in the table. Total intraoperative valve competence was achieved in 86%; 10% of the repairs were slightly leaky and 4% were technical failures. Postoperative complications included stenosis of

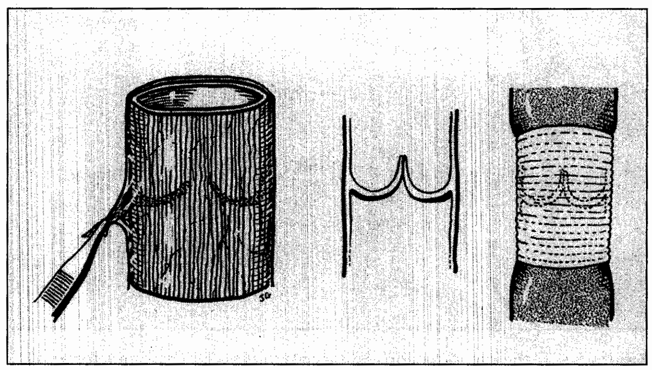


Figure 3 – Prosthetic sleeve *in situ*: surgical manipulation of a refluxive valve may result in rendering the valve competency. The phenomenon is more often seen in smaller-caliber veins. A prosthetic jacket may be applied to the valve station in such cases to maintain valve competency. Further constriction of the valve station in an effort to correct reflux that persists even after normally encountered mild venospasm may result in iatrogenic stenosis and is not recommended.

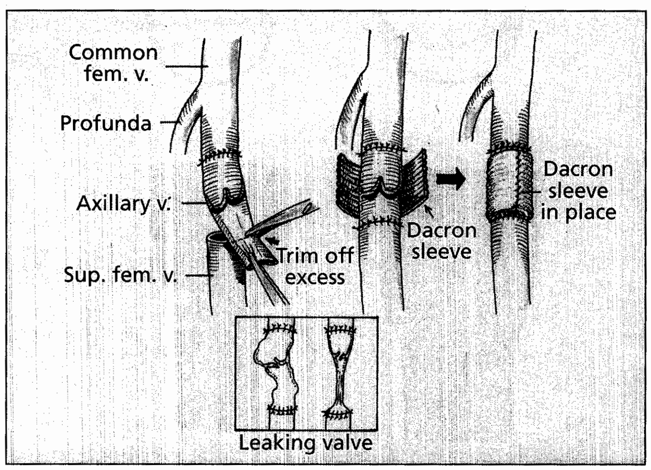


Figure 4 – Technique of axillary vein transfer: the valve should be inserted under optimal tension without torsion. The shallow axillary valves are easily susceptible to malcoaptation and reflux due to technical deficiencies such as torsion or excessive or inadequate tension (inset).

the repaired valve in 4%, thrombosis of the repair in < 1%, deep venous thrombosis not involving the repair in 3.5%, hematoma/seroma in 5%, and wound infection in 2%. Among 210 prosthetic sleeves used, prosthetic infection was < 2% even though 31% of operated patients had active ulcers at the time of surgery.

Among 267 stasis ulcers in the series, healing occurred within 90 days of valve reconstruction in 93%.

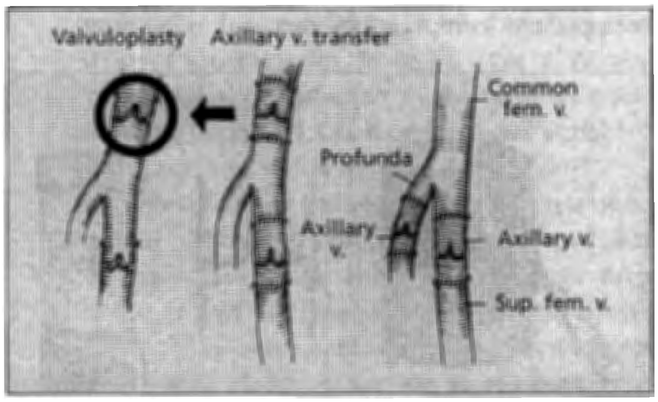


Figure 5 – Technical variations in reconstruction of the deep femoral vein: valvuloplasty or axillary vein transfer (left) may be performed in lieu of the technically more difficult direct profunda valve reconstruction, especially when there is axial transformation of the deep femoral vein. When this technique is employed, the superficial femoral vein should be reconstructed concomitantly.

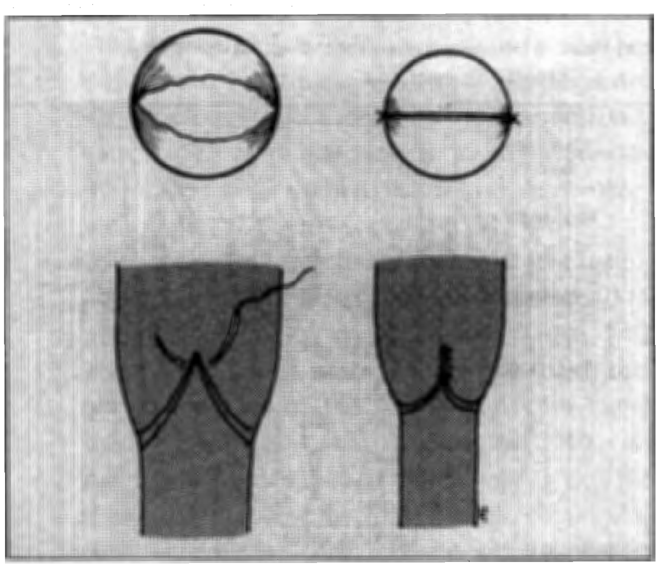


Figure 6 – Transcommissural repair utilizes transluminal sutures to close the commissural valve angle while simultaneously tightening the valve cusp. The use of angioscopy is optional. This type of repair is preferred over external valvuloplasty, which closes the valve angle by transmural sutures without tightening the valve cusps.

An expanded variety of technical options for venous valve reconstruction are now available. External techniques have certain advantages over the original internal technique: they do not re-

Table – Technique of venous valve reconstruction in 550* venous segments in 347 cases†.

	n
Internal valvuloplasty	91
External valvuloplasty	151
Prosthetic sleeve *in situ*	130
Axillary vein transfer	101
Transcommissural repair with angioscopy	31
Other§	46

*Includes 23 failed repairs not listed. †Multiple valves were repaired in 131 cases, double valves repaired in 98, and three or more valves each in 33. In 49 cases, saphenous stripping and perforator disruption was performed in addition to multiple valve repairs. §Includes segment transfers, ligation of refluxive duplication conduits or collaterals, and venoplastic procedures.

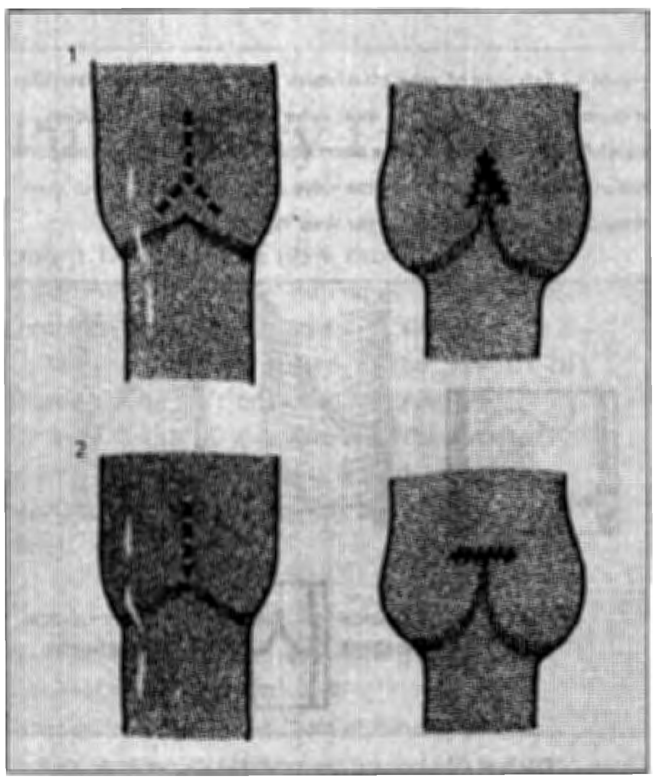
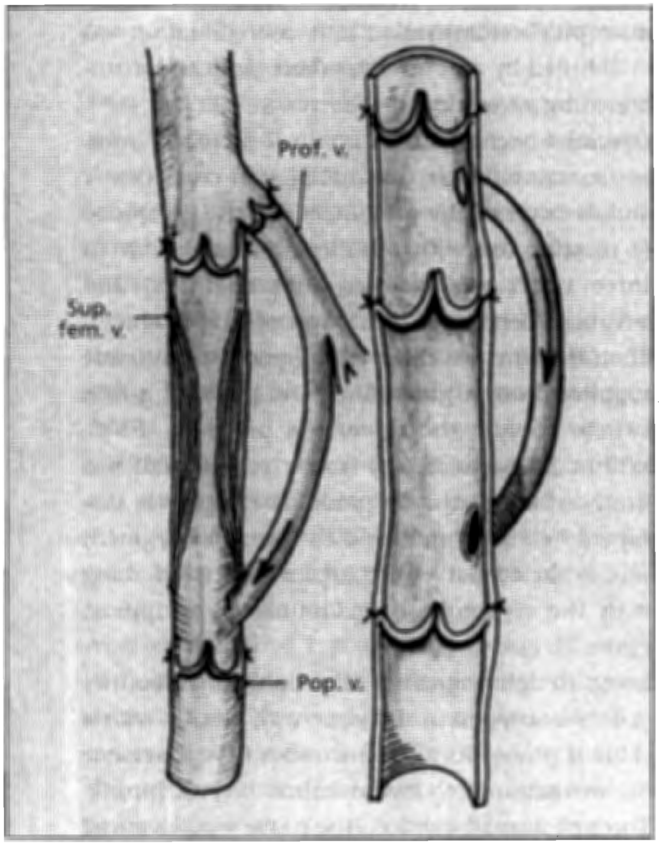


Figure 7 – Venoplastic techniques: Y-V venoplasty or a longitudinal–transverse venoplasty tightens valve cusps and enlarges the valve sinuses without direct suturing of the valve cusps themselves. The techniques are useful in select instances when other techniques are technically difficult.



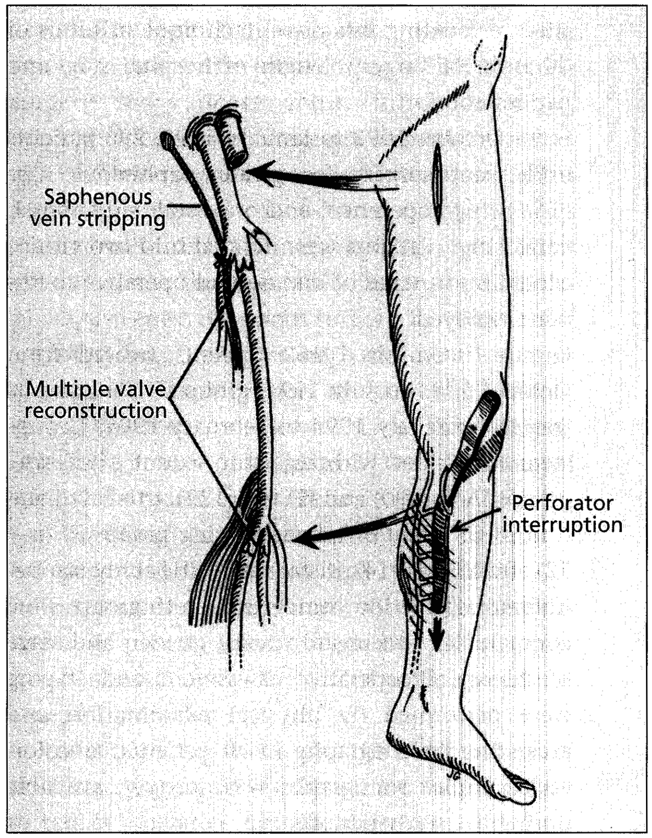


Figure 8 – Multiple valve reconstruction. (A) Repair at multiple levels of the axial vein (axial–axial collaterals) or at the origin of the major tributary vein and distally in axial vein (tributary collaterals) may control collateral reflux. (B) Such multiple valve reconstructions encompassing the superficial femoral, deep femoral, or crural veins can be combined with proximal saphenous vein stripping and disruption of medial perforators through limited groin and crural incisions.

quire a venotomy, are rapidly executed enabling multiple valve reconstructions, and can be utilized even in smaller-caliber veins. The complication rate is low. Venous competence was restored and rapid ulcer healing occurred in 93% of limbs operated for stasis ulceration.

__Raju S, Hardy JD.__ Technical options in venous valve reconstruction. Am J Surg 1997; 173: 301-7.

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Cryophlebectomy to Reduce Operative Trauma in Varicose Vein Surgery

Varicose veins account for a wide spectrum of clinically significant problems in industrialized countries. These range from merely cosmetic discomfort to thrombophlebitis, deep venous thrombosis with pulmonary embolism, and venous ulcerations imposing considerable costs on health-care systems. Surgical therapy should yield good functional and cosmetic results and be cost-effective. After the introduction of cryosurgery for varicose veins at our institution we felt that operative results had markedly improved. In order to substantiate our clinical impression, we performed a retrospective study evaluating this novel technique in terms of duration of surgery, length of hospital stay, and patient comfort.

From October 1993 to January 1995, 296 patients underwent surgery for greater saphenous vein (GSV) incompetence and/or distal side-branch varicosities. Patients were divided into two groups according to stage of disease and operative methods employed.

Group I comprised 162 patients treated from October 1993 to July 1994; group II 134 patients treated from July 1994 to February 1995. Groups were subdivided with regard to extent of disease: groups IA (n = 90) and IIA (n = 122), truncal dilatation of GSV and distal varicosities; groups IB (n = 72) and IIB (n = 14), distal varicosities only (saphenofemoral junction competent). Both groups were comparable with regard to age, gender, and stage of disease. Preoperative assessment and staging were performed by physical examination and ascending phlebography in all patients, as color-coded duplex sonography was not (yet) available during the study period.

Operative techniques in group I were as follows. Group IA patients underwent crossectomy and invasive stripping of the GSV with a disposable Babcock stripper, and microphlebectomy of distal varicosities. A 2- to 3-mm stab incision was made, the varicose vein was captured by a Varady hook (roughly a modified crochet hook), exteriorized through the incision, and pulled out with a mosquito clamp under gentle traction. Up to 20-30 incisions per limb were necessary to eradicate all varicosities. Group IB patients were treated by microphlebectomy only. Limb exsanguination was established by an Esmarch rubber strap and maintained by a tourniquet.

Operative techniques in group II included intra- and extraluminal cryostripping. After crossectomy and division of the proximal GSV, the cryoprobe (a metallic rod with a hollow core, available in three sizes) was inserted into the GSV, and advanced distally to the "point of insufficiency." Then the core was filled with liquid nitrous oxide supplied from a gas cylinder by pressing a foot switch, cooling the tip of the probe to –85°C. Within 2-3 seconds, the frozen venous wall was firmly attached to the probe, the vein was disrupted by a jerky pull, and the proximal segment was extracted out of the inguinal excision along with the cryoprobe (intraluminal cryostripping, figure 1).

Long, straight segments of peripheral varicosities could be stripped in the same way, usually with a thinner probe. Tortuos varicosities were amenable to extraction by extraluminal cryostripping. Through a small incision, the probe was advanced subcutaneously to the preoperatively marked vein, freezing was activated, and the vessel attached to the probe was pulled out (figure 2).

Frequently, only three to four incisions per extremity were required. Where necessary, microphlebectomy was also employed in group II patients. Exsanguination in group II patients was achieved by sterile, inflatable, roll-on tourniquet cuffs.

Patients were encouraged to walk on the day of surgery and were discharged when fully mobilized and free of pain. Low-dose heparin was adminis-

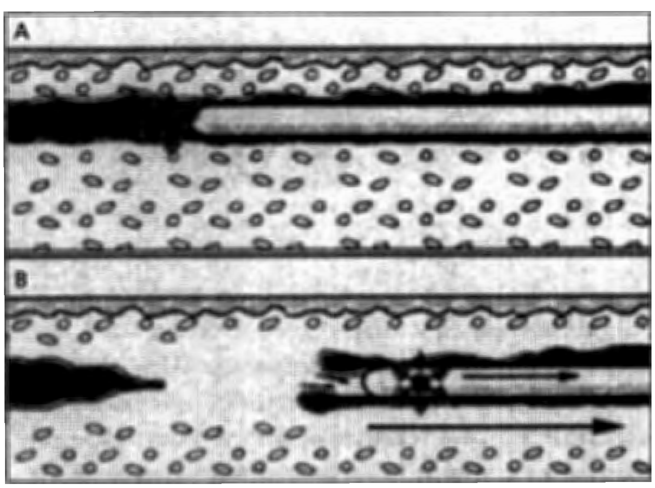

Figure 1 – Intraluminal cryostripping.

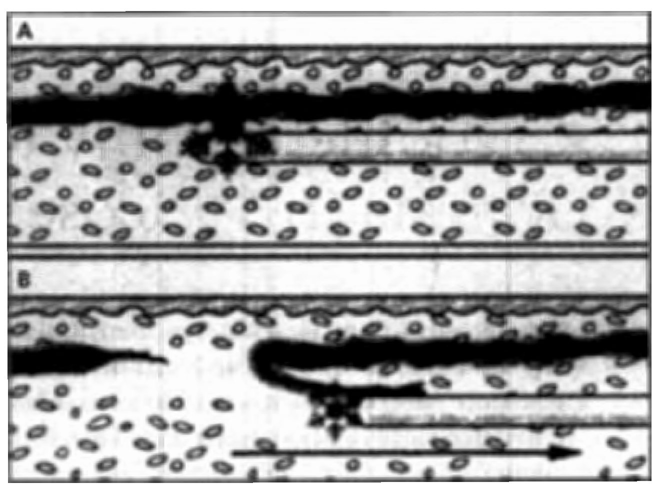

Figure 2 – Extraluminal cryostripping.

tered for 7-21 days until postoperative hematomas and indurations had resolved.

Data concerning operative time, length of hospital stay, and complications for the study groups were compared for statistical significance using Student's *t*-test; $p < 0.01$ was considered significant. Cosmetic results were evaluated subjectively at clinical follow-up 6 weeks after surgery.

Duration of surgery was significantly reduced after the introduction of cryosurgery: 67 ± 21.3 min for group IIA vs. 113.6 ± 35 min for group IA ($p < 0.001$), and 53.3 ± 5.5 min for group IIB vs. 74.4 ± 35.3 min for group IB ($p < 0.001$). Hospital stay was also significantly curtailed: 6.1 ± 2.2 days vs. 9.1 ± 5.1 days ($p < 0.001$) for group IIA vs. IA; 4.8 ± 2.5 days vs. 5.5 ± 2.3 days ($p < 0.05$) for group IIB vs. IB.

After extraluminal cryostripping (group II), three patients (2.2%) sustained circumscript calf skin necroses, and hypertrophic scar formation was observed in 10 patients (7.4%). Deep infections of the groin wound necessitating intervention occurred twice in group I (1.2%) and once in group II (0.7%). There was one case of deep venous thrombosis in each group (0.6% and 0.7%). No case of neuropathy was observed.

Closing the inguinal incision by intradermal running suture and the mini-stab wounds with steristrips and band aids resulted in excellent cosmetic outcome in both groups. Scars were hardly visible after 6 weeks. Number and extent of postoperative hematomas were drastically reduced by routine limb exsanguination.

Surgical progress during the last decade was centered around reducing operative trauma, taking into consideration cosmetic and economic aspects as well. The term "minimally invasive surgery" was coined to summarize these efforts, which included surgery for varicose veins. In our opinion, microphlebectomy is one major step toward reducing operative trauma compared with the often inch-long incisions made to expose perforators with conventional techniques. Cryosurgery is, as our experience shows, a further means of minimizing invasiveness of venous surgery. By omission of several tedious operative steps, i.e. distal counterincision, GSV mobilization, division, and ligation, and attachment of the vein to the stripper, cryosurgery not only reduces the duration of surgery but also gives better cosmetic results. The use of extraluminal cryoextraction cannot be recommended in patients with thin, friable, or inflamed skin, as our complication rates demonstrate. To prevent these undesirable effects, exposure of a given spot to the cooled probe should not exceed 3 seconds.

In conclusion, we think that the combination of cryosurgery and microphlebectomy, for its ability to reduce operative trauma, thus improving cosmetic outcome and patient comfort, truly deserves to be titled "minimally invasive venous surgery."

Manner M, Koeth T, Geelhaar G, Stickel W. *Kryotechnik in der Varicenchirurgie: ein neues Konzept zur Reduktion des Operationstraumas. Chirurg 1999; 70: 79-84.*

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