INTRODUCTION

Various modes of surgeries are done for management of venous incompetence and leg ulcer. Technical details of these procedures in detail are beyond the scope of this article. Thus, methods of surgical procedures have been described in short to provide the readers some ideas on the same. Original studies, reviews, case reports, guidelines and recommendation have been reviewed.

Based on the available evidence of comparative advantages and disadvantages, recommendations on surgical management of venous incompetence and leg ulcer have been made.

DIFFERENT SURGERIES

Open venous surgery

Open surgery encompasses high ligation, division and stripping (HL/S) of the great saphenous vein (GSV) or short saphenous vein (SSV), combined with excision of segments of varicose veins if required. Open surgical procedure has been the gold standard surgical procedure for leg ulcer and venous incompetence. Although associated with hospitalization and many other surgical complications, this has given significantly good results in competent hands. Open surgical procedure has been the gold standard surgical procedure for leg ulcer and venous incompetence. Although associated with hospitalization and many other surgical complications, this has given significantly good results in competent hands. For some situations, open surgery is particularly useful like in the case of large dilated and tortuous saphenous vein located immediately under the skin or aneurysmal enlargement at the saphenofemoral junction or in case of thrombosed vein from past thrombophlebitis attack where the probe or channel for endovenous ablation cannot be inserted.

High ligation and division

High ligation and division of GSV below knee stripping prevented deep vein reflux significantly at 24 months follow-up.[1] In another randomized controlled trial (RCT) on 133 legs of 100 patients, only ligation was associated with much higher need of reoperation at 5 years (6% HL/S vs. 20%) in only HL group (P > 0.02).[2]

Phlebectomy

This is an additional treatment and not done regularly. Two common methods are:

- Ambulatory phlebectomy: The operation...
is done with tumescent anesthesia. Varicose veins are avulsed with hooks or forceps (stab or hook phlebectomy or miniphlebectomy)

- Powered phlebectomy: Hydrodissection of varicose vein is done with fibreoptic transillumination powered phlebectomy instrument. This is much faster and can remove the larger number of varicose veins.

Conservative surgical approach
These are more sophisticated procedure and needs special skill. Two techniques - Conservative ambulatory Hemodynamic management of VAricose vein (CHIVA) technique and Ablation Sélective des Varices sous Anesthésie Locale (ASVAL) technique are done. Ablation of incompetent portion of saphenous vein is done preserving all competent tributaries and saphenous trunk in CHIVA tributaries, and saphenous vein (even incompetent portion) is spared in ASVAL.

EVIDENCE AND RECOMMENDATION

- For the treatment of venous incompetence without ulcer (for simple varicosity; clinical-etiolo-gy-anatomy-pathophysiology [CEAP] Class 2): Surgery is recommended over compression therapy as it offers higher compliance, better symptom control and quality of life (QoL) improvement, higher cost effectiveness to simple compression therapy[3,4] (evidence Level A)
- For the treatment of venous incompetence with ulcer: (CEAP Class C3-C6 including leg ulcers: Surgery (HL/S and phlebectomy) offers no additional advantage over compression alone[5-7] (evidence Level A). Thus, compression (without surgery) is recommended for treatment of venous leg ulcer
- For the prevention of venous ulcer recurrence: Surgical management (HL/S and phlebectomy) along with compression offers definite advantage to reduce venous ulcer recurrence[6-8] (evidence Level A). Thus, HL/S and phlebectomy) along with compression is recommended for prevention of ulcer recurrence
- There is some advantage of powered phlebectomy over the conventional one like fewer incisions, less traumatic thus less potential complication and better learning curve. So powered phlebectomy is suggested. Newer generation instrument, if available should be used
- CHIVA and compression had no significant difference in ulcer healing rate. But CHIVA had significantly less recurrence rate than compression.[9] Evidence Level B. As this need expertise, conservative surgeries can be undertaken only in selected candidates for reducing recurrence of ulcer if facilities are available
- There is limited advantage of stripping along with HL (over HL alone). Evidence Level C. More numbers of RCT are required to assess the efficacy of ligation alone without stripping.

Endovenous ablation
Endovenous intervention to induce ablation of the incompetent vein has been introduced to reduce the complications associated with open surgical procedure. Endovenous ablation can be done with thermal or chemical (sclerotherapy) techniques.

Endovenous thermal ablation
Incompetent veins can be ablated without surgically opening the area. These are called endovenous thermal ablation and are performed with the laser, radiofrequency or superheated steam. These are new techniques, minimally invasive and have been increasingly used since the last decade. Ultrasonographically guided percutaneous catheter is placed inside the vein at required places. Thermal ablation damages the endothelium and denatures the collagen leading to fibrosis of the vein. Of late, radial emitting laser tip has been introduced. This requires lesser energy and thus has a lesser chance of side-effects.

Endovenous laser ablation
Hemoglobin specific laser wavelengths (810, 940, and 980 nm) and water specific laser wavelengths (1319, 1320, and 1470 nm) are used to destroy the incompetent veins. 1320-nm neodymium-doped yttrium aluminum garnet laser and 1470-nm diode laser gave good results with minimum side effects.[10,11] Endovenous laser ablation (EVLA) has the advantage of nil or minimum hospital stay, less pain and discomfort, early return to work, minimum surgical hazards thus lesser chance of adverse effects like bleeding or abrasion.

Short-term efficacy of EVLA in saphenous incompetence was assessed in many RCTs. Occlusion of the SSV after 3 months was achieved in 98-95.9% at 1 year.[12-14]

There is one Indian trial (uncontrolled, un-blinded) on 1470 mm laser which has a short follow-up period.[15] It showed venous occlusion rate and ulcer healing rate as 98.61% and 85%, respectively. Overall, studies on higher wavelength laser are scanty and RCT on this seems necessary to prove its efficacy.

Complication
Bruising is very common and is seen in most patients. Also seen are paresthesia, thrombophlebitis, skin burns in 0.46%, and thrombotic events with occasional pulmonary embolism and sural nerve paresthesia.

Endovenous radiofrequency ablation
Radiofrequency ablation (RFA) was approved by the US Food and Drug Administration (FDA) in 1999 for saphenous ablation.[16] This is a rapid and minimally invasive procedure. For RFA, ideal vein should have a diameter within 2-15 mm range.
There are chances of extension of thrombus into the femoral vein. The risk increases with larger vein diameter (>8 mm) and history of deep venous thrombosis (DVT).[17]

**Complication**

Use of local anesthetics in liver disorder should be carefully monitored. Coagulopathy, immobility, pregnancy and breastfeeding are considered as relative contraindications for thermal ablation procedures. Obstructed saphenous vein from a previous surgery or procedure or thrombophlebitis may restrict insertion of the probe in thermal ablation indicating necessity for open surgery.

**Sclerotherapy**

Injury to the endothelial cells and collagen tissue underneath leading to fibrosis and obliteration of vein lumen is a well-accepted modality of treatment of venous incompetence. Now foam sclerosants are used more frequently and give much better result than previously used liquid sclerosants. FDA approved sclerosing agents are glycerine (along with epinephrine), detergents as sodium tetradecyl sulfate (STS), polidocanol and sodium morrhuate.

**Liquid sclerotherapy**

This is primarily used for spider veins or telangiectasia (size ≤ 3 mm). The agent is injected with tuberculin syringes and 30- or 32-gauge needle. Larger varicose veins and proximal parts affected are treated first followed by the smaller ones and the distal parts. Extravasation causes severe pain and so care should be taken to prevent its occurrence. Magnification loupes and transillumination may help in better visualization during the procedure. Maximum 1.0 ml of the agent per site and maximum 10-20 injections per session is recommended.[16]

**Foam sclerotherapy**

This is one of the most effective and the least invasive among all endovenous ablation techniques with lower complication rates.[19,20] Solution of STS or polidocanol mixed with carbon dioxide (preferred) or air (max 20 ml), is injected, while the limb is elevated at 30° and kept in that position for 10-20 min. Intra-operative ultrasonography can monitor the movement of the foam. One RCT suggested follow-up with compression bandage for more than 24 h with thromboembolus-deterrent stockings for another 2 weeks.[21]

**Complications**

Common complications are dose dependent and include pigmentation, pain, allergy, and urticaria. Serious complications are rare and include thrombophlebitis, pulmonary emboli, stroke, skin necrosis, nerve damage (saphenous, sural), DVT, anaphylactic reaction, visual disturbances, migraine-like headache or confusion and even death.

**Results**

Average early improvement rate is 70% as reported in some prospective studies.[22] Long term success and a chance of relapse depend on the presence of axial reflux.

Liquid sclerotherapy performs poorly in the treatment of GSV incompetence where foam sclerotherapy appears much more efficacious and equally safe as found in a randomized controlled multicenter clinical trial.[23]

Recurrence rate was also significantly higher in the liquid sclerotherapy treated cases when compared to the foam therapy.

**Comparative analysis**

Endovenous laser ablation versus standard surgery (HL/S) (in saphenous incompetence, reflux and primary varicosity).

There are many RCTs on the short-term efficacy of EVLA and comparison with HL/S and ablation. There was a significant improvement in venous clinical severity score in both EVLA and standard surgery as found in one RCT. There was significantly less pain score and early recovery in EVLA.[24]

Less pain and earlier return to normal activity with EVLA (average 2 days vs. 7 days [P = 0.001]) was reported in other study.[25] However, some studies have reported more pain and restricted mobility after EVLA.[26] Postoperative hematomas[27] were found to be lesser with laser.

Other studies have reported no difference in short-term safety and efficacy or early QoL between EVLA using a wavelength of 980 nm and HL/S. However, EVLA was more expensive than open surgery.[28]

**Radiofrequency ablation versus surgery (high ligation, division, and stripping)**

One international, multicenter, prospective RCT on 85 patients compared RFA and HL/S and followed it up for 2 years. The RFA reported significant short-term (4 months) advantage in terms of earlier recovery, less postoperative pain, fewer adverse events, and superior QoL scores.[29] At 2 years, there was almost equal chance of reflux.[30]

Radiofrequency ablation was found to take less time to perform; 25 versus 40 min as reported by Hinchliffe et al.[31]

There was significantly lesser pain, faster recovery and earlier return to work after RFA than after surgery.[32]

On evaluating all the RCTs on this aspect, the venous Guideline Committee of The Society for Vascular Surgery and the American Venous Forum accepted the immediate advantage of RFA over HL/S but concluded that the RCTs were of low quality as these lacked bias protection measures. Thus, high
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quality RCTs is still required to assess the comparative efficacy of RFA over HL/S in superficial venous insufficiency and reflux. There is no evidence on long term effect of RFA.

Endovenous laser ablation versus radiofrequency ablation

Not many RCTs exist in this comparison. Single-center randomized trial on 50 patients with right left comparison-insignificant higher occlusion rate of saphenous vein in favor of RFA. Complication rate was similar. Another trial reported lesser perioperative pain after RFA. Clinical and QoL improvements were similar in both groups at 6 weeks. Recanalization rate at 1 year indicated laser ablation was significantly better than RFA.

Sclerotherapy versus surgery

Less recurrence was found in sclerotherapy in comparison to surgery in 1 year and 2 years in two large uncontrolled trials. Polidocanol foam sclerotherapy was found to be less efficacious in a RCT and a systematic review.

Sclerotherapy versus radiofrequency ablation versus surgery

In one meta-analysis on 64 studies, foam therapy and RFA were equally effective as surgery after 3 years. However, they reported EVLA had the highest success rate in short-term and long term.

Radiofrequency ablation versus endovenous laser ablation versus sclerotherapy

In a systematic review and meta-analysis of RFA, EVLA, and foam sclerotherapy for primary varicose veins. Luebke and Brunkwall found EVLA as superior in saphenous occlusion rate, phlebitis, DVT, and paresthesias. There was higher recurrence rate in the presence of saphenofemoral incompetence with foam sclerotherapy. No conclusive remarks were possible on a long term results.

EVIDENCE AND RECOMMENDATION

- Laser is safe, effective, less invasive, requires shorter hospital stay, causes less bleeding, bruising, and is possibly less painful in most of the cases
- Thus, they are recommended in saphenous incompetence, reflux and primary varicosity (evidence Level B)
- Lasers are preferred over HL/S for short-term benefit. For comparison of long-term benefit between EVLA and HL/S, more studies are required
- Comparative efficacy between EVLA and RFA is unknown due to lack of evidence. More RCTs are necessary
- Sclerotherapy is recommended for telangiectasia, reticular veins, and varicose veins (evidence Level B)
- Foam sclerotherapy is recommended over liquid sclerotherapy for incompetence
- As per the available evidence (evidence Level C), sclerotherapy cannot be recommended over standard surgery for saphenous vein incompetency, about success and prevention of relapse. More studies are required
- Due to gross heterogeneity in the study methods as well as in the results, a meaningful comparison of endovenous methods with open surgery was difficult especially about the long term efficacy and recurrence. EVLA may offer some advantage in short-term over RFA and surgery, but no recommendation can be made.

PERFORATOR INCOMPETENCE

Techniques for treating perforator incompetence are subfascial endoscopic perforator vein surgery, percutaneous ablation of perforators (PAPs), RFA and EVLA.

Subfascial endoscopic perforator vein surgery is done under general or epidural anesthesia. Deep posterior compartment is opened through division of the fascia and the perforators transected with ultrasonic harmonic scalpel. In PAPs, perforators are punctured under ultrasound guidance with local anesthesia.

Results

In an uncontrolled prospective cohort study with 810-nm diode laser, 78% occlusion of the perforating veins was achieved after 3 months of procedure.

EVIDENCE AND RECOMMENDATION

Ablation of incompetent perforator vein either alone or in addition to classical GSV ligation and stripping was not found to have any significant positive effect on ulcer healing or preventing recurrence as found in the review by O’Donnell. They suggested GSV ablation to reduce ulcer recurrence. More RCTs are required to evaluate the exact role of perforator ablation in ulcer healing.

Perforator ablation is currently not recommended for management of ulcer.

Skin grafting for venous ulcers

Whilst compression therapy treats the underlying pathology, ulcers remain open in some cases for months or years, or heal very slowly. Additional treatments such as skin grafts or tissue-engineered skin may be used to hasten the healing process.

Skin grafts used for venous leg ulcers are pinch grafts and split-thickness skin, or meshed grafts may also be performed on larger wounds. Grafting should be considered for large or refractory ulcers, when the venous hypertension is well-controlled and when the ulcer bed is clean with healthy granulation tissue. Despite the common use of skin grafts in venous leg ulcers, no valuable study is available to assess and quantify the effect of grafting on the healing of venous ulcers.
and to compare this strategy of treatment with other strategies, such as standard wound care.[40]

Skin grafting generally is not effective if there is persistent edema, which is common with venous insufficiency, and if the underlying venous disease is not addressed.

Other newer modalities of treatment

The efficacy of other emerging treatments such as topical recombinant growth factors or other products of tissue engineering is not sufficiently evident. Randomized controlled studies are lacking for many biological products.[46]

Apligraf™ is a living bi-layered bioengineered skin substitute, composed of a Type I collagen matrix. It was approved by the FDA in 1998 for the treatment of leg ulcers of >1-month duration that have not adequately responded to conventional therapy.

EVIDENCE

Used with compression, Apligraf™ heals venous leg ulcers more effectively than simple dressings and compression, from 49% of complete closure to 63% at 6 months.[46,47] (evidence Level D).

REFERENCES

1. MacKenzie RK, Allan PL, Ruckley CV, Bradbury AW. The effect of long saphenous vein stripping on deep venous reflow. Eur J Vasc Endovasc Surg 2004;28:104-7.
2. Dweryhouse S, Davies B, Harradine K, Earnshaw JJ. Stripping the long saphenous vein reduces the rate of reoperation for recurrent varicose veins: Five-year results of a randomized trial. J Vasc Surg 1999;29:589-92.
3. Michaels JA, Brazier JE, Campbell WB, MacIntyre JB, Palfreyman SJ, Ratcliffe J. Randomized clinical trial comparing surgery with conservative treatment for uncomplicated varicose veins. Br J Surg 2006;93:175-81.
4. Michaels JA, Campbell WB, Brazier JE, MacIntyre JB, Palfreyman SJ, Ratcliffe J, et al. Randomised clinical trial, observational study and assessment of cost-effectiveness of the treatment of varicose veins (REACTIV trial). Health Technol Assess 2006;10:1-196, iii.
5. Guest M, Smith JJ, Tripuraneni G, Howard A, Madden P, Greenhalgh RM, et al. Randomised clinical trial of varicose vein surgery with compression versus compression alone for the treatment of venous ulceration. Phlebology 2008;13:183-9
6. Gohel MS, Barwell JR, Taylor M, Chetter IC. Long term results of compression therapy alone versus compression plus surgery in chronic venous ulceration (ESCHAR): Randomised controlled trial. BMJ 2007;334:580-5.
7. Barwell JR, Davies CE, Deacon J, Harvey K, Minor J, Sassano A, et al. Comparison of surgery and compression with compression alone in chronic venous ulceration (ESCHAR study): Randomised controlled trial. Lancet 2004;363:1854-9.
8. Geerts WH, Bergqvist D, Pineo GF, Heit JA, Samama CM, Lassen MR, et al. Prevention of venous thromboembolism: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (8th Edition).
9. Zamboni P, Cisno C, Marschetti F, Mazza P, Fogato L, Carandina S, et al. Minimally invasive surgical management of primary venous ulcers vs compression treatment: A randomized controlled trial. Eur J Vasc Endovasc Surg 2003;26:337-8.
10. Proebstle TM, Moehlert T, G ill D, Herdeman M. Endovenous treatment of the great saphenous vein using a 1,320 nm Nd: YAG laser causes fewer side effects than using a 940 nm diode laser. Dermatol Surg 2005;31:1678-83.
11. Pannier F, Rabe E, Maurins U. First results with a new 1470-nm diode laser for endovenous ablation of incompetent saphenous veins. Phlebology 2009;24:26-30.
12. Min RJ, Khilnani N, Zimmet SE. Endovenous laser treatment of saphenous vein reflux: Long-term results. J Vasc Inter R Radiol 2003;14:991-6.
13. Huisman LC, Bruins RM, van den Berg M, Hissink R. Endovenous laser ablation of the small saphenous vein: Prospective analysis of 150 patients, a cohort study. Eur J Vasc Endovasc Surg 2009;38:199-202.
14. Knipp BS, Blackburn SA, Bloom JR, Fellows E, Laforge W, Pfleifer JF, et al. Endovenous laser ablation: Venous outcomes and thrombotic complications are independent of the presence of deep venous insufficiency. J Vasc Surg 2008;48:1538-45.
15. Rathod J, Taori K, Joshi M, Mudhada R, Rewatkar A, Dhovane M, et al. Outcomes using a 1470-nm laser for symptomatic varicose veins. J Vasc Inter R Radiol 2010;21:1835-40.
16. Gloviczki P, Gloviczki ML. Evidence on efficacy of treatments of venous ulcers and on prevention of ulcer recurrence. Perspect Vasc Surg Endovasc Ther 2009;21:259-68.
17. Lawrence PF, Chandra A, Wu M, Rigberg D, DeRubertis B, Gelabert H, et al. Classification of proximal endovenous closure levels and treatment algorithm. J Vasc Surg 2010;52:388-93.
18. Gloviczki P, Comerota AJ, Dalson MC, Ekho BG, Gillespie DL, Gloviczki ML, et al. The care of patients with varicose veins and associated chronic venous diseases: Clinical practice guidelines of the Society for Vascular Surgery and the American Venous Forum. J Vasc Surg 2011;53:S2-48S.
19. Breu FX, Guggenbichler S, Wollmann JC 2nd. European consensus meeting on foam sclerotherapy 2006, Tegernsee, Germany. Vasa 2008;37 Suppl 71:1-29.
20. Breu FX, Guggenbichler S. European consensus meeting on foam sclerotherapy, April, 4-6, 2003, Tegernsee, Germany. Dermatol Surg 2006;32:1130-6.
21. O’Hare JL, Stephens J, Parkin D, Earnshaw JJ. Randomized clinical trial of different bandage regimens after foam sclerotherapy for varicose veins. Br J Surg 2010;97:650-6.
22. Goldman MP. Treatment of varicose and telangiectatic leg veins: Double-blind prospective comparative trial between aethoxyskerol and sotradecol. Dermatol Surg 2002;28:52-5.
23. Rabe E, Otto J, Schliephake D, Pannier F. Efficacy and safety of great saphenous vein sclerotherapy using standardised polidocanol foam (ESAF): A randomised controlled multicentre clinical trial. Eur J Vasc Endovasc Surg 2008;35:238-45.
24. Carradice D, Mekako AI, Mazari FA, Samuel N, Hatfield J, Chetter IC. Randomized clinical trial of endovenous laser ablation compared with conventional surgery for great saphenous varicose veins. Br J Surg 2011;98:501-10.
25. Darwood RJ, Theivacumaru N, Dellagrammaticas D, Mavor AI, Gough MJ. Randomized clinical trial comparing endovenous laser ablation with surgery for the treatment of primary great saphenous varicose veins. Br J Surg 2008;95:294-304.
26. Pront K, Gauw SA, Mooij MC, Gaatstra MT, Lawson JA, van Goethem AR, et al. Randomised controlled trial comparing sapheno-femoral ligation and stripping of the great saphenous vein with endovenous laser
ablation (980 nm) using local tumescent anaesthesia: One year results. Eur J Vasc Endovasc Surg 2010;40:649-56.

27. Christenson JT, Gueddi S, Gemayel G, Bounaumeaux H. Prospective randomized trial comparing endovenous laser ablation and surgery for treatment of primary great saphenous varicose veins with a 2-year follow-up. J Vasc Surg 2010;52:1234-41.

28. Rasmussen LH, Bjoern L, Lawaetz M, Blemings A, Lawaetz B, Eklof B. Randomized trial comparing endovenous laser ablation of the great saphenous vein with high ligation and stripping in patients with varicose veins: Short-term results. J Vasc Surg 2007;46:308-15.

29. Lurie F, Creton D, Eklof B, Kabnick LS, Kistner RL, Pichot O, et al. Prospective randomized study of endovenous radiofrequency obliteration (closure procedure) versus ligation and stripping in a selected patient population (EVOlVeS Study). J Vasc Surg 2003;38:207-14.

30. Lurie F, Creton D, Eklof B, Kabnick LS, Kistner RL, Pichot O, et al. Prospective randomised study of endovenous radiofrequency obliteration (closure) versus ligation and vein stripping (EVOlVeS): Two-year follow-up. Eur J Vasc Endovasc Surg 2005;29:67-73.

31. Hinchliffe RJ, Ubhi J, Beech A, Ellison J, Braithwaite BD. A prospective randomised controlled trial of VNUS closure versus surgery for the treatment of recurrent long saphenous varicose veins. Eur J Vasc Endovasc Surg 2006;31:212-8.

32. Rautio T, Othinmaa A, Perälä J, Ohltonen P, Heikkinen T, Wiik H, et al. Endovenous obliteration versus conventional stripping operation in the treatment of primary varicose veins: A randomized controlled trial with comparison of the costs. J Vasc Surg 2002;35:958-65.

33. Morrison N. Saphenous ablation: What are the choices, laser or RF energy. Semin Vasc Surg 2005;18:15-8.

34. Shepherd AC, Gohel MS, Brown LC, Metcalfe MJ, Hamish M, Davies AH. Randomized clinical trial of VNUS ClosureFAST radiofrequency ablation versus laser for varicose veins. Br J Surg 2010;97:810-8.

35. Gale SS, Lee JN, Walsh ME, Wojnarowski DL, Comerota AJ. A randomized, controlled trial of endovenous thermal ablation using the 810-nm wavelength laser and the ClosurePLUSS radiofrequency ablation methods for superficial venous insufficiency of the great saphenous vein. J Vasc Surg 2010;52:645-50.

36. Kulkarni SR, Slim FJ, Emerson LG, Davies C, Bulbulia RA, Whyman MR, et al. Effect of foam sclerotherapy on healing and long-term recurrence in chronic venous leg ulcers. Phlebology 2013;28:140-6.

37. Pang KH, Bate GR, Darvall KA, Adam DJ, Bradbury AW. Healing and recurrence rates following ultrasound-guided foam sclerotherapy of superficial venous reflux in patients with chronic venous ulceration. Eur J Vasc Endovasc Surg 2010;40:790-5.

38. Wright D, Gobin JP, Bradbury AW, Coleridge-Smith P, Spoelstra H, Berridge D, et al. Varisolve® polidocanol microfoam compared with surgery or sclerotherapy in the management of varicose veins in the presence of trunk vein incompetence: European randomized controlled trial. Phlebology 2006;21:180-90.

39. Jia X, Mowatt G, Burr JM, Cassar K, Cook J, Fraser C. Systematic review of foam sclerotherapy for varicose veins. Br J Surg 2007;94:925-36.

40. van den Bos R, Arends L, Kockaert M, Neumann M, Nijsten T. Endovenous therapies of lower extremity varicosities: A meta-analysis. J Vasc Surg 2009;49:230-9.

41. Luetske T, Brunkwall J. Systematic review and meta-analysis of endovenous radiofrequency obliteration, endovenous laser therapy, and foam sclerotherapy for primary varicosis. J Cardiovasc Surg (Torino) 2008;49:213-33.

42. Hissink RJ, Bruins RM, Erkens R, Castellanos Nuijts ML, van den Berg M. Innovative treatments in chronic venous insufficiency: Endovenous laser ablation of perforating veins: A prospective short-term analysis of 58 cases. Eur J Vasc Endovasc Surg 2010;40:403-6.

43. O’Donnell TF Jr. The present status of surgery of the superficial venous system in the management of venous ulcer and the evidence for the role of perforator interruption. J Vasc Surg 2008;48:1044-52.

44. Fonder MA, Lazarus GS, Cowan DA, Aronson-Cook B, Kohli AR, Mamelak AJ. Treating the chronic wound: A practical approach to the care of nonhealing wounds and wound care dressings. J Am Acad Dermatol 2008;58:185-206.

45. Jones JE, Nelson EA. Skin grafting for venous leg ulcers. Cochrane Database Syst Rev 2007 Apr 18:CD001737.

46. Enoch S, Grey JE, Harding KG. ABC of wound healing. Recent advances and emerging treatments. Br Med J 2006;332:962-5.

47. Falanga V, Margolis D, Alvarez O, Auletta M, Maggiacomo F, Altman M, et al. Rapid healing of venous ulcers and lack of clinical rejection with an allogeneic cultured human skin equivalent. Human Skin Equivalent Investigators Group. Arch Dermatol 1998;134:293-300.

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