Taking Up Subfascial Endoscopic Perforator Surgery for Patients of Lower Limb Varicose Veins with Below Knee Perforators, in A Government Medical College—A Review of Eleven Cases

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Abstract Varicose veins are the most common manifestation of chronic venous insufficiency (CVI) worldwide. They interfere with the patients' daily activities and hamper their professional endeavors, and therefore need to be addressed at the earliest with the best tools. Eleven patients of varicose veins of the lower limb with below knee perforators underwent subfascial endoscopic perforator surgery (SEPS) from October 2010 to December 2011 in our institute. The procedure was successfully completed in all 11 patients. The mean operating time was 78 min (60–96 min). The results showed a favorable outcome for the patients in terms of faster recovery and less morbidity.

Keywords Communicating veins or perforators · Subfascial endoscopic perforator surgery

Introduction

Chronic venous insufficiency of the lower limb comprises varicosities of the great or short saphenous trunk or their tributaries and/or the communicating veins. The valves of the communicating veins or the perforators allow unilateral flow of blood from the superficial to the deep venous system.

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Failure of these valves leads to reflux of blood in the superficial system, aggravating its venous pressure. Various studies done worldwide have indicated that perforating veins are important in the causation of venous ulcers and that their division accelerates healing and may reduce recurrence of ulceration.

In the early 1940s, recognizing the importance of these perforators in the pathogenesis of venous ulcers, Linton advocated the open technique for ligation of perforators under direct vision. High incidence of postoperative wound healing complications led to disrepute of this procedure. Advent of subfascial endoscopic perforator surgery (SEPS) facilitated endoscopic subfascial exploration and interruption of perforator veins. It is proving to be an attractive alternative to the open procedure with comparable results, lower morbidity, and wound complications.

Patient and Methods

This study is a retrospective analysis of eleven patients who underwent SEPS during the period from October 2010 to September 2011. The CEAP (clinical sign, etiology, anatomical distribution, and pathophysiology) was used to select the patients. All the selected patients had a clinical sign score of $\geq 2S$ for their lower limb chronic venous insufficiency (CVI) (Fig. 1). An informed consent was taken from all the patients before subjecting them to this study. Involvement of the perforators and exclusion of deep vein thrombosis was done in all patients by a careful history taking and physical examination (Trendelenburg's and modified Perthes test were employed).

Color Doppler was used to correlate the clinical findings. Localization of perforators was done with a 7.5 MHz transducer, with the patient standing, making use of distal augmentation

Fig. 1 Pre-operative photograph of a patient of lower limb varicosity

and release technique, and patients performing Valsalva maneuver during the procedure. Abdominal ultrasonography done in 3 patients, with bilateral lower limb varicosities, revealed no obvious pathology.

SEPS was performed using a two-port technique (Fig. 2). The leg to be operated was exsanguinated with a tourniquet tied over the corresponding thigh. A 10 mm trocar was introduced into the subfascial plane under direct vision through a 1.5 cm incision made around 10 cm distal to the tibial tuberosity and 2 cm medial to the tibial crest. A laparoscopic camera was introduced first into this space, and a distal advancement along with a side-to-side movement was used for the initial dissection. CO₂ insufflation of the subfascial compartment to a pressure of about 20 mmHg was then used to dissect out this plane in medial calf up to just above the ankle. The second incision for a 5 mm port was made more posteriorly and distally, for the introduction of a harmonic scalpel. Dissection, identification, and division of all perforators, which stood out as strand on CO₂ insufflation of the subfascial space, were done using this harmonic scalpel (Fig. 3).

Clinical outcome was evaluated in terms of assessment of any perioperative complications, postoperative assessment of pain (depending on duration of analgesics used), ambulation

Fig. 3 Tackling perforators using Harmonic scalpel during the procedure

time, length of hospital stay, wound-related complications (e.g., bruises, infection, skin necrosis residual, or recurrent varicosities), ulcer healing time, and impact on the procedure on the preexisting skin changes (hyperpigmentation/eczema). The patients were followed up at 1, 3, and 5 weeks and then at monthly interval in the postoperative period (Fig. 4).

Results

A total number of 11 patients of lower limb varicosities including 8 male and 3 female patients were studied. Three of them harbored bilateral lower limb varicosities. The clinical presentations were of spontaneous bleeding from the dilated veins over the ankle in two patients. Dilated veins with hyperpigmentation of the leg were present in seven patients. Four patients presented with a venous ulcer over the gaiter area, three in active stage and one with a healed ulcer. Three of them had coexistent hyperpigmentation.

Most common perforators detected on clinical examination and color Doppler were below knee (Boyd) and ankle (Cockett). All patients had a concomitant saphenofemoral and two patients had a saphenopopliteal incompetence. None of the patients was found to have any deep venous occlusion. Abdominal ultrasonography in patients with bilateral disease revealed no apparent pathology.

Fig. 2 Intra-operative port-positions during SEPS

Fig. 4 Post-operative view following SEPS

All patients underwent SEPS with flush ligation of saphenofemoral or saphenopopliteal junction by a surgical team headed by the second author. SEPS was undertaken on all patients along with saphenofemoral flush ligation And saphenopopliteal flush ligation in two patients with corresponding incompetence. An interval of a week was kept between surgeries for the two limbs in patients with bilateral varicosities. One of the female patients with bilateral disease who underwent SEPS on both lower limbs, on two separate occasions, was hospitalized twice at 1-month interval.

The mean operating time was 78 min (60–96 min). Analgesics were required for an average of 2 days postoperatively. Ambulation was allowed at a mean of the third postoperative day, and all patients were discharged on the fourth or fifth days following SEPS. Exception to this result was a patient who required an additional 5 mm port placement (below the first

two ports, forming an isosceles triangle) for control of bleeding due to tear of a below knee (BK) perforator intraoperatively. He needed analgesics for 4 days postoperatively, could ambulate on day 5, and was discharged on day 7 following surgery. Another patient was seen to have a residual varicosity in the postoperative period which was managed with injectable sclerosant therapy. One patient developed a localized hematoma over the leg following the procedure, which resolved spontaneously. None developed skin necrosis.

Patients with dull ache and swelling of the affected leg had significant symptomatic improvement at the third week of follow-up. Complete ulcer healing was noted at the fifth week of follow-up in two of three patients presenting with active ulcers, while ulcer size decreased in one of them. No definite decrease in hyperpigmentation was perceived in the follow-up after surgery (Table 1).

Table 1 Clinical presentation, management, and follow-up details of the patients with perforator incompetence

S. No.	Age/ Sex	Presenting Features	Site of Incompetence on Color Doppler	Surgery Undertaken (SFJ flush ligation, stripping + BK-SEPS)	Complication	F/U Findings at 5 Weeks
1	50/M	B/L varicosities + bleeding—left leg varicosity	B/L SFJ and BK perforators—left	B/L; below knee SEPS only on left side	—	No further bleeding
2	39/M	Pain in the right leg + ulcer at lower medial leg	Right SFJ + SPJ and ankle perforators	Right side + right-sided SPJ flush ligation	A residual varicose vein in leg—inj. sclerotherapy given	Ulcer healed; pain ↓; no residual varicosity
3	34/M	Painful swelling left leg + hyperpigmented left ankle	Left SFJ + below knee and ankle perforators	Left side	—	Swelling and pain ↓, but no change in pigmentation
4	28/M	Bleeding from right ankle varicosity	Right SFJ + below knee perforators	Right side	Tear of a BK perforator intra-operatively—managed conservatively	No further bleeding
5	52/M	B/L varicosities + venous ulcer and hyperpigmentation of left inner ankle	B/L SFJ and below knee perforators	B/L	—	Ulcer healed; hyperpigmented skin persisted
6	43/M	Left leg varicosities, dull ache + hyperpigmented skin of lower leg	Left SFJ + left ankle perforators	Left side	—	No change in skin pigmentation; dull ache and swelling disappeared
7	46/F	Left leg varicosities, healed venous ulcer + hyperpigmented lower leg skin	Left SFJ + below knee and ankle perforators	Left side	—	No residual varicosities, no change in pigmentation
8	40/M	Right lower limb varicosities + dull ache and hyperpigmentation	Right SFJ + BK perforators	Right side	Localized hematoma, spontaneous resolution	No dull ache, no change in pigmentation
9	42/M	Right leg varicosities + nonhealing ulcer and hyperpigmentation	Right SFJ + SPJ and below knee perforators	Right side; right-sided SPJ flush ligation	—	Ulcer ↓ in size; hyperpigmentation improved
10	54/F	B/L lower limb varicosities + dull ache + leg hyperpigmentation	B/L SFJ + B/L below knee perforators	B/L; below knee SEPS (B/L); (two hospital admissions)	—	Dull ache ↓ but no change in pigmentation
11	38/F	Left leg varicosities, swelling, and dull ache	Left SFJ + below knee perforators	Left side	—	Swelling and ache improved

SFJ, saphenofemoral junction; SPJ, saphenopopliteal junction; B/L, bilateral

Discussion

Varicose veins are defined as dilated, tortuous, and elongated veins. They occur due to defect in the strength and characteristics of the venous wall. There is significant increase in the collagen content with significant reduction in the elastin contents of these veins [1]. They affect 5 % or more of adult population of western countries [2]. Reflux disease from venous valvular incompetence accounts for the majority (>80 %) of chronic venous diseases. Valve malfunction can be inherited or acquired through sclerosis or elongation of valve cusps or dilation of valve annulus despite normal valve cusps. Valvular disease below the knee appears to be more critical in the pathophysiology of severe disease than does valvular disease above the knee [3]. The perforator veins are frequently implicated when venous ulcers exist [3]. These veins connecting the deep with the superficial venous system may have valve failure.

Changes also occur at the cellular level. In the liposclerotic area extensive capillary permeability occurs. Transcapillary leak of osmotically active particles, mainly fibrinogen, occurs. The venous fibrinolytic activity is decreased in CVI, and extravascular fibrin prevents normal exchange of oxygen and nutrients in the surrounding cells [4]. In addition, leukocyte sequestration in the cutaneous microcirculation with increased production of leukocyte degranulation enzymes and oxygen-free radicals are important to the development of skin changes of CVI [5].

The CEAP classification is a recent scoring system that stratifies venous disease based on clinical presentation, etiology, anatomy, and pathophysiology. The Perthes test for deep venous occlusion and the Brodie-Trendelenburg test of axial reflux have been replaced by in-office use of the continuous-wave, hand-held Doppler instrument supplemented by Duplex evaluation [6]. In our patients color Doppler/Duplex scan using 7.5 MHz probe was utilized for detection of incompetent perforators.

Linton's open method of subfascial ligation of perforator veins, although has the advantage of identification of greater number of perforators, carries higher morbidity and wound complication rate. The mean hospital stay and the period of convalescence are more favorable with SEPS [7]. Hauer in Germany was among the first surgeons to use a mechanical system for endoscopic subfascial surgery and, to date, has the greatest experience with the procedure [8]. Later, Glovickzi, in the United States, employed CO₂ insufflation [9]. This technique generated renewed enthusiasm owing to its technical ease, and this was the technique used for all our patients. The procedure is associated with much less scarring and a faster recovery than the open method. The North American registry confirmed a low 2-year recurrence rate of venous ulcers and a more rapid ulcer healing with the laparoscopic

method of perforator interruption [10]. In a recent study using subfascial balloon dissection and interruption of incompetent perforating veins (usually in conjunction with great saphenous vein ligation and stripping), 92 % of patients exhibited significant improvement of venous stasis ulcers within 4–14 weeks [11]. Although balloon dissection has been classically used for subfascial dissection in SEPS, in our patients the subfascial space was opened up using CO₂ insufflation to a pressure of 20 mmHg and dissection using the laparoscopic camera. This reflects the presence of a loose connective tissue in this potential space between the fascia cruris and the underlying flexor muscles.

Conclusion

Patients of chronic venous insufficiency must be carefully evaluated clinically and through Duplex scan in order to precisely detect any deep, superficial, and perforator incompetence. Perforator incompetence has been specifically linked to the genesis of venous ulcer, so their proper management is crucial. Endoscopic approach to perforator surgery is a fast-evolving surgical alternative to the open perforator interruption technique in patients of chronic venous insufficiency. The technique of subfascial dissection using CO₂ insufflation and laparoscopic camera dissection which was employed in our patients is less technically demanding than a spacemaker balloon dissector required for the same purpose. The former technique may prove to be helpful in government hospital setups which cater to the major chunk of these patients and usually lack the availability of a balloon dissector.

Conflict of Interest The authors do not have any disclosable interest.

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