

Subfascial endoscopic perforator surgery (SEPS) in chronic venous insufficiency. A 14 years experience

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SUMMARY: Subfascial endoscopic perforator surgery (SEPS) in chronic venous insufficiency. A 14 years experience.

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Introduction. *Subfascial Endoscopic Perforator Surgery (SEPS) enables the direct visualization and section of perforating veins. Morbidity and duration of hospitalization are both less than with conventional open surgery (Linton's or Felder's techniques).*

Patients and methods. *A total of 322 legs from 285 patients with a mean age of 56 years (range 23-90) were treated at our Department from May 1996 to January 2010. In 309 cases, an endoscope (ETM Endoskopische Technik GmbH, Berlin, Germany) was introduced through a transverse incision approximately 1.5 cm in length and 10 cm from the tibial tuberosity, as with Linton's technique. A spacemaker balloon dissector for SEPS, involving a second incision 6 cm from the first, was used in only 13 cases.*

Results. *The procedure used in each case was decided on the basis of preoperative evaluation. SEPS and stripping were performed in 238 limbs (73.91%), SEPS and short stripping in 7 limbs (2.17%), SEPS and crosssection in 51 limbs (15.84%), and SEPS alone in 26 limbs (8.07%). 103 patients presented a total of 158 trophic ulcers; the healing time was between 1 and 3 months, with a healing rate of 82.91% after 1 month and 98.73% after 3 months.*

Conclusion. *Subfascial ligature of perforating veins is superior to sclerotherapy and minimally invasive supra fascial treatment for the treatment of CVI. It is easy to execute, minimally invasive and has few complications.*

RIASSUNTO: Chirurgia endoscopica sottofasciale delle perforanti (SEPS) nell' insufficienza venosa cronica. Quattordici anni di esperienza.

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Introduzione. *La chirurgia endoscopica sottofasciale delle perforanti (SEPS) nel trattamento dell'insufficienza venosa cronica (IVC) consente la visualizzazione diretta e la sezione delle vene perforanti comportando minore morbilità e tempi di degenza inferiori rispetto al trattamento chirurgico convenzionale a cielo aperto (interventi di Linton, di Felder).*

Pazienti e metodi. *I pazienti trattati nel Dipartimento di Scienze Chirurgiche sono stati 285, da maggio 1996 a gennaio 2010, di età media di 56 anni (range 23-90), per un totale di 322 arti. Nel trattamento di 309 arti inferiori ci siamo avvalsi dell'utilizzo di endoscopio (ETM Endoskopische, Tachnik GmbH, Berlin, Germany), introdotto tramite incisione orizzontale di 1,5 cm di lunghezza a 10 cm dalla tuberosità tibiale lungo la linea di Linton. Nel primo periodo, in 13 pazienti, è stato utilizzato lo spacemaker balloon dissector, che prevede una seconda incisione di 6 cm distalmente alla prima.*

Risultati. *Sulla base dello studio preoperatorio sono stati effettuati 4 tipi di interventi: SEPS e stripping in 238 arti (73,91%), SEPS e stripping corto in 7 arti (2,17%), SEPS e crosssection in 51 arti (15,84%), unicamente SEPS in 26 arti (8,07%). Ben 158 lesioni ulcerative sono guarite in un periodo di tempo variabile tra 1 e 3 mesi con un tasso di guarigione complessivo del 98,73%; il tasso di guarigione ad un mese è stato dell' 82,91%.*

Conclusione. *La legatura sottofasciale delle perforanti è il metodo più efficace nel trattamento dell'IVC rispetto ad altre tecniche, quali la scleroterapia e il trattamento mini-invasivo sovrasciale. La SEPS è di semplice esecuzione, anch'essa mini-invasiva ed è gravata da un esiguo numero di complicanze.*

KEY WORDS: SEPS - Subfascial endoscopic perforator surgery - Ulcer - Chronic venous insufficiency - Varices.
Chirurgia endoscopica sottofasciale delle perforanti - Ulcere - Insufficienza venosa cronica - Varici.

Introduction

Chronic venous insufficiency (CVI) may be congenital or dysplastic (present since birth), primary (from unknown causes) or secondary (post-thrombotic, post-traumatic, etc.). It can affect the venous supra fascial (superficial), trans fascial (perforating veins) and subfascial

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(deep) circulation. Stasis has a key role in all forms of CVI and causes changes to the vasomotor reflexes liberating vasoactive amines, the increase and activation of leucocytes, impaired regulation of microcirculatory exchange (venule-capillary and lymphatic) and liberation of lysosomal enzymes, damaging the interstice and causing tissue fibrosis.

Subfascial endoscopic perforator surgery (SEPS) enables the direct visualization and section of perforating veins. Morbidity and duration of hospitalization are both less than with conventional open surgery (Linton's or Felder's techniques) (1-7). Video-assisted SEPS is thus, in our opinion, the best method for the treatment of perforating vein incompetence in chronic venous insufficiency.

CVI is an important clinical condition with considerable epidemiological implications and socioeconomic repercussions. The prevalence of venous insufficiency in American adults is approximately 27% and more than 6 million people in the United States have CVI, with treatment costs of up to \$2.5 billion and 2 million lost working days every year (8). The economic and social impact with respect to diagnosis, treatment, lost working days and quality of life is also significant in Europe.

The incidence of IVC is 0.5-3%, and 1.5% of European adults suffering varicose ulcers. The incidence is higher (3%) in Sweden. The prevalence of CVI of the lower limbs is currently 10-50% in men and 50-55% in women. Clinically manifested varicose disease is found in 10-33% of women and 10-20% of men, while the annual incidence of venous varices is 2.6% in women and 1.9% in men. The correlation between prevalence of varices and age is nearly linear: 7-35% of men and 20-60% of women aged 35 to 40 years; and 15-55% of men and 40-78% of women over 60.

Venous insufficiency and varices are uncommon in children and adolescents. However, children with a family history of varices may develop venous ectasia or incompetence in adolescence (9). Chronic venous insufficiency and related ulcerative disorders thus have a remarkable reach and social impact.

Patients and methods

A total of 285 patients with a mean age of 56 years (range 23-90) were treated at the Department of Surgical Sciences of "Sapienza" University (Rome, Italy), from May 1996 to January 2010, for a total of 322 limbs. In the first period (from 1996 to 2000), the operating surgeon was G. Battisti (10) in the treatment of 130 patients and 150 limbs. The procedure is carried out as follows.

The patient is asked to lie in the supine position for preoperative mapping. Where saphenectomy is indicated, SEPS is the last procedure before stripping.

An approximately 2-3 cm longitudinal cutaneous incision is made in the medial surface of the leg proximal to the trophic ulcer, as with Linton's technique. The subcutaneous adipose tissue is dissected, and

the muscle fascia isolated and incised in the same direction as the skin. A small area of fascia is gently separated from the underlying muscle to enable the introduction of an (*ETM Endoskopische Technik GmbH, Berlin, Germany*) endoscope (HAUER) (11). This instrument is 183.3 mm long with a working length of 170 mm. Its work channel is 7.5 x 13 mm and can be connected to an external aspirator. It has a 30 mm diameter lens and a 30° quadrangular objective, and can be connected with all instruments used in laparoscopic surgery. The endoscope is advanced by observing the maneuver on the monitor. The distal branch of the perforating vein is located and sectioned or treated by electrocoagulation. The source can be clipped upstream for safety. Many surgeons avoid suturing fascia and subcutaneous layers to prevent liponecrosis. After suturing, a compression bandage is applied. The patient can be discharged with a compression bandage the day after surgery (10, 12).

Patients with a CEAP (Clinical-Etiology-Anatomy-Pathophysiology) CVI score of C3-C6 (Fig. 1) had a clinical mean preoperative score of 6.66 (range 2-16) and an invalidity score of 1.6 (range 1-3); 103 patients presented a total of 158 trophic ulcers (Fig. 2). Of these, 14 had a mixed pathogenesis (Figs. 3,4). Ulcer diameter varied from 1 cm to 15 cm (mean 3.66 cm). Their duration varied from 30 days to 17 years, with persistent ulcers often difficult to treat. Echo-color-Doppler was used for preoperative diagnosis of the number and location of the incompetent perforating veins.

Surgery was carried out under peripheral anesthesia (epidural or spinal) in 270 patients. In the remaining 15 patients, general anesthesia was preferred by the patient or necessary for anesthesiological reasons. In 309 cases, the patient was placed in a supine position with the leg rotated externally and an endoscope with a 5° lens (*ETM Endoskopische Technik GmbH, Berlin, Germany*) was introduced through a transverse incision approximately 1.5 cm in length and 10 cm from the tibial tuberosity, as with Linton's technique. A space-maker balloon dissector for SEPS, involving a second incision 6 cm from the first, was used in only 13 cases, during the first period.

Clinical classification (Class 0-6)
C0: no visible or palpable signs of venous disease
C1: teleangiectasia or reticular veins
C2: varicose veins
C3: edema without skin changes
C4: skin changes due to venous disease: pigmentation, eczema, lipodermatosclerosis
C5: as C4 with healed ulceration
C6: as C4 with active ulceration

Fig. 1 - CEAP classification of venous disease.



Fig. 2 - Ulcerative lesions with hypodermatitis.

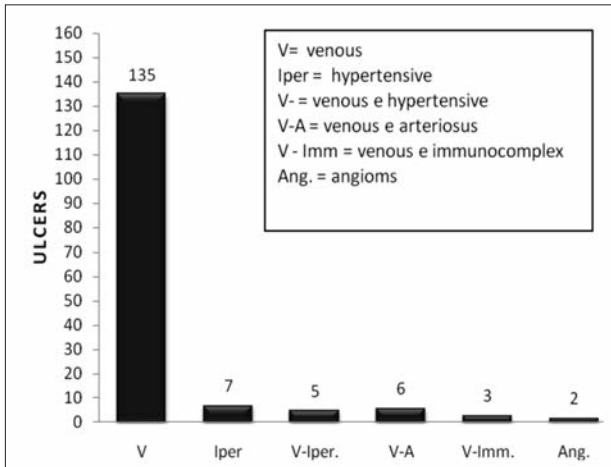


Fig. 3 - Etiologic classification of leg ulcers.

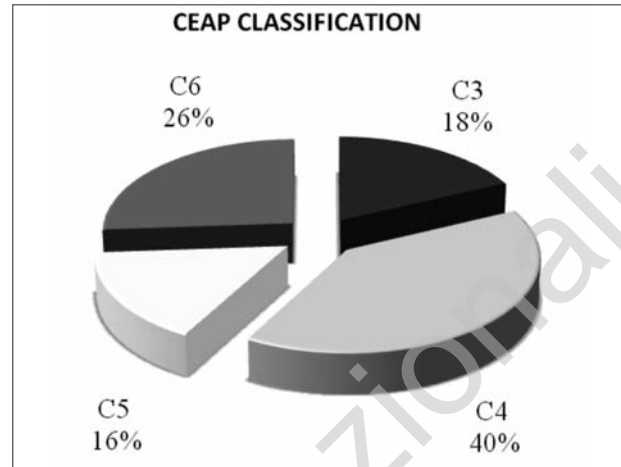


Fig. 5 - Subdivision of patients in CEAP risk classes.

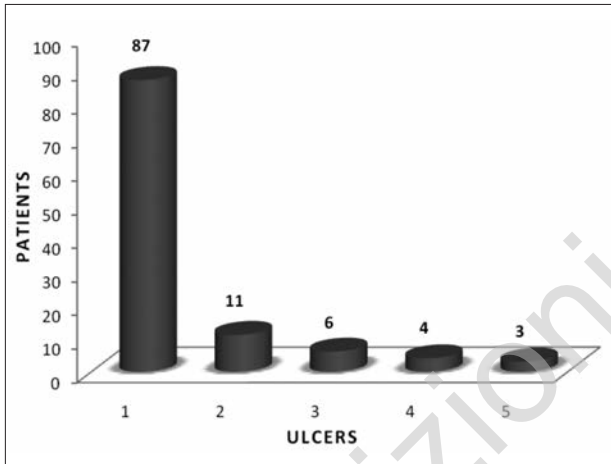


Fig. 4 - Number of leg ulcers per patient.

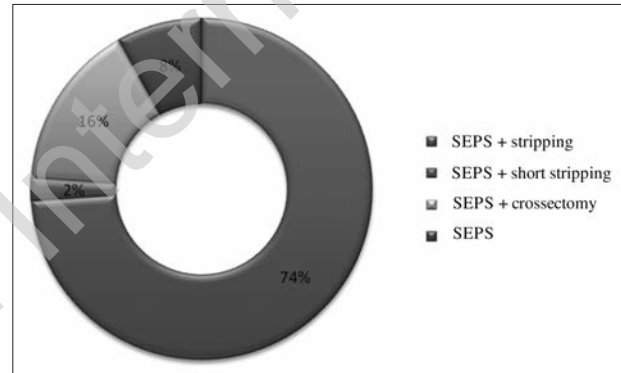


Fig. 6 - Types of surgery performed.

Results

All legs underwent CEAP classification. Surgery was performed on those scored as C3-C6, breaking down as follows: C3: 58 legs (18%); C4: 129 (40%); C5: 51 (16%); C6: 84 (26%) (Fig. 5). The procedure used in each case was decided on the basis of preoperative evaluation. SEPS and stripping were performed in 238 limbs (74%), SEPS and short stripping in 7 limbs (2%), SEPS and crosssectomy in 51 limbs (16%), and SEPS only in 26 limbs (8%). (Fig. 6). The mean duration of surgery was 30 minutes, with a maximum of 120 minutes when first learning the technique.

There were 736 perforating veins in all, located as follows: Cockett II, 311 (42%); Cockett III, 307 (42%); paratibial, 74 (10%); and several locations, 44 (6%) (Fig. 7). A mean of 2.28 veins was treated per leg (range 1-5).

Fasciotomy was necessary for the treatment of para-

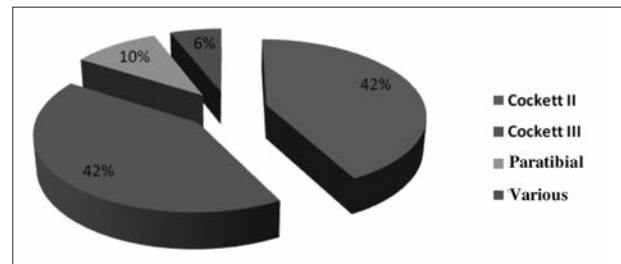


Fig. 7 - Perforating vein interruption by endoscopic section.

tibial and short perforating veins where double clipping was not possible. This technique also reduces pressure in deep veins in the calf, reducing the risk of compartment syndrome (13). The Cockett I perforating vein was dissected in just 11 cases (1.49%): generally, it was either not present or not incompetent, or there was insufficient space available due to insufficient regional extension, given its location between the rigid structures of the tibial malleoli and the medial margin of Achilles tendon. Attempts are being made to try to avoid this problem with

use of a flexible trocar (14, 15). A compression bandage was applied after surgery.

The mean duration of hospitalization was 3.7 days in the first period (May 1996 - December 2000) (10) and 1.07 days in the second (January 2001 - January 2010). The follow-up (1-36 months) demonstrated a marked improvement in the clinical score (Fig. 8) and a decrease in the invalidity score (Fig. 9); the latter tended to increase at the 30-month follow-up due to recurrent ulcers in 7 patients with C1 insufficiency or newly incompetent paratibial perforating vein.

Post-surgery, the 158 ulcers healed in between 1 and 3 months. The healing rate at 1 month was 83% (131 ulcers) and at 2 months 94% (an additional 21 ulcers: 10 in 45 days and 11 in 60 days). By 3 months, a further 7 ulcers had healed and 2 mixed type ulcers (a hypertensive venous component and an immune-complex venous component) were considerably reduced in diameter, without completely healing. The total healing rate at 3 months was thus 98.73%.

There were no relapses 24 months after surgery, 7 relapses after 36 months, 5 after 48 months and another 6 after 60 months. Like Gloviczki (16), we believe these patients may have suffered further incompetence of the paratibial or Cockett I vein, in which case a further SEPS is indicated (17).

In the first period (1996-2000) 24 patients could not be discharged the day after surgery: 7 due to dehiscence of the inguinal surgical wound, 7 due to post-operative hyperthermia, 5 due to hematoma in the inguinal region, and 5 due to concomitant conditions and need for further investigations. In the second period (2000-2010), 8 patients with concomitant diseases were discharged on postoperative day 2: of these, 3 had diabetes, 3 had hypertensive cardiopathy, and 2 had suffered post-epidural headache. Only 1 patient, suffering intense post-epidural headache and hyperthermia, was discharged 3 days after surgery.

Patients returned for removal of the compression bandage and sutures on postoperative day 7. All patients underwent follow-up after 30, 60, 90, and 180 days and 1, 3, 4, and 5 years. There were no complications involving bleeding. There were 2 single cases of lymphorrhea at the 3rd distal of the leg, reabsorbed after 15 days; 3 cases of lymphorrhea in the inguinal region; and 1 case of postoperative thrombophlebitis. 4 patients underwent re-SEPS 4 years later, due to the presence of incompetent perforating veins that had not been identified during the original procedure.

Discussion

Subfascial ligation of perforating veins is superior to sclerotherapy and minimally invasive suprafascial treat-

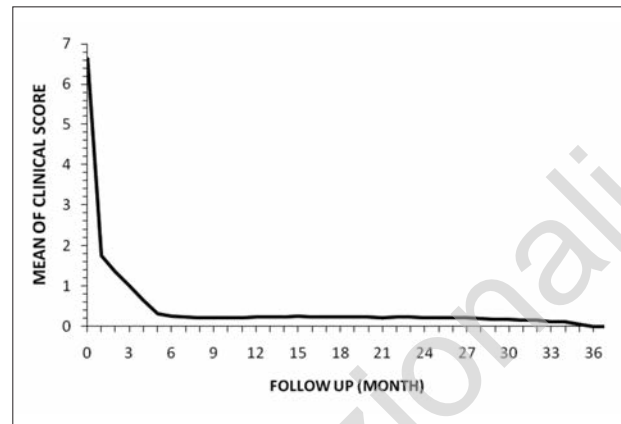


Fig. 8 - Improvement of clinical score during follow-up.

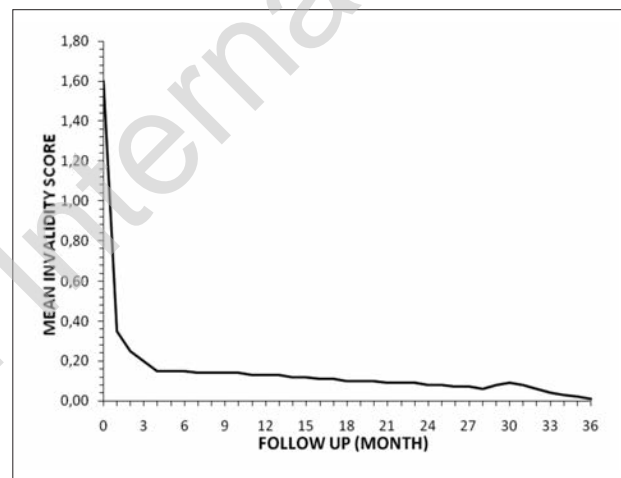


Fig. 9 - Variation of invalidity score after SEPS.

ment for the treatment of CVI, as perforating vein insufficiency is nearly always involved in the pathogenesis of venous ulcers. The 60% efficacy offered by sclerotherapy is comparatively low, as recanalization due to high pressure regimens is too common (18-22). In contrast, while minimally-invasive suprafascial treatment gives a good esthetic result, it does not permit the complete ligation of subfascial veins (22), especially where there are multiple branches.

In our study of 736 perforating veins dissected by SEPS, 699 were identified with preoperative echo-color-Doppler examination. The remaining 37 were also ligated and dissected for preventive purposes. In our opinion, there is no contraindication to peripheral circulation surgery in association with SEPS. We resorted to crosssection in cases with documented ostial valve insufficiency, to stripping in cases of long reflux and absence of perimalleolar dermohypodermatitis and to short proximal stripping in cases of perimalleolar dermohypodermatitis (23-29).

Conclusions

CVI is undoubtedly exacerbated by perforating vein incompetence. In comparison with Linton's or Felder's techniques, endoscopic treatment enables a targeted, simple and effective ligation through a small incision in an area away from the area of lipodermatosclerosis. It also enables the ligation of all incompetent perforating veins, including those not visible with echo color Doppler, as well as enabling paratibial fasciotomy (30). This method is easy to perform, minimally invasive, and has few complications. Moreover, it can be carried out in patients with respiratory and cardiovascular impairment. Drawbacks include technical problems, cost of the equipment and the risk of deep vein thrombosis. In addition, according to Gloviczki et al., the clinical and hemodynamic improvements attributable to SEPS are difficult to assess (31). There is also the risk that perforating veins near the tibial crest are not noticed, or that any adhesions secondary to ulcerative processes or to lipodermatosclerosis prevent the instrument's easy passage.

Literature reports of post-operative complications are as follows: delayed healing 0-11% (14, 32); sural nerve paraesthesia 1.9-3% (14, 15); and tibial nerve paraesthesia 1% (33). Other possible complications include two cases of deep vein thrombosis of the popliteal vein, one of intraoperative bleeding and one of liponecrosis (26). Two cases of arterial and posterior tibial nerve lesions have also been reported, each due to flow changes after deep fascia incision for paratibial perforator ligation (34), and two cases of pulmonary embolism in thrombophilic patients.

Gloviczki reports a relapse rate of 70% in the first three years in patients with post-thrombotic syndrome, due to incompetence or failure to ligate perforating veins. Nelson reports relapse rates of 8% at three and 18% at five years (35). In contrast, our relapse rate was just 5.6% after 60 months. In the final analysis, by enabling the subfascial interruption of perforating veins and combining a minimally invasive technique with conventional surgical procedures for the superficial venous circulation (36), SEPS is, in our opinion, a highly effective treatment for CVI.

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