

Recurrent residual or progressive varicose veins: postoperative long term follow-up of 353 patients



Ann. Ital. Chir., 2017 88, 6: 526-533
pii: S0003469X17027671

Juliana Anna Ebner*, Anna Ebner*, Maurizio Taurino**, Stefan Morandell*, Markus Falk***, Carlo Stringari*, Charalampos Dellis*, Heinrich Ebner^o

*Department of Vascular and Thoracic Surgery, Central Hospital, Bozen, Italy

**Vascular Surgery University, La Sapienza, Ospedale Sant'Andrea, Rome, Italy

***Inovaq J. Bruneck, Italy

^oSouth Tyrolian Society for Vascular and Thoracic Diseases, Bozen, Italy (SVGTCHIR.it)

Recurrent residual or progressive varicose veins: postoperative long term follow-up of 353 patients

AIM: This study aimed to evaluate the postoperative incidence of recurrent varicose veins (vv) and the possibility to differentiate the different types of recurrence.

MATERIAL OF STUDY: Patients who underwent surgery for saphenofemoral junction (SFJ) incompetence, great saphenous vein (GSV) varicosity and at least one perforator incompetence and varicosity of tributaries between January 1998 and December 2003 were selected for the study. Surgery consisted in SFJ flush ligation, GSV stripping, perforator vein ligation, and phlebectomies. Patients were assessed by detailed interview, clinical examination, and color duplex imaging after 10 years. The differentiation in recurrent, residual and progressive vv was done by comparison of the pre-and intra-operative and the phlebographic documentation in particular with the findings on follow-up.

RESULTS: 353 patients (400 legs) were analyzed at 120 ± 21 months. At follow up the vv were classified as recurrent in 23,75%, residual in 23,25%, and progressive in 21% of cases. Nine patients (1.9%) were reoperated after 70 ± 33 months, and 17 (3.5%) underwent sclerotherapy during follow-up.

CONCLUSIONS: Recurrent, residual, and progressive vv can be clearly differentiated with the presented methodology. The authors suggest a revised definition (NEVVAS- new vv after surgery) because the term recurrent and the known acronyms do not embrace exactly the three types of vv after surgery. Since residual and many recurrent vv are due to avoidable technical or tactical errors, it is important to classify them properly in order to avoid these complications.

KEY WORDS: Neovarices, NEVVAS (New Varicose Veins After Surgery), Neovascularization, Recurrent varicose veins, Residual varicose veins, Progressive varicose veins

Introduction

The incidence of recurrent varicose veins (vv) is reported to be 6–80%¹⁻⁷. This extremely wide range results from many factors, such as different definitions of recur-

rent vv, time to recurrence, interval of follow-up, diagnostic methods, methods for detection, and surgical techniques^{3,5,8-12}.

A further issue is the lack of consensus on the definitions of recurrence, preoperative assessment, treatment, classification, methods, and duration of follow-up^{1,4,7,12}. The term "recurrence" includes different types of vv after surgery: recurrent veins, residual veins and those due to disease progression^{4,14}. However, since surgical recurrence clearly denotes the reappearance of the same disease on the operated site after surgery, and is pathologically and etiologically not the same as a residual or a

Pervenuto in Redazione Luglio 2017. Accettato per la pubblicazione Settembre 2017.

Correspondence to: Prof. Heinrich Ebner, Silberleitenweg 38, 39018 Terlan, Italy (e-mail: heinrichebner21@gmail.com)

progressive vv it is necessary to differentiate these entities.

The aim of this study with prospectively collected data was to evaluate the postoperative incidence of real recurrent vv and the possibility to differentiate between the different types of recurrence at a long follow-up period.

Materials and Methods

All patients who underwent surgery for primary vv between January 1998 and December 2003 in our department were assessed by preoperative clinical protocol, ultrasound, and phlebography. Of these, only patients with saphenofemoral junction (SFJ) incompetence, important great saphenous vein (GSV) varicosity, and at least one perforator incompetence and varicosity of collaterals who underwent this extensive surgery were selected for long term follow-up of at least 10 years. Patients with competent perforators and with post-thrombotic limbs were excluded. Participants provided written informed consent. The study is approved by the ethics committee of the medical service of South Tyrol, Bolzano Italy (approval no. 40/2015).

PRE-OPERATIVE DATA

Pre-operative information was documented in a detailed protocol concentrated on physical examination and clinical history focused on chronic venous incompetence. Clinical presentation and varicose vein extension, SFJ incompetence, venous ulcers, and incompetent perforators were plotted graphically. Venous insufficiency was classified according the CEAP classification. Additionally, we investigated the use of postoperative sclerotherapy or operative procedures. Almost all patients (97.5%) underwent phlebography for the study purposes, and 100% underwent color duplex imaging for preoperative operation planning only. The duplex findings were therefore not regularly documented. The varicose veins and the escape points found were signed on the leg the day before intervention.

Preoperative ascending phlebography was performed according to the technique of Hach. This permits a static and hemodynamic evaluation of the superficial and deep venous system also under a Valsalva test and compression manoeuvres. This iconographic documentation represents the basis of the study allowing a comparison of the preoperative findings with those at follow-up. It permits to draw well founded conclusions on the cause of the different types of recurrence.

Intra- and post-operative data

In a detailed operative protocol, in addition to general patient data, we reported local intraoperative findings,

data on the procedure on the saphenofemoral junction, extension of stripping, intervention on the small saphenous vein (SSV), number of varicose collaterals, and the site and method (direct or subcutaneous dissection) of perforating vein preparation. Postoperative complications were also collected.

SURGICAL TECHNIQUE

All patients were operated by flush-ligation of the SFJ and their collaterals, partial or total stripping of the GSV and SSV, epifascial ligation of at least one incompetent perforating vein, and phlebectomies according to Mueller's technique.

Surgery was performed under general or peridural anesthesia. Antithrombotic prophylaxis included subcutaneous sodic heparin 5000 IU three times a day for seven days. The extremities were bandaged for two weeks postoperatively and then compressed by grade II calf stockings for ≥ 6 months.

FOLLOW-UP

We assessed patients by detailed interview, clinical examination, and color duplex imaging at a long-term follow-up (9-12 years). Detailed history of onset and localization of complaints and varicose veins, clinical examination, and echocolordoppler findings (in relation to the site and scars of the previous intervention) were recorded. Vv distant from the surgical sites were investigated separately in order to verify or deny a possible hemodynamic association with the operated site. All assessments were done by physicians not involved in the previous surgery.

All examined limbs were classified according to the CEAP classification. Color duplex imaging was used to examine the entire venous system of the lower limb with an 8-MHz linear array transducer in the standing and supine positions; Valsalva maneuver in the groin and manual compression with sudden release distal to the venous segment under examination were used to assess the presence of reflux. Retrograde flow on Doppler recordings >0.5 s was considered reflux. Tortuous veins with a diameter >3 mm were defined as varicose veins. Groin neovascularization was classified according to the classification of Fischer⁸. All data were collected and plotted on a pre-assigned protocol in the event of postoperative varicose veins.

DEFINITION OF RECURRENT VARICOSE VEINS

Only those vv detected in previously operated areas were considered recurrent (surgical definition of recurrence). Instead of the general term of recurrent veins after

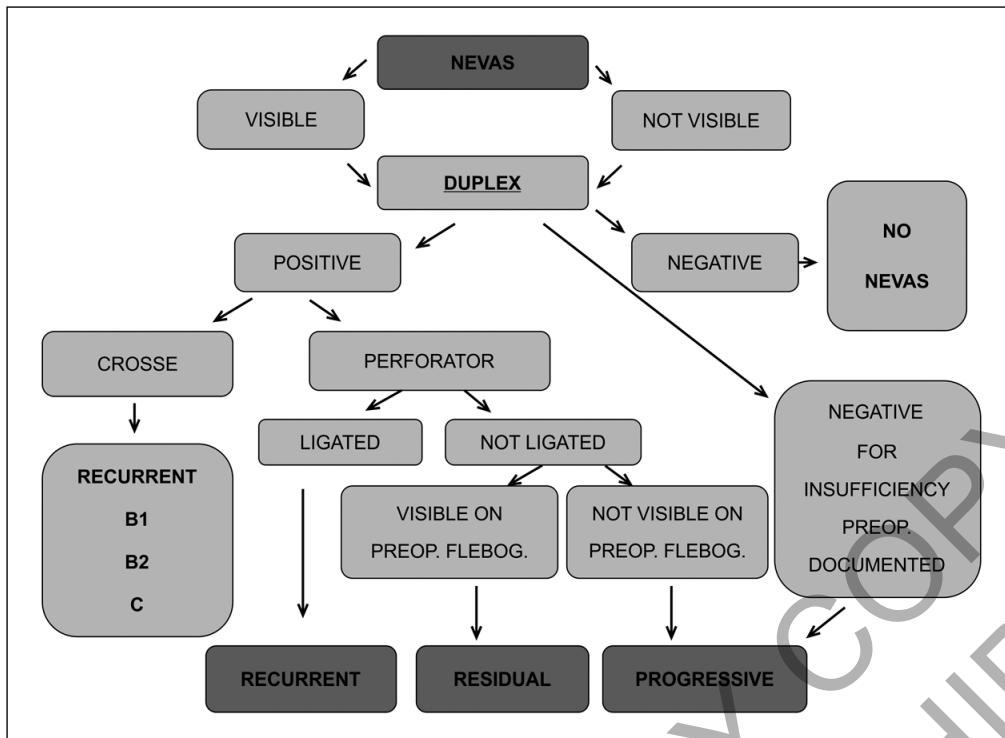


Fig. 1: Flowchart for NEVVAS (New Varicose Veins After Surgery) classification according to pre- and postoperative clinical findings, pre-operative phlebographic documentation of points of incompetence, op-record and duplex-ultrasonographic findings and data at follow-up.

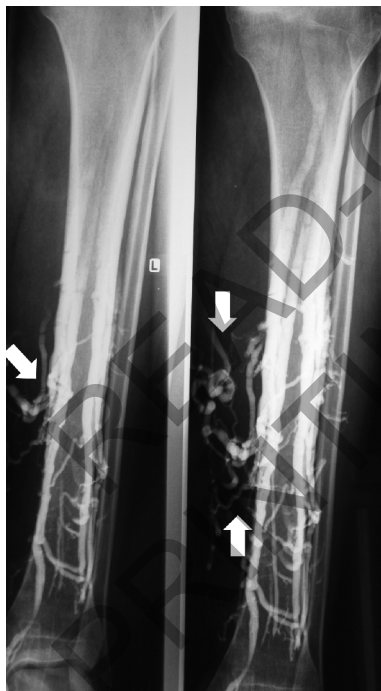


Fig. 2: An insufficient Cockett II – perforating vein in an early phase of ascending press-phlebography on the left (one arrow) and in a later phase (right) with clear filling of superficial dependent varicose veins (two arrows). In this case, only the superficial veins were extracted; an epifascial ligature was not performed. Sixty-five months later, the patient complained of a reappearance of varicose veins; at follow-up an insufficient perforator in position Cockett II was found on ultrasound. Since the perforator was not ligated at the first intervention, even if present and clearly insufficient, this was defined as a residual varicose vein. In case of a previous ligature it would be classified as a recurrent varicose vein.

surgery (REVAS)⁷, used in the literature for all types of new vv after surgery, we adopted the term new varicose veins after surgery (NEVVAS). These are classified as (Fig. 1):

- a) recurrent: vv in the operated areas, not present immediately (>6 first 6 weeks) after surgery, documented both clinically and/or by color duplex scanning. This term also includes vv distant from the operated areas but in hemodynamic dependence on insufficiencies in operated areas.
- b) residual: vv in the operated areas immediately (<6 weeks) after surgery or present preoperatively (clinically or phlebographically) but not operated on.
- c) progressive: due to progression of chronic venous insufficiency, developed later (>6 months) in new, not operated sites, and not hemodynamically connected with previously operated sites.

ASSESSMENT

We differentiated in our clinical series residual, recurrent, and progressive vv comparing preoperative clinical and phlebographic findings in particular with operating reports and the clinical documentation and ultrasound findings at the postoperative follow-up following a detailed flow chart (Fig. 1).

STATISTICS

Data were processed and analyzed by SPSS 19 for Windows (IBM Corp, Armonk, NY) with Chi-squared

or Fisher's exact tests (categorical data), Cox regression (time to recurrence, multivariate analysis), Kaplan-Meier (time to recurrence), and Student's t-tests or Mann-Whitney rank sum test (numeric variable). Statistical significance was set at two-sided $p < 0.05$.

Results

From January 1998 to December 2003, 741 extremities were operated for vv; 534 underwent the extensive surgery described above and were called for long-term follow-up. A total of 61 legs were lost to follow-up (24 patients died, 37 were unable to be located). Thus, 419 patients (473 limbs) were contacted (follow-up rate of 88.6%).

Sixty-six patients (73 limbs) were unavailable for a check-up and were interviewed by phone. Thus, data from 353 patients (400 legs) were analyzed. Mean follow-up was 120 ± 21 months. The mean age was 52 ± 12 years (range, 21–78 years), and 67% of patients were female. All operated limbs were preoperatively in CEAP group 2 (74.8%) or higher (Table V).

Hach classification²⁵ of the Great Saphenous Trunk was type IV in 89.9% of legs, type III in 9.1%, and type II in 1.1%.

SURGICAL TECHNIQUE

Extensive surgery was used for 400 analyzed limbs, and the SSV was operated in 11 cases. In all cases a high ligation and division of the great saphenous vein and ligation of all visible collaterals was performed, with complete stripping of the GSV in 89.8% and a short stripping in 10.2% of cases. Nine-hundred and forty-nine perforating veins were ligated (Table I). The mean operating time was 172 ± 67 minutes.

Three-hundred and twelve operations (65.9%) were performed under general anesthesia and 161 (34.1%) by peridural anesthesia. Postoperative complications occurred in 16.2% (77 legs; 13.3% surgical and 2.9% non-surgical problems).

TABLE I - Distribution of operated perforating veins

Perforating veins	Number	%
Dodd	31	3.2%
Hunter	12	1.3%
Boyd	149	15.7%
Sherman	23	2.4%
Cockett III	198	20.8%
Cockett II	239	25.2%
Cockett I	91	9.6%
May	66	6.9%
Custer	15	1.6%
Lateral perforating veins	122	12.8%
TOTAL	949	100%

APPEARANCE OF POSTOPERATIVE NEVVAS

Patients complained of vv on the operated site in 98 limbs (24.5%) after a mean time of 55.64 ± 53.4 months and in 61 limbs (15.3%) on a new site after a mean time of 41.6 ± 27.5 months. The remaining 241 limbs (60.2%) were asymptomatic.

At the clinical examination were found visible veins in 182 limbs (46%). All clinically visible varicose veins were confirmed by duplex imaging. Clinically visible vv were significantly correlated with perforator incompetence ($p = 0.0001$). In addition we found by duplex 84 (20.5%) more limbs with clinically non visible vv.

CLASSIFICATION OF POSTOPERATIVE VARICOSE VEINS

The total incidence of objective clinical and/or echographic vv after extensive surgery was 66.5% (266) after a mean follow-up of 120 ± 21 months. They are classified as: residual in 16.5%; recurrent in 15.5%; and progressive in 15% of cases. Additionally, 13.8% of limbs presented a combination of two types of them (Tables II, III). Adding the combined NEVVAS, the overall incidence was 23.75% for recurrent, 23.25% for residual, and 21% for progressive vv after surgery. In 11 cases (2.8%), classification was not possible because of missing preoperative, intraoperative, or postoperative data.

TABLE II - Classification of NEVVAS

Type of NEVVAS	Number	%
Recurrent	62	15.5%
Residual	66	16.5%
Progressive	60	15%
Combined	55	13.8%
Neovascularization	12	3.0%
No varicose veins	134	33.5%
Not evaluable	11	2.8%
TOTAL	400	100%

NEVVAS, new varicose veins after surgery.

TABLE III - Distribution of 55 combined NEVVAS

Combination	Number	% of 400 legs
Neovascularization + residual	7	1.75%
Neovascularization + progressive	11	2.75%
Neovascularization + recurrent	5	1.25%
Recurrent + residual	16	4%
Recurrent + progressive	9	2.25%
Recurrent + not evaluable	3	0.75%
Residual + progressive	4	1%
TOTAL	55	13.75%

NEVVAS, new varicose veins after surgery.

TABLE IV - Types of NEVVAS and the Fischer's classification of duplex-ultrasonography findings on the groin

Former SFJ	Recurrent	Residual	Progressive	Type of NEVVAS		No NEVVAS	not valuable	Total
				Combined	Neovasc.			
type A	23	62	60	15	0	134	10	304
type B1	3	3	0	24	12	0	1	43
type B2	32	1	0	16	0	0	0	49
type C	4	0	0	0	0	0	0	4
TOTAL	62	66	60	55	12	134	11	400

NEVVAS, new varicose veins after surgery. SFJ, saphenofemoral junction.

TABLE V - Comparison of preoperative CEAP class and CEAP at follow-up after 120 ± 21 months

		CEAP Class on Follow-up							Total
		0	1	2	3	4	5	6	
CEAP Class									
Preop.	2	30	139	120	8	6	0	0	303
	3	6	28	16	4	2	0	0	56
	4	4	6	9	5	6	0	1	31
	5	1	0	1	1	1	3	0	7
	6	1	0	2	0	0	0	0	3
TOTAL		42	173	148	18	15	3	1	400

CEAP, Clinical, Etiologic, Anatomic and Pathophysiologic assessment of lower extremity venous disease

NEVVAS were found on the saphenofemoral junction, isolated, or in combination with more distal varicosities in 96 cases (36.1%). In 44.3% NEVVAS were caused by one or more insufficient perforator veins. In 8.3% of cases, the SSV was the source of NEVVAS. In 11.3%, a source could not be identified.

By duplex examination, the SFJ was normal in 304 cases and pathologic in 96; 10.7% (n 43) were classified as type B1, 12.2% (n 49) as type B2, and 1.0% (n 4) as type C, according to Fischer (Table IV). In 29 limbs (30%) NEVVAS were a mere instrumental finding without clinical correlation. Type B1 was more frequently found (44%) in the combined varicose vein group after surgery. 12 times there was an isolated neovascularization (type B1) found. Type B2 dominated in recurrent varicose veins (52%) and was also present in the combined group (30%) (Table IV). Progressive vv had no pathological duplex findings.

INDICATION FOR REINTERVENTION

Nine patients (1.9%) were reoperated after 70 ± 33 months, and 17 (3.5%) underwent sclerotherapy during follow-up for varicose veins after surgery.

Based on the findings at the follow-up there was an indication for reintervention in 22.2% of NEVVAS due to extensive varicose veins, SFJ incompetence, perforator incompetence, or a combination of these. Adding up the 9 patients who underwent repeat surgery during follow-up, the indication for surgery accounted for 24.1%.

Discussion

The term "recurrence" for vv after surgery is misleading since this term is used for recurrent, residual and progressive vv after surgery as an umbrella term.

In contrast, recurrence in surgery clearly denotes the reappearance of the same disease on the operated site after surgery, and is pathologically and etiologically not the same as a residual or a progressive vv.

We suggest therefore the generic term NEVVAS (NEw Varicose Veins After Surgery) instead of REVAS⁷, which pools together the three different entities. NEVVAS are subclassified as recurrent, residual, or progressive^{12,14}.

The term PREVAIT²⁷ was not considered for argumentation since this term refers only to residual and recurrent varices as stated in the definition²⁷.

The recently coined term "neovarices"²⁸ is based on the same considerations discussed in this paper.

Residual varicose veins are avoidable, while the progression of the disease may be prevented by prophylactic measures alone. On the contrary, recurrence is generally due to technical failure (primarily the surgeon's) and is also avoidable. Undoubtedly, it is difficult to distinguish between residual, recurrent, or progressive veins in daily practice. However, for accurate classification and scientific purposes, it is mandatory. Differentiation was possible in our study due to a critical comparison of pre- and intraoperatively collected data, the phlebographic documentation of SFJ and per-

forator incompetence and their location and duplex as well as clinical findings at follow-up.

A key point in this study is represented by the phlebographic examinations performed in almost all the patients. The static and hemodynamic informations of the superficial and deep venous system allowed to compare the location of preoperatively present escape points and varicose veins with the intraoperative performed ligations and extractions as well as with the duplex detected new vv on follow up. Nowadays this examination has been outmoded by duplex examinations. In the time of study it was a still often used diagnostic tool and an ideal tool for the classification technique used.

Only 2.8% of cases were not classified because of lack of documentation or uncertain interpretation.

The incidence of "true" recurrence in this study was 15.5% of limbs, or 23.75% when combined with the 8.25% for combined vv (Table III), similar to the reported 23-42%^{3,4,9,11,15} for true postoperative recurrence, but in evident contrast to the generalized allegations of recurrences of 6-80%¹⁻⁷.

Groin recurrence suggests a technical error for type B2 refluxes⁸. For type B1 (neovascularization), it is difficult to recognize a technical or tactical error. Neovascularization is considered in the literature as a routine finding^{3,16} or as an innocent bystander^{2,17}.

Several studies have attempted to reduce the incidence with covering techniques, without any definite results,^{18,19} although cribriform fascia closure seems sufficient to reduce neovascularization²⁰.

In the present study, we found 96 recurrences in the groin (10,7% Type B1, 12,2% type B2, and 1,0% type C) (Table IV).

B1 findings were combined only three times with a recurrence (a dependent varicosity on the thigh). Therefore, we believe that type B1 recurrence alone should not be considered a true recurrence, since the clinical relevance of grade I neovascularization on duplex scanning is not clear²¹. Further investigations of the anatomical evolution of these neovascularizations will reveal if there is an evolution to different reflux grades. It is possible that type B1 is a precursor to B2, where one of the capillary veins enlarges due to long-lasting pressure through the avaluvar veins.

The principal aim of postoperative follow-up is to identify NEVVAS in order to operate or sclerose and thus avoid disease progression, as later interventions lead to more difficult operations and less desirable results. Symptomatic recurrences are indicated for operation, but there is uncertainty for isolated reflux on duplex imaging without clinical evidence. In our opinion, even asymptomatic reflux >0.5 sec is indicated for operation. Smaller and type B1 varicosities do not seem to justify operation. Some authors suggest distinguish between recurrences requiring and not requiring reintervention^{7,8,16}. This may be an alternative to distinguish mere duplex findings from clinically or hemodynamically important recurrences, as we suggest.

Residual veins are assessed differently. Sometimes a surgeon may leave a varicose vein, an insufficient perforator, or a side branch within the treatment plan, such as in hemodynamic venous surgery. Here, the aim was to eradicate all vv, so a residual vein was considered a surgeon's error. An incidence of 23,75% for residual veins is unacceptable and unnecessarily increases the incidence of NEVVAS

The aim to eradicate all vv is not uncommon. Those who administer perioperative sclerotherapy generally have the same goal²². With the introduction of foam, this technique seems to experience a revival^{23,24}. Compared to extensive surgery, this technique presumably represents an easier and less time-consuming procedure. However, evidence-based results are presently lacking.

Extensive surgery is apparently in contrast to so-called hemodynamic surgery, which was not used when this study's operations were performed, even though Hach²⁵ had suggested in 1981 eradicating only insufficient GSV segments.

The percentage of totally stripped GSVs was quite high (89.8%), but the extent of GSV varicosity was classified as class IV according to Hach in 89.8% of legs, which was due to the exclusive inclusion of extensive varicosities; 207 legs (28%) were excluded from the study for varicosities that were not as extensive. In our department, this procedure is called the Babcock-Cockett radical vein operation, coined by Urs Brunner and perpetuated by Robert May and Jörg Vollmar, regrettably without a scientific record. Babcock stands for the stripping of the GSV and Cockett for the perforator ligature; varicose collaterals were additionally extracted in order to remove all present varicosities and their sources and this explains the adjective radical. Isolated perforator insufficiencies or saphenous main-stem varicosities were not operated at our institution.

None of the 11 operated SSVs had a recurrence, residual vein, or disease progression. In contrast, 8.3% of NEVVAS, exclusively progressive vv, were due to SSV incompetence.

Conclusions

In summary, this extensive surgery for vv allows fair results regarding the incidence of true recurrence. In total recurrence, residual and progressive veins accounted for an overall NEVVAS rate of 66.5%, in accordance with the literature. Pooling these entities under the term "recurrence" is not reasonable and confusing. Not all NEVVAS were clinically evident; 30.5% were found on duplex imaging without clinical evidence and therefore are of difficult allocation. Further investigations are needed to determine the clinical importance of mere ultrasonographic findings without clinical or subjective signs. The real recurrence rate in surgical terms is as high as 23.75%. These and residual vv (23.25%) are due main-

ly to technical and tactical errors, and therefore avoidable. Progressive varicosities (21%) are difficult to avoid, except by prevention.

These data may help surgeons in operation planning and in preparing preventive information for the patient. Distinguishing the three types of NEVVAS is important for scientific studies, for the comparison of different techniques, for the patient's information and consent, for teaching purposes, and for improved planning and operative performance.

Riassunto

OBIETTIVO: Obiettivo di questo studio è di riconoscere l'esatta incidenza di varici recidive dopo chirurgia e di vedere se sono differenziabili le recidive vere dalle varici residue e dalle varici dovute ad una progressione della malattia varicosa.

MATERIALE E METODO: Per questo studio furono selezionati tutti i pazienti operati per un'insufficienza primaria della crosse con varicosità della VGS (Vena grande safena) e delle tributarie e con almeno una perforante insufficiente tra gennaio 1998 e dicembre 2003. La tecnica operatoria, cosiddetta tecnica radicale secondo Babcock Cockett, consisteva in una legatura e resezione a raso della crosse safenofemorale, stripping della VGS, legatura e sezione di almeno una perforante e di flebectomie multiple.

La differenziazione in varici residue, recidive e progressive avvenne attraverso il confronto dei dati rilevati pre ed intra operatoriamente ed i risultati del controllo al follow-up.

I reperti al follow-up vennero confrontati in particolare con la situazione flebografica preoperatoria.

RISULTATI: 353 pazienti (400 arti) furono controllati a 120 ± 21 mesi dall'intervento (percentuale di follow-up dell'88,6%). All'esame clinico furono diagnosticate vv (vene varicose) in 182 estremità (46%), confermate tutte all'ecocolordoppler. L'ecocolordoppler evidenziò altri 84 arti (20,5%) con vv, non visibili all'esame clinico. Pertanto l'incidenza totale (obiettività clinica e/o ecografica) di vv era del 66,5%, che si compone nel 23,25% di vv residue, nel 23,75% di vv recidive e nel 21% di vv progressive. In 11 casi (2,8%) la classificazione non era possibile per dati imprecisi o per flebografie mancanti.

CONCLUSIONI: Il presente lavoro ha dimostrato come si possano distinguere nettamente tre entità diverse di vv dopo chirurgia applicando uno schema di documentazione preciso e prospettico basato su un parametro diagnostico affidabile. L'incidenza di varici recidive „vere“ era del 23,75%.

Di conseguenza viene proposto di sostituire il termine generale „vv recidive“ (REVAS) e di usare un acronimo più confacente, denominato NEVAS (new varices after surgery- nuove varici dopo chirurgia).

La classificazione dei diversi tipi ha un'importanza non solo scientifica e teorica, ma acquista significato clinico e profilattico se si considera che una varice residua può essere evitata con maggiore attenzione al mappaggio, con maggiore precisione nell'approccio ai punti di fuga e nella valutazione causale degli stessi. Le vv recidive invece debbono indurre il chirurgo a rivedere la sua tecnica e la precisione della stessa. Per la varice progressiva, spesso tralasciata in letteratura, purtroppo rimane solo la profilassi generale per l'insufficienza venosa cronica.

Acknowledgements

The authors would like to thank Ms. Janet Giuliani for revisions and corrections to the English text.

References

1. Blomgren L, Johansson G, Dahlberg-Akerman A, et al.: *Recurrent varicose veins: Incidence, risk factors and groin anatomy*. J Vasc Endovasc Surg, 2004; 27:269-74.
2. Egan B, Donnelly M, Bresnihan M, et al.: *Neovascularisation: An "innocent bystander" in recurren*. Eur J Vasc Endovasc Surg, 2004; 44:1279-284.
3. Jones, et al.: *Neovascularisation is the principal cause of varicose vein recurrence: Results of a randomized trial of stripping the long saphenous vein*. Eur J Vasc Endovasc Surg, 1996; 12:442-45.
4. Kostas T, Ioannou CV, Touloupakis E, et al.: *Recurrent varicose veins after surgery: A new appraisal of a common and complex problem in vascular surgery*. Eur J Vasc Endovasc Surg, 2004; 27:275-82.
5. Noppeney T, Kluess HG, Gerlach H, et al.: *Leitlinie zur Diagnostik und Therapie des Krampfaderleidens*. Gefäßchirurgie online publication, 20 October 2004.
6. Parés JO, Juan J, Tellez R et al.: *Varicose vein surgery: stripping versus the CHIVA method: A randomized controlled trial*. Ann Surg, 2010; 251:624-31.
7. Perrin MR, Guex JJ, Ruckley CV, et al.: *Recurrent varices after surgery (REVAS), a consensus document*. Cardiovasc Surg, 2000; 8:233-45.
8. Fischer R, Linde N, Duff C, et al.: *Das Krossenrezidiv. Eine Nachkontrolle nach 34 Jahren*. Phlebologie, 2000; 29:17-22.
9. Rass K, Frings N, Glowacki P, et al.: *Comparable effectiveness of endovenous laser ablation and high ligation with stripping of the great saphenous vein: Two-year results of a randomized clinical trial (RELACS study)*. Arch Dermatol, 2012; 148:49-58.
10. Belcaro G, Cesarone MR, Di Renzo A, et al.: *Foam-sclerotherapy, surgery, sclerotherapy, and combined treatment for varicose veins: a 10-year prospective, randomized, controlled, trial (VEDICO trial)*. Angiology, 2003; 54:307-15.
11. Carradice D, Mekako AI, Mazari FA, et al.: *Clinical and technical outcomes from a randomized clinical trial of endovenous laser*

- ablation compared with conventional surgery for great varicose veins. *Br J Surg*, 2011; 98:1117-23.
12. Ebner H, Ebner JA: *Rezidivraten nach Varizenoperation: Eine kritische Analyse*. Gefäßchirurgie, 2014; 19:237-43.
13. Mumme A, Olbrich S, Barbera L, Stucker M: *Saphenofemorales Leistenrezidiv nach Stripping der Vena Saphena Magna: Technischer Fehler oder Neovaskularisation?* *Phlebologie*, 2002; 31:38-44.
14. Smith JJ, Brown L, Greenhalgh RM, Davies AH: *Randomised trial of pre-operative colour duplex marking in primary varicose vein surgery: outcome is not improved*. *Eur J Vasc Endovasc Surg*, 2002; 23:336-43.
15. Royle JP: *Recurrent varicose veins*. *World J Surg*, 1986; 10:944-53.er
16. Frings N, Nelle A, Tran P, et al.: *Reduction of neoreflux after correctly performed ligation of the saphenofemoral junction. A randomized trial*. *Eur J Vasc Endovasc Surg*, 2004; 28:246-52.
17. Geier B, Mumme A, Hummel T et al.: *Validity of duplex-ultrasound in identifying the cause of groin recurrence after varicose vein surgery*. *J Vasc Surg*, 2009; 49:968-72.
18. De Maeseneer MG, Giuliani DR, Van Schil PE, De Hert SG: *Can interposition of a silicone implant after sapheno-femoral ligation prevent recurrent varicose veins?* *Eur J Vasc Endovasc Surg*, 2002; 24:245-49.
19. Heim D, Negri M, Schlegel U, De Maesener M: *Resecting the great saphenous stump with endothelial inversion decreases neither neovascularisation nor thigh varicosity recurrence*. *J Vasc Surg*, 2008; 47:1028-32.
20. De Maeseneer MG, Philipsen TE, Vandenbroeck CP, et al.: *Closure of the cribriform fascia: An efficient anatomical barrier against postoperative neovascularization at the saphenofemoral junction? A prospective study*. *Eur J Vasc Endovasc Surg*, 2007; 34:361-66.
21. De Maeseneer MG, Tiellu IF, Van Schil PE, et al.: *Clinical relevance of neovascularisation on duplex-ultrasound in the longterm follow-up after varicose vein operation*. *Phlebology*, 1999; 14:118-22.
22. Iwamoto S, Ikeda M, Kawasaki T, Monden M: *Treatment of varicose veins: an assessment of intraoperative and postoperative compression sclerotherapy*. *Ann Vasc Surg*, 2003; 17:290-95.
23. Islamoglu F.: *An alternative treatment for varicose veins: Ligation plus foam sclerotherapy*. *Dermatol Surg*, 2011; 37:470-79.
24. Ebner H, Falk M, Ferrara F, Cacciatore E, Dompè G, Farina A, Ebner JA: *Perioperative Sclerotherapy: A survey of current practice by Italian phlebologically-active physicians*. *Ann Ital Chir*, 2015; 86(2):177-84.
25. Hach W: *Die Erhaltung eines transplantationswürdigen Venensegmentes bei der partiellen Saphenaresektion als Operationsmethode der Stammvarikose*. *Phlebol Proktol*, 1981; 10:171-73.
26. Fischer R, Linde N, Duff C, Jeanneret Ch, Chandler JG.: *Late recurrent saphenofemoral junction reflux after ligation and stripping of the greater saphenous vein*. *J Vasc Surg*, 2001; 34:236-40.
27. Eklof B, Perrin M, Delis KT, Rutherford RB, Gloviczki P: *Updated terminology of chronic venous disorders: The VEIN-TERM transatlantic interdisciplinary consensus document*. *J Vasc Surg*, 2009; 49(2):498-01.
28. Lawson JA, Toonder IM: *A review of a new Dutch guideline for management of recurrent varicose veins*. *Phlebology*, 2016; 31(1 Suppl):114-24.