Thieme

Treatment of recurrent saphenofemoral incompetence: surgical approach still up-to-date?

Therapie des inguinalen Crossenrezidivs: Ist die offene Re-Crossektomie noch zeitgemäß?

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ABSTRACT

Introduction Recurrent varicose veins are a common medical problem despite the development of new operation techniques and a variety of minimal invasive treatments. The ideal treatment of recurrent saphenofemoral incompetence is still matter of debate. Nowadays, the open inguinal reoperation seems to fade into the background because of available less invasive treatment alternatives.

Methods This review article is based on current guidelines and a systematic PubMed search of article references dealing with the use and effectiveness of various techniques for the treatment of recurrent aphenofemoral incompetence. Besides this main topic, we highlight the causes, classification and frequency of recurrence after varicose vein treatment.

Results Recurrence of varicose veins after surgical or endovenous treatment for great saphenous vein incompetence is a frequent event. Causes for same site recurrence are neovascularization, especially after surgical treatment, and recanalization or reflux into groin tributaries after endovenous ablation leaving a saphenofemoral stump, as well as tactical and technical errors. Disease progression is leading to different site recurrence. Clinically relevant saphenofemoral recurrence can be treated by inguinal reoperation or ultrasound guided foam sclerotherapy without any anatomical restrictions. However, inguinal reoperation particularly when providing a barrier technique seems to be more effective than sclerotherapy in the long-term and is connected with a high patients' satisfaction in spite of its invasiveness. Endovenous ablation is likewise effective but limited to the treatment of persistent saphenous or accessory trunks. In many cases the combination of surgical or endovenous treatment with foam sclerotherapy is a feasible approach.

Conclusion Due to its long-term efficacy the surgical approach with inguinal reoperation for recurrent saphenofemoral incompetence is indeed still up-to-date. Randomized studies comparing surgery, endovenous ablation and foam sclerotherapy are needed to find out, if the potentially lower recurrence rates of the surgical approach outweigh the lower invasiveness with a need for repeated treatment sessions in case of sclerotherapy.

ZUSAMMENFASSUNG

Einleitung Die Rezidivvarikose ist trotz der Entwicklung neuer Verfahren und Operationsstrategien ein relevantes medizinisches Problem. Zur Therapie inguinaler Crossenrezidive (ICR) steht die offene Re-Crossektomie zur Verfügung, die derzeit gegenüber weniger invasiven Verfahren in den Hintergrund tritt.

Methoden Diese Übersichtsarbeit basiert auf aktuell verfügbaren Leitlinien und einer Literaturrecherche bei PubMed zur Frage des Einsatzes und der Effektivität verschiedener Verfahren zur Therapie des ICR.

Ergebnisse Inguinale Re-Crossektomie und Schaumsklerosierung sind uneingeschränkt anwendbar. Die Operation, sofern mit Barrieretechnik kombiniert, scheint langfristig effektiver als die Verödung und ist mit einer hohen Patientenzufriedenheit verbunden. Endovenös thermische Ablationsverfahren können für individuelle Fälle mit geeignetem anatomischem Befund eingesetzt werden. Vergleichende Studien fehlen.

Schlussfolgerung Die offene Re-Crossektomie ist zeitgemäß. Ob der Vorteil der potentiell höheren Effektivität bei der Operation stärker wiegt als die geringere Invasivität der Schaumsklerosierung verbunden mit häufigeren Therapiesitzungen müsste mittels randomisierter kontrollierter Studien geklärt werden.

Introduction

With a prevalence of more than 30 %, varicose veins and the associated chronic venous insufficiency (CVI) are amongst the most common diseases of adults in industrialised nations [1]. During the course of the disease, they have a considerable impact on the quality of life [2], may lead to chronic inflammation and ulceration, and significantly increase the thromboembolic risk [3], so that guidelines now advise active treatment at an early stage [4, 5, 6]. If patients have incompetent saphenous veins, they should be offered endovenous ablation, i. e. endovenous laser therapy or radiofrequency ablation, or open surgery with high ligation and stripping. Active treatment should have preference over compression therapy alone [6].

Recommendations for recurrent varicose veins that have arisen in the previously treated inguinal region are less explicit. As has been shown not only in recent randomised controlled trials, varying degrees of clinical recurrence may occur in 50 % of patients five years after treatment, whether by open surgery or endovenous ablation [7]. These clinical conditions are usually classified according to the recurrent varices after surgery (REVAS) criteria based on the presence of varices in a limb that had previously undergone an operation for varicose veins. This clinical definition covers both 'true' recurrences that have developed in the surgical field but also residual varicose veins that had already been diagnosed preoperatively and new varicose veins resulting from disease progression [8]. Taken with respect to the treated patients as a whole, varicose veins that arise from the previously treated inguinal region account for a considerable proportion of clinical recurrences in the long term (5 years after surgery): 18–33 % following endovenous laser ablation of the great saphenous vein (GSV), 5–17 % after high saphenofemoral ligation and stripping of the GSV [9]. Inguinal recurrences demonstrated by duplex ultrasound apparently differ depending on the procedure used: while recurrences following correctly performed high ligation arise mainly from neovascularisation in the saphenofemoral region, recanalisation and neoreflux in tributary vessels seem to play a greater role in the subsequent development of 'true' clinical recurrence after thermal ablation [10, 11].

Besides 'unavoidable' recurrences, which occur despite a painstaking surgical or therapeutic technique, recurrences due to technical errors (e. g. leaving a saphenofemoral stump with tributaries) or tactical errors (diagnostic errors) are probably also relevant in terms of numbers, at least as far as determining the indication for revision ('redo') surgery goes [12].

Although open surgical revision in the groin is considered to be the reference method, especially where there is a GSV stump and clinically relevant recurrent varicose veins, it is technically demanding and has a higher risk of complications than primary high ligation [4]. The additional use of barrier techniques in recent years is a very promising development to prevent repeat recurrent saphenofemoral incompetence [13, 14, 15]. Given the complication risk, less invasive methods such as ultrasound-guided foam sclerotherapy (UGFS) are increasingly being recommended and implemented [6, 16]. The combination of surgery and UGFS or in situ foam sclerotherapy by direct injection is another approach frequently used in practice [17].

In this way, many questions on the treatment of recurrent saphenofemoral incompetence remain open: If there is a need for treatment, what is the most appropriate method? Does the choice of method depend on the findings? What are the advantages and disadvantages associated with each method? Are less invasive methods becoming more important? Given the degree of invasiveness, is open revision saphenofemoral ligation still relevant today?

This review article is based on currently available guidelines and the recent literature on questions of the aetiology, pathogenesis, clinical relevance and therapeutic options for recurrent saphenofemoral incompetence.

Definition, aetiology, and pathogenesis of recurrent varicose veins

There are various definitions and classifications of recurrent varicose veins.

In 2000, Michel Perrin inaugurated the REVAS classification, which has been increasingly used in prospective studies, also with redo surgery, and which has become the recognised standard for the classification of clinical recurrences [8,18]. Recurrent varicose veins can be distinguished as follows:

1. Residual varices that were documented before the planned intervention and persist postoperatively
2. Newly arising varices in an area that has not previously been treated, as a result of progression of the underlying disease
3. 'True recurrence' as the result of neovascularisation or a technical or tactical error.

Our group has proposed a modified REVAS classification, that can also be used with endovenous procedures, to include, besides neovascularisation, recanalisation and neoreflux across SFJ tributaries, e. g. an anterior accessory saphenous vein (AASV) [7].

Recurrent varicose veins are classified according to clinical criteria and, on the question of the origin and pathogenesis, also by

duplex ultrasound examinations [6, 16]. The International Union of Phlebology (UIP) consensus differentiates [19]:

1. Recurrences via a residual stump: high ligation of the GSV was not flush with the common femoral vein but more distal and left a stump; this is also usually the case following endovenous ablation, as it is inherent in the method ('distal occlusion type'). Clinical recurrence may develop from the stump via pre-existing tributaries or new vessels, and not uncommonly involves an incompetent AASV.
2. Recurrences following neovascularisation: the formation of small-calibre vessels at a previous surgical site, which fill through connections with the deep venous system.

A recent meta-analysis on the treatment of GSV incompetence included randomised controlled trials with a follow-up of at least 5 years. Rates of 7–38 % have been reported for recurrent saphenofemoral incompetence detected with duplex ultrasound after high ligation and stripping, endovenous laser ablation (EVLA) or UGFS. The recurrence rate after high saphenofemoral ligation and stripping was significantly lower than after EVLA or UGFS (20).

There are at least four important causes of recurrent varicose veins:

Progression of the underlying disease is one of the most important causes of recurrent varicose veins. It may be ascending (superficial veins dilate and become varicose), descending (the origin is reflux at the saphenofemoral or saphenopopliteal junction or reflux from incompetent perforators) or multifocal [6, 18]. Genetic factors that lead to disruption of the extracellular matrix structure (fibulin-3, matrix metalloproteinases) are important in the pathogenesis of varicose veins [21]. This is probably the starting point for the pathological venous dilatation with subsequent loss of valve function. It has also been suggested that changes in the pressure within the leg veins, e. g. following therapeutic interventions, may give rise to remodelling of the vein wall with alterations in the elastic collagen fibre matrix and activation of certain matrix metalloproteinases (MMP-2, MMP-9). Increasing evidence is appearing in the literature indicating that this remodelling, which leads to dilatation of the veins, may be induced by chronically raised venous filling pressures in the same way as they occur in the typical factors for primary varicose disease: standing or sitting for long periods, pregnancy, lack of exercise, and obesity [22]. Obesity is also an independent risk factor for the development of recurrent varicose veins [23]. Both the genetic make-up and the individual lifestyle are therefore significant not only for the progression of the underlying disease, but also for the development of 'true' recurrences (see below).

Neovascularisation is estimated to be the most important cause of clinical recurrence after impeccably performed open surgery, especially of the saphenofemoral junction [10, 18]. Neovascularisation is characterised by the formation of new vessels that show histopathological differences from residual veins. These differences include a loss of wall structure, a lack of valves and nerves, and the presence of multiple lumens within scarred connective tissue [24]. Intraoperative physical factors such as the type of suture material used at the SFJ, a surgical technique exposing free endothelium, and surgical trauma count as possible triggers of neovascularisation. Postoperative factors such as hypoxia around the stumps of ligated veins, wound-healing mechanisms, altered haemodynamics (remodelling, see above), and inflammatory or microthrombotic events are all presumably involved in the pathogenesis of neovascularisation [25].

Tactical errors consist of an inadequate or even no preoperative evaluation of the reflux, especially if the proximal point(s) of incompetence were not correctly defined, or if the treatment method chosen was inappropriate to the findings [18]. Preoperative duplex ultrasound scanning, which is now considered to be obligatory, reduces the rate of tactical errors and considerably improves the outcome of treatment [26].

Technical errors play an important role in recurrent varicose veins [12]. Recurrences that require intervention are mainly the result of technically inadequate operations, e. g. by leaving a long saphenous vein stump. This observation emphasises the necessity of the ligature around the GSV lying flush at the transition into the common femoral vein [27]. Technical errors can be prevented by relevant specialisation and structured surgical training.

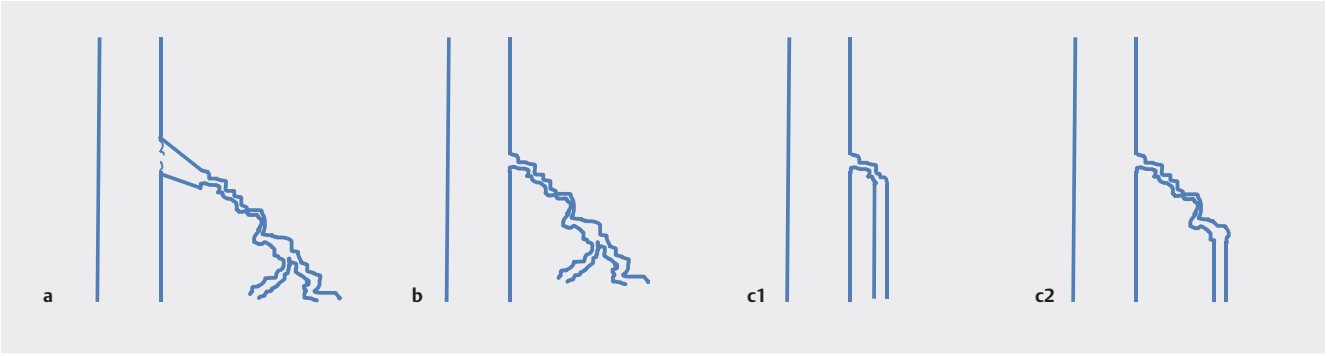
Treatment of recurrent saphenofemoral incompetence

Several therapeutic options may be considered for the treatment of recurrent saphenofemoral incompetence: endovenous thermal ablation (EVTA), UGFS, open inguinal revision surgery or a combination of procedures. Given the greater difficulty and complication risk of redo groin surgery compared with the primary operation, a trend towards less invasive methods can be seen [6, 16]. The choice and use of the various procedures depend significantly on the findings and should be determined preoperatively on the basis of the clinical picture and the duplex ultrasound images, taking the patient's wishes into account (▶ **Fig. 1**).

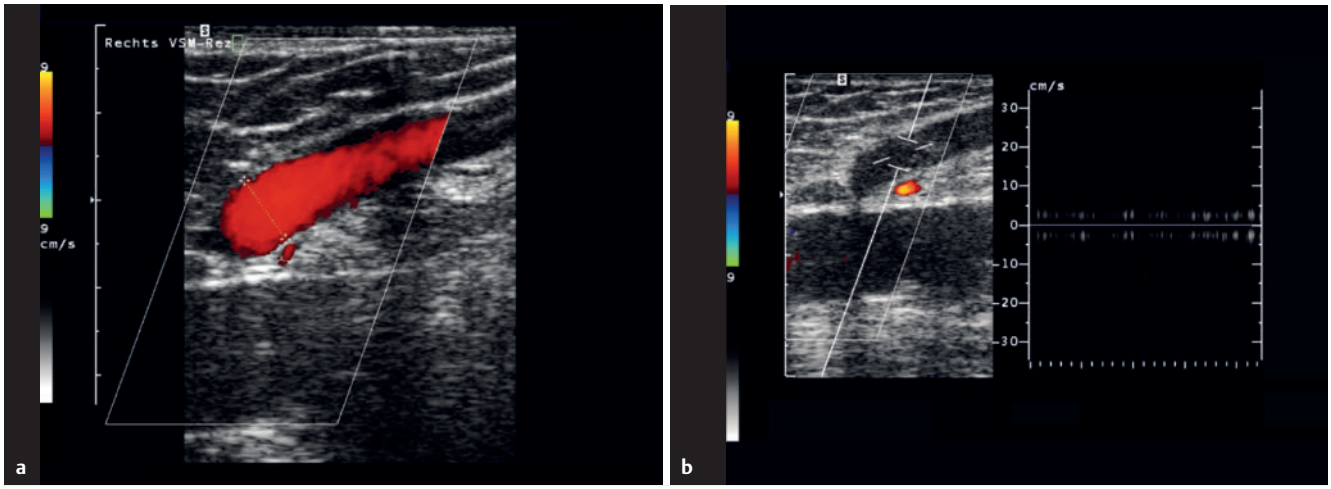
Endovenous thermal ablation (EVTA)

EVTA is not suitable for all types of recurrent varicose veins [28, 29]. Findings of recurrence with persistent GSV segments or a straight-flowing AASV can be treated with endovenous thermal procedures [29]. As long as the catheter can be introduced close to the saphenofemoral junction, all the available techniques – EVLA, radiofrequency ablation, superheated steam – can basically be used (▶ **Fig. 1c1** and ▶ **Fig. 2**).

Often, however, there is a segment of variable length with new vessels lying between the trunk vein and the opening into the femoral vein. In this case, superheated steam or a combination of thermal ablation and foam sclerotherapy via the inserted catheter may be worthwhile, as is possible with the segmental radiofrequency catheter (▶ **Fig. 1c2** and ▶ **Fig. 3**). Good patient satisfaction, low complication rates, and short operating times seem to make EVTA an attractive alternative to inguinal revision surgery in appropriate cases [28]. Studies with follow-up periods of up to 18 months confirm its efficacy with occlusion rates around 95 % [29, 30]. However, there are no long-term results or prospective controlled trials for the treatment of recurrence, and EVTA is not available to everyone, due to the lack of reimbursement in the outpatient sector. The advantages and disadvantages of EVTA compared with redo groin surgery are summarised in ▶ **Table 1**.



▶ **Fig. 1** Patterns of recurrent saphenofemoral incompetence and therapeutic options, provided there is clinical relevance. a Residual saphenous vein stump with new vessel formation transitioning into a branch varicose vein; no catheterisable trunk vein in the anatomical vicinity of the source of reflux → Proposed treatment: redo surgery in the groin. b Neovascularisation transitioning into a branch varicose vein without any evidence of a saphenous stump; no catheterisable trunk veins in the anatomical vicinity of the source of reflux → Proposed treatment: foam sclerotherapy or redo groin surgery in combination with foam sclerotherapy. c1 Neovascularisation (short segment) or short stump transitioning into a catheterisable trunk vein (e. g. GSV, AASV) → Proposed treatment: endovenous thermal ablation or redo groin surgery and stripping of the trunk vein. c2 Neovascularisation (longer segment) transitioning into a catheterisable trunk vein (e. g. GSV, AASV) → Proposed treatment: endovenous thermal ablation in combination with foam sclerotherapy or redo groin surgery, foam sclerotherapy and stripping.



▶ **Fig. 2** Duplex ultrasound scan of recurrent saphenofemoral incompetence with fully preserved incompetent right great saphenous vein. **a** Demonstration of reflux in colour Doppler. **b** One month after endovenous laser ablation, demonstration of complete occlusion in colour and pulse-wave Doppler (no reflux seen during a Valsalva manoeuvre).

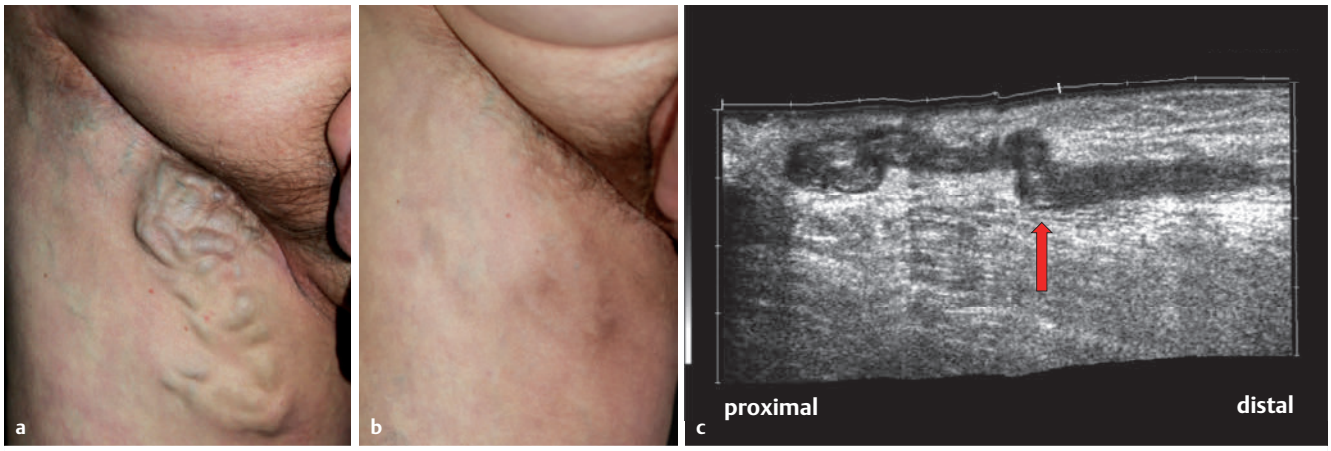
Ultrasound-guided foam sclerotherapy (UGFS)

According to the European guidelines on sclerotherapy, all varicose veins, including recurrences, can be treated with sclerotherapy – in particular UGFS – irrespective of the nature and diameter of the vessels concerned [31]. In the first instance, therefore, the technique is not restricted to the specific indications applying to EVTA. The advantages of UGFS over all other procedures lie in its minimal invasiveness and cost-effectiveness. Even if inguinal repeat recurrences are often seen on duplex ultrasound, sclerotherapy can basically be repeated as desired. We can therefore say that sclerotherapy is of a palliative nature. In some situations, there is no alternative (▶ **Fig. 3**)

Three to five years after UGFS of recurrent saphenofemoral incompetence, Pavei et al. found the repeat recurrence rate on duplex ultrasound scanning to be 28 %, associated with a clinical repeat recurrence in 20 % of the patients [32].

Foam sclerotherapy is of particular value in that it can be combined with EVTA and especially with open inguinal revision surgery [17].

Even so, sclerotherapy also carries risks. For example, direct injection of sclerosant in the region of a stump with recurrent saphenofemoral incompetence is associated with an increased risk of thrombosis [17]. This risk may also place a certain restriction on UGFS with increasing diameter of the inguinal vessels concerned. The necessity for one or more repeat therapy sessions may also be a disadvantage, as many patients prefer to have treatment all in one go [33]. As there are few available data on the long-term effectiveness of sclerotherapy for recurrent saphenofemoral incompetence, it is hardly possible to draw any firm conclusions. The advantages and disadvantages of the method are summarised in ▶ **Table 1**.



▶ **Fig. 3** Extensive recurrence in the right groin following ilioinguinal lymph node dissection. **a** Preoperative clinical appearance. **b** Clinical appearance 3 months after endovenous laser ablation of a persistent GSV (from 10 cm below the inguinal crease to Hach IV) in combination with foam sclerotherapy of the inguinal varicosity via the angiography catheter inserted before the thermal ablation. **c** Ultrasound follow-up examination (SieScape®) on day 1 postop. showed complete occlusion of the inguinal varicosity. The arrow shows the junction with the persistent GSV.

▶ **Table 1** Advantages and disadvantages of the different therapeutic modalities

	RGS	EVTA	UGFS
Advantages	• Can be used for all types of recurrence, especially large-diameter vessels, residual stumps • Many years of experience • Well-demonstrated efficacy for specific surgical techniques (see ▶ **Table 2**)	• Minimal risk of subsequent bleeding • Less invasive • Shorter time off work • Can be performed in an outpatient setting • General anaesthetic not required	• Cost-effective • Minimally invasive • Can be repeated • Can be combined
Dis-advantages	• Usually needs hospital admission • Risk of complications greater than with other procedures • The operation is more difficult, requires greater experience • Time-consuming operation	• Lack of general reimbursement • Anatomical limitations of use • No long-term results available	• Thrombosis risk • Still insufficient data on effectiveness

Abbreviations: EVTA = endovenous thermal ablation; RGS = redo groin surgery; UGFS = ultrasound-guided foam sclerotherapy

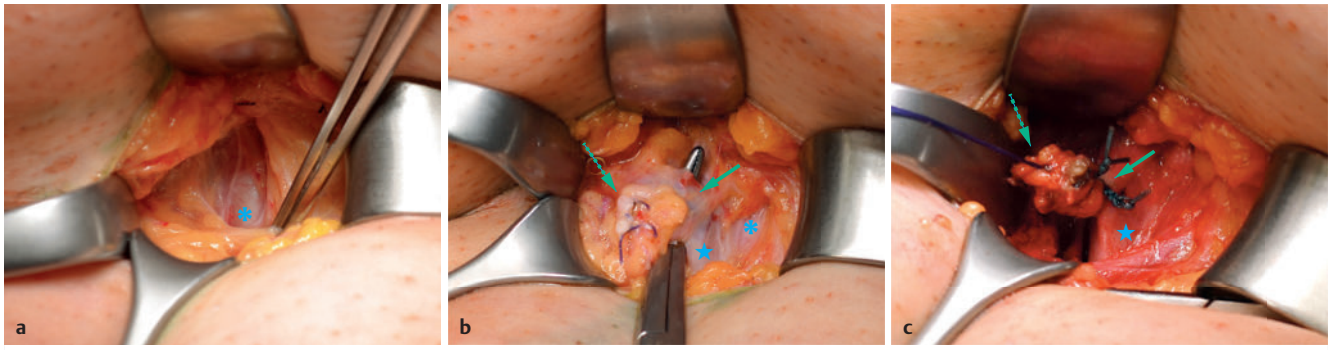
Inguinal revision surgery

Inguinal revision surgery or redo groin surgery, as it is known, can also be performed on any type of recurrent saphenofemoral incompetence (▶ **Fig. 1**). A large-scale retrospective analysis from the Netherlands found that revision surgery and EVTA are used in a ratio of about 70:30 [34]. Redo groin surgery seems to be particularly suitable for large-diameter varicose openings e. g. with a residual stump (▶ **Fig. 1a**). It is possible to achieve long-term freedom from saphenofemoral recurrence in this way and, from our own experience in this situation, the operation is not particularly difficult or beset with complications [15]. Various access routes to the origin of the saphenofemoral recurrence have been described, with an anterior approach for less scarred situations and a lateral approach with dissection around the femoral vessels for cases with more severe cicatrisation having proved their worth (▶ **Fig. 4**) [15, 35].

Throughout the international literature, however, redo groin surgery is considered to be a challenge for the surgeon, associated with an increased risk of complications, and correspondingly restricting the patient's postoperative activity and quality of life [8, 16, 18].

However, it is interesting to note that this last aspect does not have a negative effect on patient satisfaction with treatment [14, 15, 36]. Despite lower complication rates after EVLA than with open surgery in the treatment of recurrent saphenofemoral incompetence, there was no difference in the postoperative patient satisfaction in the previously mentioned study [34].

Nevertheless, it has to be remembered that even after meticulously performed revision surgery, neovascularisation may again occur with clinically relevant repeat recurrent saphenofemoral incompetence. Historically, the rate of repeat recurrence seen with duplex ultrasound is about 70 % after 2.5 years, i. e. the therapeutic approach is almost ineffective [37]. This figure, however, has been drastically reduced by various means. In the past 20 years, anatomical and prosthetic barrier techniques in particular have been developed and integrated into the surgical procedure in order to reduce the risk of neovascularisation. These techniques include endothelial inversion sutures of the saphenous stump, sutured closure of the fascia cribrosa, and attaching a silicone or polytetrafluoroethylene (PTFE) patch [13, 15].



▶ **Fig. 4** Surgical procedure for left redo groin surgery. **a** Lateral access (modified after Junod [35]) over the common femoral artery (*) going around the scar tissue. **b** Dissecting out medially over the common femoral vein (large asterisk), exposure of the saphenous stump (arrow) with Overholt forceps passed beneath. The scar tissue (dotted arrow) is hardly touched until ligation at the saphenofemoral junction.c Surgical field after double stump ligation at the level of the common femoral vein with non-adsorbate sutures (arrow) and endothelial inversion suture (dotted arrow). A precise description of the surgical technique can be found in [15].

▶ **Table 2** Studies on the surgical treatment of recurrent saphenofemoral incompetence

Lead author and year of publication	Type of study	Study arms	Number (legs)	FU (months)	FU rate (%)	RIR on duplex ultrasound	Clinical RIR
Bhatti 2000 [36]	PC	RGS + PTFE patch	81	19	86	37 %	12 %
Creton 2002 [38]	PC	RGS + PTFE patch	170	59	70	13 %	4 %
Winterborn 2007 [39]	RCT	RGS + PTFE patch	40	24	80	31 %	13 %
Freis 2016 [14]	RS	RGS + PTFE patch	86	12	n/a	?	2 %
De Maeseneer 2004 [13]	nRCT	RGS + silicone patch	73	60	93	9 %	26 % (thigh varicosities)
Gerontopoulou 2018 [15]	FUS	RGS + Endothelial inversion suture	100	18	n/a	5 %	3 %

Abbreviations: FU = follow-up; FUS = follow-up study; RGS = redo groin surgery; RIR = repeat inguinal recurrence; n/a = not applicable; nRCT = non-randomised controlled trial; PC = prospective cohort study; PTFE = polytetrafluoroethylene; RCT = randomised controlled trial; RS = retrospective study

In recent years, several prospective cohort studies, a few retrospective studies, and both randomised and non-randomised controlled trials have been published on barrier techniques in redo groin surgery. ▶ **Table 2** gives an overview. In the literature, the rates of repeat recurrence after applying a PTFE patch are 13–37 % on duplex imaging and 2–13 % on clinical examination after a follow-up period of 12–59 months [14, 36, 38, 39]. De Maeseneer et al. investigated the use of a silicone patch in a prospective non-randomised comparative study. The patient group who received a silicone patch showed an 80 % lower rate of repeat recurrence on duplex ultrasound after 5 years, compared with the no-patch group (9 % vs 45 %) [13]. Using a simple barrier method – the endothelial inversion suture according to Frings [40] (▶ **Fig. 4c**) – our surgical group has been able to achieve a duplex-ultrasound repeat recurrence rate of 5 % with clinical repeat recurrence in just 3 % of the patients after follow-up for 18 months [15]. This review shows that barrier strategies in redo groin surgery have a great potential to reduce neovascularisation rates and thus the rates of clinically relevant repeat recurrent saphenofemoral incompetence.

CONCLUSIONS

Available recent studies show that open revision surgery carried out by specialists and associated with barrier techniques increasingly ensures good results with respect to long-term freedom from varicose vein recurrence in the groin and low complication rates. The development of surgical techniques has not yet finished. Details of the surgical procedure have to be studied further. At the present time, redo groin surgery is probably the best therapeutic option for large-diameter saphenous stumps and, together with endovenous procedures and foam sclerotherapy, holds a firm place in the treatment spectrum of recurrent saphenofemoral incompetence. Nevertheless, recurrent varicose veins remain a therapeutic challenge, not least because of the still inadequate knowledge of the aetiology and pathogenesis [25]. Endovenous thermal ablation and ultrasound-guided foam sclerotherapy offer less invasive approaches than open revision surgery, and are being used more often. However, overall study data

are sparse, with short follow-up periods and sometimes only small numbers of patients.

There are definitely no studies comparing the three therapeutic procedures mentioned above. As the anatomical findings may be very different, more work is needed on precise descriptions and classification systems. Given the premise that different procedures may be the optimal treatment for the different findings (▶ **Fig. 1**), corresponding studies are needed to focus on personalised treatment. We need more studies to obtain better evidence and establish recommendations for differentiated treatment in the future.

Conflict of interest

Ms Gerontopoulou: travel expenses and congress support from Bauerfeind AG

References

[1] Rabe E, Guex JJ, Puskas A et al. VCP Coordinators. Epidemiology of chronic venous disorders in geographically diverse populations: results from the Vein Consult Program. Int Angiol 2012; 31: 105–115

[2] Darvall KA, Bate GR, Adam DJ et al. Generic health-related quality of life is significantly worse in varicose vein patients with lower limb symptoms independent of CEAP clinical grade. Eur J Vasc Endovasc Surg 2012; 44: 341–344

[3] Chang SL, Huang YL, Lee MC et al. Association of varicose veins with incident venous thromboembolism and peripheral artery disease. JAMA 2018; 319: 807–817

[4] Kluess HG, Noppeney T, Breu FX et al. Leitlinie zur Diagnostik und Therapie der Krampfadererkrankung – Entwicklungsstufe S2. Phlebologie 2010; 39: 271–289

[5] NICE clinical guideline 168.Varicose veins in the legs – the diagnosis and management of varicose veins. Issued: July 2013. http://guidance.nice.org.uk/CG168

[6] Wittens C, Davies AH, Bäkgaard N et al. Management of Chronic Venous Disease; Clinical Practice Guidelines of the European Society for Vascular Surgery (ESVS). Eur J Vasc Endovasc Surg 2015; 49: 678–737

[7] Rass K, Frings N, Glowacki P et al. Same site recurrence is more frequent after endovenous laser ablation compared with high ligation and stripping of the great saphenous vein – 5-year results of a randomized clinical trial (RELACS study). Eur J Vasc Endovasc Surg 2015; 50: 648–656

[8] Perrin MR, Guex JJ, Ruckley CV et al. Recurrent varices after surgery (REVAS), a consensus document. REVAS group. Cardiovasc Surg 2000; 8: 233–245

[9] Rass K. Crossektomie und Stripping vs. endothermische Ablation der V. saphena magna: Was können wir aus aktuellen Langzeitanalysen lernen? Phlebologie 2018; 47: 265–271

[10] Theivacumar NS, Darwood R, Gough MJ. Neovascularization and recurrence 2 years after varicose vein treatment for sapheno-femoral and great saphenous vein reflux: a comparison of surgery and endovenous laser ablation. Eur J Vasc Endovasc Surg 2009; 38: 203–207

[11] De Maeseneer MG, Vandenbroeck CP, Hendriks JM et al. Accuracy of duplex evaluation one year after varicose vein surgery to predict recurrence at the sapheno-femoral junction after five years. Eur J Vasc Endovasc Surg 2005; 29: 308–312

[12] Geier B, Hummel T, Burger P. Residual stumps as a cause for inguinal varicose vein recurrences: A multicentre study. Eur J Vasc Endovasc Surg 2008; 36 (2):207–210

[13] De Maeseneer MG, Vandenbroeck CP, Van Schil PE. Silicone patch saphenoplasty to prevent repeat recurrence after surgery to treat recurrent saphenofemoral incompetence: Long-term follow-up study. J Vasc Surg 2004; 40 (1):98–105

[14] Freis H, Geier B, Mumme A et al. Barrier patch implantation during redo surgery for varicose vein recurrences in the groin: 1-year results. Ann Vasc Surg 2016; 35: 98–103

[15] Gerontopoulou SA, Kath W, Rass K. Short-Term Efficacy of Inguinal Reoperation for Recurrent Saphenofemoral Incompetence using the Stump Suture Technique. Ann Vasc Surg 2018; pii: S0890–5096(18)30432–1. doi: 10.1016/j.avsg.2018.04.015

[16] De Maeseneer M. Surgery for recurrent varicose veins: toward a less-invasive approach? Perspect Vasc Surg Endovasc Ther 2011; 23 (4):244–249

[17] Creton D, Uhl JF. Foam sclerotherapy combined with surgical treatment for recurrent varicose veins: short term results. Eur J Vasc Endovasc Surg 2007; 33: 619–624

[18] 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: 275–282

[19] De Maeseneer M, Pichot O, Cavezzi A et al. Duplex ultrasound investigation of the veins of the lower limbs after treatment for varicose veins e UIP consensus document. Eur J Vasc Endovasc Surg 2011; 42: 89–102

[20] Hamann S, Giang J, De Maeseneer M et al. Editor's Choice- Five Year Results of Great Saphenous Vein Treatment: A Meta-analysis. Eur J Vasc Endovasc Surg 2017; 54: 760–770

[21] Ellinghaus E, Ellinghaus D, Krusche P et al. Genome-wide association analysis for chronic venous disease identifies EFEMP1 and KCNH8 as susceptibility loci. Scientific RepoRts | 7: 45652 | DOI: 10.1038/srep45652

[22] Pfisterer L, König G, Hecker M et al. Pathogenesis of varicose veins – lessons from biomechanics. Vasa 2014; 43: 88–99

[23] Hartmann K, Klode J, Pfister R et al. Recurrent varicose veins: sonography-based re-examination of 210 patients 14 years after ligation and saphenous vein stripping. Vasa. 2006; 35 (1): 21–26

[24] Stücker M, Netz K, Breuckmann F et al. Histomorphologic classification of recurrent saphenofemoral reflux. J Vasc Surg 2004; 39: 816–821

[25] Brake M, Lim CS, Shepherd AC et al. Pathogenesis and etiology of recurrent varicose veins. J Vasc Surg 2013; 57: 860–868

[26] Blomgren L, Johansson G, Emanuelsson L et al. Late follow-up of a randomized trial of routine duplex imaging before varicose vein surgery. Br J Surg 2011; 98: 1112–1116

[27] Mumme A, Hummel T, Burger P et al. High ligation of the saphenofemoral junction is necessary. Results of the German Groin Recurrence Study. Phlebologie 2009; 38: 99–102

[28] Theivacumar NS, Gough MJ. Endovenous laser ablation (EVLA) to treat recurrent varicose veins. Eur J Vasc Endovasc Surg 2011; 41: 691–696

[29] Hwang JH, Park SW, Chang IS et al. Endovenous thermal ablation of recurrent varicose veins due to residual great saphenous venous insufficiency after saphenous venous surgery: A comparative study. Dermatol Surg 2018. doi: 10.1097/DSS.0000000000001543. [Epub ahead of print]

[30] Nwaejike N, Srodon PD, Kyriakides C. Endovenous laserablation for the treatment of recurrent varicose vein disease – a single centre experience. Int J Surg 2010; 8: 299–301

[31] Rabe E, Breu F X, Cavezzi A et al. for the Guideline Group: European guidelines for sclerotherapy in chronic venous disorders. Phlebology 2013; 29: 338–354

[32] Pavei P, Ferrini M, Spreafico G et al. Ultrasound guided foam sclerotherapy of recurrent varices of the great and small saphenous vein: 5-year follow up. Veins and Lymphatics 2014; 3 (4655): 57–59

[33] Shepherd AC, Gohel MS, Lim CS et al. The treatment of varicose veins: an investigation of patient preferences and expectations. Phlebology 2010; 25: 54–65

[34] van Groenendael L, van der Vliet JA, Flinkenflögel L et al. Treatment of recurrent aricose veins of the great saphenous vein by conventional surgery and endovenous laser ablation. J Vasc Surg . 2009; 50 (5): 1106–1113

[35] Bruning G, Schinagl H. Surgical management of recurrent insufficiency of the sapheno-femoral junction using modified technique of Junod. J Dtsch Dermatol Ges 2011; 9: 646–647

[36] Bhatti TS, Whitman B, Harradine K et al. Causes of re- recurrence after polytetrafluoroethylene patch saphenoplasty for recurrent varicose veins. Br J Surg 2000; 87 (10): 1356–1360

[37] Gibbs PJ, Foy DM, Darke SG. Reoperation for recurrent saphenofemoral incompetence: a prospective randomized trial using a reflected flap of pectineus fascia. Eur J Vasc Endovasc Surg 1999; 18: 494–498

[38] Creton D. Surgery for recurrent Sapheno-femoral incompetence using expanded polytetrafluoroethylene patch interposition in front of the femoral vein: long term outcome in 119 extremities. Phlebology. 2002; 16: 93–97

[39] Winterborn RJ, Earnshaw JJ. Randomised Trial of Polytetrafluoroethylene Patch Insertion for Recurrent Great Saphenous Varicose Veins. Eur J Vasc Endovasc Surg 2007; 34: 367–373

[40] 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