"Correct" crossektomy of the great or small saphenous vein

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Keywords
Great saphenous vein, small saphenous vein, crossektomy, flush ligation

Summary
Recurrent varicose veins at the groin are mostly result due to a technical failure during the primary surgery with leaving a residual stump of the great saphenous vein. Therefore there should exist minimum requirements for a "correct" crossektomy of the great or small saphenous vein. A so called "flush ligation" with ligation of the great or small saphenous veins directly at their orifice to the deep vein is absolutely necessary. Furthermore an oversewing of the stump should prevent any contact of the endothelium with the surrounding tissue in order to prevent a so called neovascularization. Therefore an electrocoagulation of the endothelium should also be performed. Furthermore the fossa ovalis should be sutured to prevent reflux from the deep to the superficial venous system.

Schlüsselwörter
Vena saphena magna, Vena saphena parva, Krossektomie, flush ligation

Zusammenfassung
Durch die deutsche Leistenrezidivstudie zeigte sich, dass vor allem technische Fehler bei der Erstoperation mit einem zu lang belassenen Stumpf der V. saphena magna Ursache für nachfolgende Krossenrezidive sind. Daher sollten für eine korrekte Krossektomie gewisse Mindestanforderungen gelten. Dazu zählt vor allem eine bündige Ligatur an der Einmündung der tiefen Vene (sogenannte „flush ligation"). Diese ist an der saphenofemoralen Mündung unbedingt zu fordern und an der saphenopoplitealen Mündung, aufgrund der schwierigeren anatomischen Verhältnisse, anzustreben. Weiteres Merkmal einer „korrekten" Krossektomie ist eine adäquate Versorgung des Stumpfes mittels Invertierungsplastik und Elektrokoagulation des Endothels. Zudem sollte vor allem im Bereich der saphenofemoralen Mündung eine kurzstreckige (0,5–1,0 cm lange) Inspektion der V. femoralis communis sowie ein Verschluss der Fossa ovalis erfolgen.

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Introduction

The introduction of new endovenous procedures has seen conventional varicose vein surgery once again become the focus of scientific attention. Not least due to the German Groin Recurrence Study, it became apparent that technical errors in initial surgery, leaving an excessively long stump of the great saphenous vein, are the main cause of recurrence at the saphenofemoral junction (1). In order to perform correct crossectomy, therefore, certain minimum requirements should be met. As the procedure is usually elective, it should be ensured that all relevant aspects of the surgery are discussed with the patient. The possible risk of nerve damage during surgery particularly on the small saphenous vein should be addressed. The operation can be performed under general or regional anaesthesia. Pre-operative antibiotic prophylaxis is not usually necessary. In the absence of other dispositional risk factors, thrombosis prophylaxis using drugs can also be omitted (4).

Duplex-guided, pre-operative marking by the surgeon should really be obligatory. However, an Anglo-American study on the small saphenous vein, for example, did not confirm this to be the case. This study compared endovenous laser treatment with conventional crossectomy of the small saphenous vein (2). The pre-operative marking was performed by "vascular laboratory employees". Interestingly, this study showed a better outcome in the endovenous group, which is not surprising, given the infection rates of 10% in the surgical group and the absence of duplex ultrasound scanning by the surgeon (2). Nevertheless, these studies were then included in meta-analyses (3).

Postoperatively, the patients should be mobilised and compression therapy applied. In our clinic a medical compression bandage is used, which is exchanged for a medical compression stocking at check-up on the first postoperative day. We recommend subsequent compression therapy for a duration of 2 weeks, although here too, various recommendations exist (5).

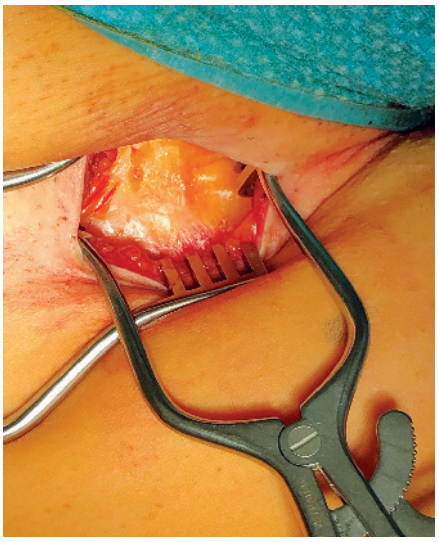

Fig. 1 Fascia of Scarpa: from here dissection is made along the longitudinal axis of the leg

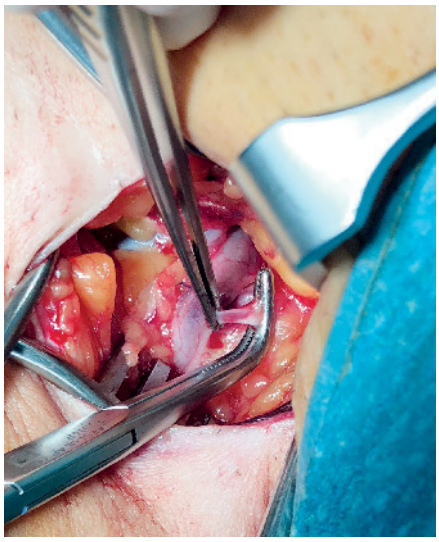

Fig. 3 Ligation of all tributaries

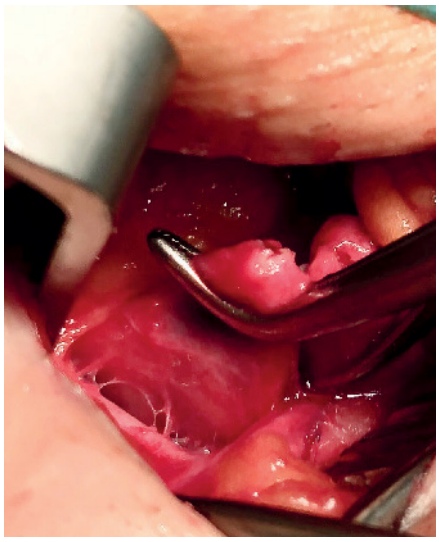

Fig. 5 Flush ligation, i.e. dividing the great saphenous vein immediately at its junction with the deep vein

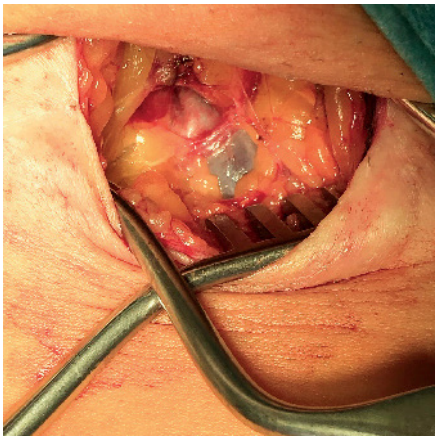

Fig. 2 Great saphenous vein with an intersecting artery

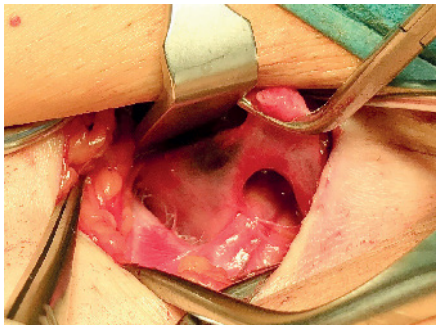

Fig. 4 Saphenofemoral junction with exposure of a short segment of the common femoral vein. The common femoral artery is laterally palpable

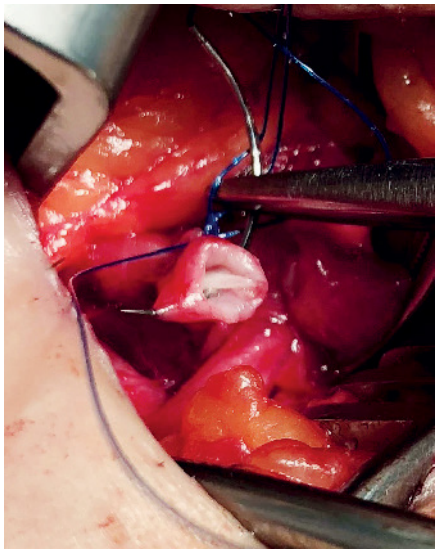

Fig. 6 Oversewing of the vascular stump to prevent recurrences, particularly neovascularisation

Surgical steps

Great saphenous vein

With the patient in the supine position and, if appropriate, with slight external rotation of the hip joint, the femoral pulse is palpated. The incision is then made medial to the palpable pulse, directly in the inguinal fold and approximately 3–4 cm in length. This subsequently leads to good cosmetic results. In obese patients, it can be advantageous, where appropriate, to make the skin incision somewhat above the inguinal fold. Subsequently, a sharp dissection is performed through the subcutaneous fatty tissue as far as the fascia of Scarpa. This is visible as a thin fibrous layer (▶ Fig. 1). Any isolated bleeding is coagulated using a cautery. As lymph nodes and lymphatic vessels are to be found below the fascia of Scarpa, further dissection should now ensue along the longitudinal axis of the leg. The fascia of Scarpa is therefore now incised longitudinally. Usually, the deeper-lying great saphenous vein is now rapidly located and good visualisation can be achieved with a second retractor (▶ Fig. 2). Although the great saphenous vein has now been identified, the established rule in vascular surgery is not to sever anything before one is certain. Therefore, the great saphenous vein is now followed further in the proximal direction. To allow better dissection, it is advisable to free the great saphenous vein from the surrounding connective tissue and then to dissect further in this layer. In particular, this allows easier visualisation of the tributaries emptying into the saphenofemoral junction and reduces the risk of damaging one of these tributaries (▶ Fig. 3). At the latest when all the tributaries at the confluence have been divided and ligated, the actual saphenofemoral junction can be visualised (▶ Fig. 4). The common femoral vein should be exposed shortly above and below its junction with the great saphenous vein, in order not

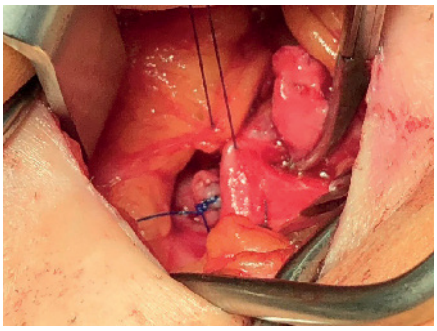

Fig. 7 Closure of the saphenous hiatus

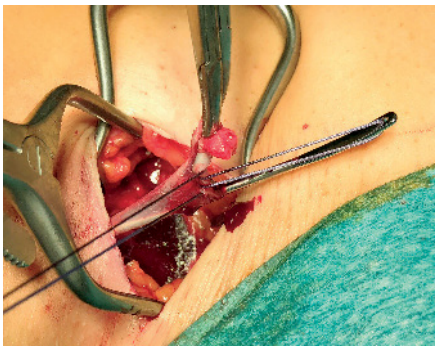

Fig. 8 Attaching the vein to the PIN stripper using a suture

Fig. 9 Invagination stripping at the distal point of insufficiency. The wire and the attached vein are brought out via a short stab incision.

Fig. 10 Pre-operative duplex ultrasound-guided marking of the incision and the confluence of the small saphenous vein and the popliteal vein (indicated by a cross)

to overlook any tributaries entering directly into the deep vein.

As a rule, this can also be performed bluntly with a dissecting swab. In particular, the external pudendal vein, which often joins the common femoral vein directly from the medial direction, should be ligated, in order to prevent subsequent saphenofemoral recurrence. If there are no more tributaries emptying directly into the common femoral vein, the great saphenous vein is divided. This is performed directly at the junction with the deep vein, as a so-called flush ligation (▶ Fig. 5). For this purpose, we use Overholt forceps and subsequent transfixion ligation. Thereafter, the residual stump is oversewn and the exposed endothelium inverted inwards. In studies, this endothelial closure according to Frings led to a reduced recurrence rate (6) (▶ Fig. 6). Many surgeons also perform electrocoagulation of the exposed endothelium to prevent any possible neovascularisation. Although the use of non-absorbable suture material is repeatedly propagated, the study by Frings showed no difference in this respect (6).

After the great saphenous vein has been divided and the stump treated, the fossa ovalis or saphenous hiatus is subsequently closed (▶ Fig. 7). Closure of this fascial gap in the fascia lata also aims to reduce any possible recurrence rates. Preliminary results from the LaVaCro study appear to confirm this procedure (7).

Stripping of the great saphenous vein is now performed. In our clinic, a perforation-invagination (PIN) stripper is used for this purpose. This is introduced into the great saphenous vein and brought out via a small stab incision at the distal point of insufficiency. The vein is now affixed proximally to a small eyelet of the PIN stripper using a strong suture and then removed by means of invagination stripping (▶ Fig. 8). Should the vein nevertheless tear off, a so-called retriever can be inserted, which works in a similar way to a stripper head of a Nabatoff vein stripper.

In general, various stripping methods have been described, although invagination stripping is less invasive on the tissues (8) (▶ Fig. 9). After the stripping manoeuvre, the great saphenous vein channel should be manually compressed, in order to prevent possible haematomas.

After ensuring that bleeding has ceased and the wound has been irrigated, the wound layers are closed individually. Firstly, the longitudinal incision of the fascia of Scarpa is closed using a Z-suture. This is followed by 2–3 subcutaneous sutures using the inverting technique, so that the knot is positioned downwards. The final step is an intracutaneous suture; the suture is removed at follow-up examination after 1 week.

Small saphenous vein

Particularly when treating the small saphenous vein, precise duplex ultrasound-guided marking is the key to success. Both the skin incision and the junction with the deep vein should be marked (▶ Fig. 10).

The patient should be placed in either the supine or lateral position. After the transverse incision, in the popliteal cavity if possible, an incision is again made as far as the fascia. In this case, however, in contrast to the fascia of Scarpa at the thigh, the crural fascia, which is significantly tougher, is

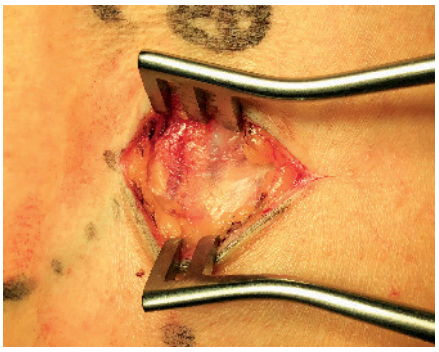

Fig. 11 View of the crural fascia

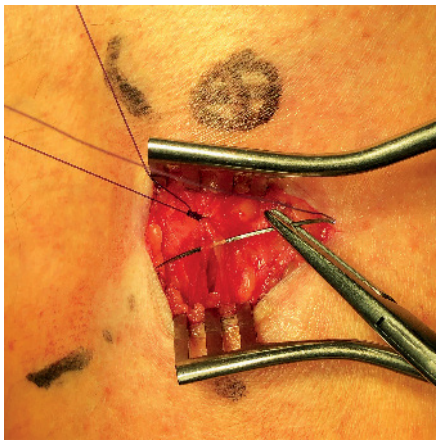

Fig. 12 Closure of the crural fascia

directly visible. A wound retractor can be used to hold the wound edges to the side, and the small saphenous vein, which usually lies immediately subfascial, is often already visible as a bluish shimmer (▶ Fig. 11). This can then be encircled or severed and followed further to the saphenopopliteal junction. This requires the leg to be flexed. Dissection of the saphenopopliteal junction should be aimed for. The question of whether muscle tributaries with large diameters should be divided and ligated remains unresolved. When dissecting the saphenopopliteal junction, attention must be paid to nerves that often intersect above or below, particularly the tibial nerve. Thereafter, the stump is treated analogously to the procedure for the great saphenous vein and the vein is stripped. The fascia is subsequently closed (▶ Fig. 12). After two or three inverting subcutaneous sutures, the skin is also intracutaneously sutured.

Discussion

In order to avoid stump recurrences, "correct" crossectomy should be performed. This particularly includes flush ligation at the junction with the deep vein. This is an essential requirement at the saphenofemoral junction and, given the difficult anatomical conditions, is to be aimed for at the saphenopopliteal junction. A further feature of a "correct" crossectomy is adequate treatment of the stump, using endothelial inversion and endothelial electrocoagulation. In addition, particularly in the area of the saphenofemoral junction, inspection of a short segment (0.5–1.0 cm in length) of the common femoral vein and closure of the fossa ovalis should be performed. The results of the LaVaCro study published to date, with clinically relevant inguinal recurrences of 1.9% after one year if these measures are adhered to, appear promising.

Conflict of interest

The authors declare that no conflicts of interest exist.

Ethical guidelines

No studies in humans or animals were conducted for this paper.

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