

# Extraluminal valvuloplasty – indication and results based on a case report

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## Keywords

Valvuloplasty, great saphenous vein, PAOD, vascular surgery

## Summary

Frequently used treatment methods for great saphenous vein insufficiency e.g. endovenous or surgical therapy, result to a destruction or removal of the vein. There exist only several methods (e.g. ASVAL or CHIVA method or external valvuloplasty) which lead to a preservation of the great saphenous vein. In this case report we describe a patient who had a femoro-popliteal bypass surgery. The great saphenous vein of the contralateral leg, which was successfully treated by external valvuloplasty 10 years ago, was used as a homograft. Intraoperatively the vein did not show any pathological changes.

## Schlüsselwörter

Extraluminale Valvuloplastie, V. saphena magna, pAVK, Bypasschirurgie

## Zusammenfassung

Die meisten der zur Verfügung stehenden Verfahren zur Sanierung einer Stammvarikose arbeiten zerstörend oder entfernend. Dies gilt sowohl für die operative Entfernung, endovenöse Katheterverfahren als auch die Sklerotherapie. Als venenerhaltende Verfahren der V. saphena magna (VSM) wurden lediglich die extraluminale Valvuloplastie, das ASVAL Verfahren sowie die CHIVA Methode beschrieben. 10 Jahre nach Durchführung einer extraluminalen Valvuloplastie konnte in unserem Hause die VSM nun erstmals als Bypassgefäß zur Anlage eines femoro-poplitealen Bypass bei einer pAVK verwendet werden. Dabei zeigte sich duplexsonographisch und intraoperativ eine gut geeignete Vene ohne postphlebitische Veränderungen.

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## Extraluminale Valvuloplastie – Indikation und Ergebnisse anhand eines Fallberichtes

**Phlebologie 2018; 47: 257–260**  
<https://doi.org/10.12687/phleb2439-5-2018>  
Received: 27. Juni 2018  
Accepted: 11. Juli 2018

## Introduction

Most of the techniques available to treat truncal varicose veins work by destroying or removing them (1). This applies not only to surgical removal and endovenous catheter techniques but also to sclerotherapy (2). Extraluminal valvuloplasty, the ASVAL technique and the CHIVA method are the only procedures that preserve the

GSV (1, 3–6). Of these, extraluminal valvuloplasty appears to be one that is most commonly used in Germany at present (1). It is based on the pathophysiological theory of “descending varicosis” (7). This assumes that incompetence of the terminal and/or preterminal valves occurs at the early stage of the disease and damage to distal segments only occurs as a consequence (2, 8). By the implantation of a plastic patch

around the vein in the region of the saphenofemoral junction, the vein diameter is reduced to a physiological size of approx. 5 mm, and thus normal functionality of the terminal and/or preterminal valves is restored (9). This stops reflux, and even the tone of the remaining GSV can be regained (5). Preservation of the GSV is the basis for any subsequent use of the GSV as a bypass vessel for aortocoronary or femoropopliteal reconstructions. A functioning GSV is crucial for the ensuing outcome. For example, the patency rate when the GSV is used instead of plastic material is far higher (10). In contrast to plastic material, venous material is also the substance of choice if an infection or inflammation is present. A detailed duplex ultrasound scan is absolutely essential when selecting a patient for an extraluminal valvuloplasty. For instance, the absence of venous valves, postphlebotic changes to the GSV or venous valves and a vein diameter of > 10 mm in women or > 12 mm in men are contraindications to the use of the technique.

Particularly suitable indications for performing an extraluminal valvuloplasty are (9):

- High Stage I truncal vein incompetence of the GSV
- Stage I truncal vein incompetence of the GSV with reflux via an accessory vein
- Truncal vein incompetence of the vein with post-thrombotic changes with free drainage through the pelvic veins
- Truncal vein incompetence of the vein in patients with peripheral arterial occlusive disease (PAOD) or coronary artery disease (CAD)

This is made very clear in the case report described below.



**Fig. 1** Minor trauma to the big toe with incipient reddening of the forefoot



**Fig. 2** MR angiography with occlusion of the left popliteal artery

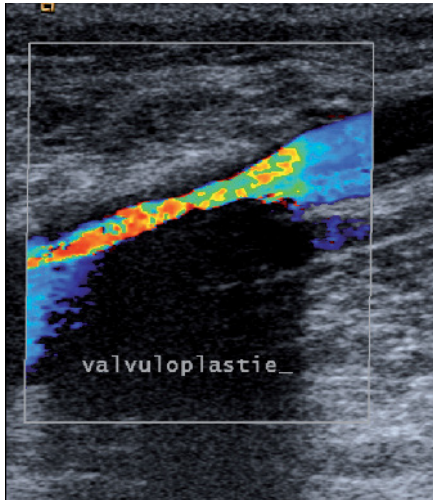
## Case report

In September 2017, a 63-old male patient attended our vascular surgery outpatient clinic as an emergency. Following a minor trauma to his left big toe 10 weeks earlier, when he had knocked it against a wardrobe, resting pain had developed that was associated with increasing cyanotic changes to the toe. An orthopaedic investigation in the meantime had shown no fracture. Clinical examination revealed a livid-coloured big toe with incipient reddening of the forefoot (▶ Fig. 1). Only a left inguinal pulse and a right popliteal pulse were detectable on palpation. The occlusion pressures on the left side were markedly reduced with an ankle-brachial index (ABI) of 0.5. Hence, even the clinical examination suggested Stage IV PAOD with critical perfusion of the extremity, and this was confirmed by imaging methods. Duplex ultrasonography showed occlusion of the left popliteal and left distal superficial femoral arteries and Doppler sonography then detected only monophasic flow signals – later confirmed by MR angiography (▶ Fig. 2). In addition, laboratory studies found an increase – albeit slight – in inflammatory parameters. In view of the clinical and biochemical findings, intravenous antibiotic treatment was instituted with a third-generation cephalosporin and urgent revascularisation was indicated. A femoropopliteal venous bypass was needed to bridge the long vascular occlusion, but previous varicose vein surgery with high ligation and stripping of the GSV meant that no suitable

vascular material was available on the left leg. However, duplex ultrasonography showed that an intact GSV was present on the right leg. Because of known risk factors for the development of PAOD in Hach Stage II truncal vein incompetence, this vein had been preserved and had undergone surgical reconstruction with extraluminal valvuloplasty 10 years earlier. A duplex ultrasound scan now showed the right GSV with an average diameter of 4.6 mm and intact valve function (▶ Figs. 3 and 4). The excellent condition of the vein as a bypass vessel was confirmed intraoperatively during the arterial reconstruction one day later. A femoropopliteal bypass from the superficial femoral artery to the popliteal artery in the third popliteal segment was performed (▶ Figs. 5–8). The operation was free of complications. The cyanotic discolouration of the toe and the associated inflammatory reaction then decreased significantly (▶ Fig. 9). The patient could be discharged from inpatient care two weeks later and then underwent regular follow-ups. After a follow-up interval of 9 months, the scar had healed normally and bypass function was satisfactory. The bypass vein showed no abnormal wall changes such as fibrosis or aneurysms.

## Discussion

This is one of the first reported cases of the successful use of the GSV for arterial reconstruction after it had previously undergone extraluminal valvuloplasty. Even 10 years postoperatively, the vein proved to be optimally suitable for use as a bypass. The intraoperative duplex ultrasound scan and clinical investigation showed none of the phlebotic changes to the GSV that have been described in long-term studies of extraluminal valvuloplasty (11). However, at present there are no long-term data as to whether veins that have undergone extraluminal valvuloplasty differ from primarily “healthy” veins in their behaviour as bypass vessels. Nevertheless, good long-term data exist for the technique of extraluminal valvuloplasty with respect to the treatment of venous insufficiency (1). For example, Joh et al described a significant reduction in vein diameter as well as a restoration of



**Fig. 3** Sonography of the venous patch 10 years postoperatively

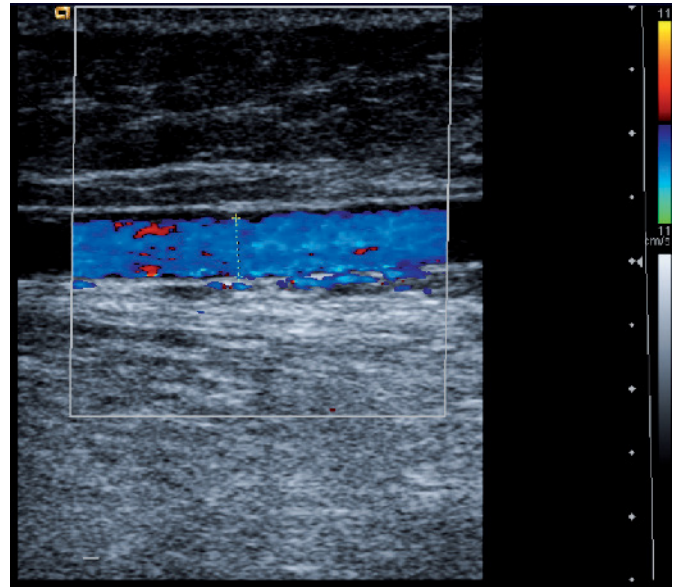
tone associated with improved venous haemodynamics 10 years after the operation (12). Therefore it can generally be assumed that as the use of extraluminal valvuloplasty becomes more widespread, in future more patients will be able to benefit from their own venous material as a possible donor vessel for autologous reconstruction.

## Conclusions

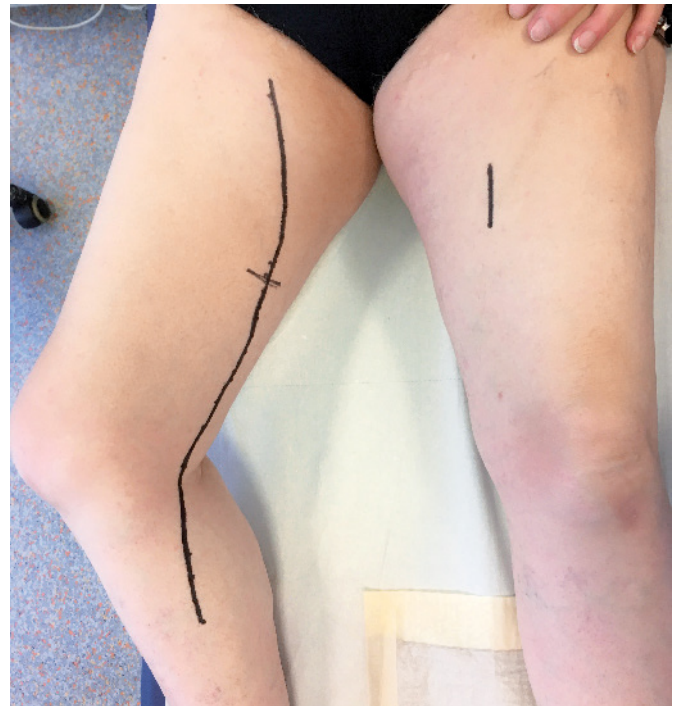
When considering the indication for treatment of truncal incompetence of the GSV in patients with atherogenic risk factors, it should be remembered that the vein is still an important vessel replacement material in cardiac and vascular surgery. The technique of extraluminal valvuloplasty enables an incompetent GSV to be reconstructed whilst preserving it at the same time. The reconstructed truncal vein is then available – if ever required – as material for small-calibre vascular replacement operations. In our example, 10 years after extraluminal valvuloplasty, the GSV used for vessel replacement showed no noteworthy degenerative changes.

## Conflict of interest

The authors declare that there are no conflicts of interest.



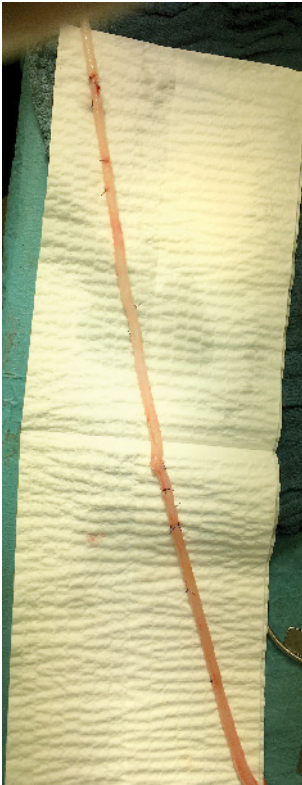
**Fig. 4** Diameter of the GSV 10 years postoperatively



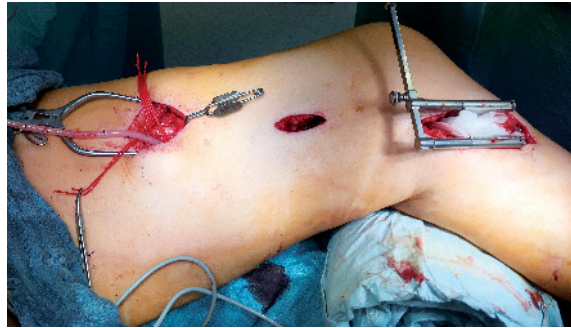
**Fig. 5** Preoperative operation planning



**Fig. 6** Intraoperative removal of the GSV



**Fig. 7** Detailed image of the GSV with no signs of postphlebotic changes



**Fig. 8**  
Arterial reconstruction



**Fig. 9**  
Postoperative result of the big toe

### Ethical guidelines

No studies in humans or animals were conducted for the manuscript.

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