Using Hpm™ roll-on cuff in varicose vein surgery

Experience of 13 775 procedures

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Introduction

The first use of a tourniquet in varicose vein surgery was described by Fischer in 1965. He initially used orthopaedic pneumatic cuffs. To achieve a bloodless field, an Esmarch rubber bandage had to be applied to the limb. The cuff pressure was set at 300 to 400 mmHg for orthopaedic and traumatology procedures; according to what is known today, this is too high and is locally traumatising. The roll-on cuff developed by Löfqvist in 1988 represented a significant improvement. This involves a relatively bloodless field, but this is adequate for varicose vein surgery and also for many other indications. Use of the Löfqvist cuff has today become the preferred method for a bloodless field in varicose vein surgery.

Technique

The use of roll-on cuffs is suitable in the surgical treatment of all forms of varicose veins. Roll-on cuffs from Hammarplast Medical AB (Sweden), Hpm™, which is the only supplier of the product, are available in sizes 25-31 cm (xsmall), 30-38 cm (small) 37-46 cm (medium), 45-56 cm (large), 55-65 cm (xlarge) and 64-80 cm (xxlarge).

The cuff is applied prior to the operation in the case of short saphenus vein surgery (SSV), side branches and in surgery on perforating veins or recurrence without re-crossectomy. However, in procedures involving crossectomy and stripping of the great saphenus vein (GSV), crossectomy must be performed first and the stripping cable introduced before the cuff can be placed on the proximal thigh. The cuff should be rolled slowly into its final position with the leg elevated, allowing the superficial and the deep veins to empty as completely as possible (Figure1). The increase in circumference, from the lower leg to the thigh, generates a pressure that empties the venous system and leads to an arterial tourniquet effect. Rubber wedges are available to fix the cuff during the operation. The cuff should be inflated to a standard of 120 mmHg. This provides adequate contact pressure to enable a bloodless field for varicose vein surgery, and other surgical or orthopaedic procedures on the limbs. The stripping procedure takes place in a bloodless field (Figure 2). This prevents direct bleeding into the saphenous canal due to tearing off of the side branches. Side branches can be removed comfortably without troublesome bleeding and with minimal incisions. Skin closure with adhesive strips (Steri-Strips) works well as the skin is usually dry.

Figure 1

When the operation is finished, a compression bandage is applied from the ankle up to the thigh. After application of the bandage, the cuff is removed. The reactive hyperaemia that now starts, with the possibility of bleeding into the saphenous canal and smaller subcutaneous channels after branch extirpation, can be largely avoided by consistent elevation of the limb for at least five minutes after release of the bloodless field and by manual compression. Additional compression of the saphenous canal by prefabricated cotton wool rolls under the compression bandage has an additional positive effect.

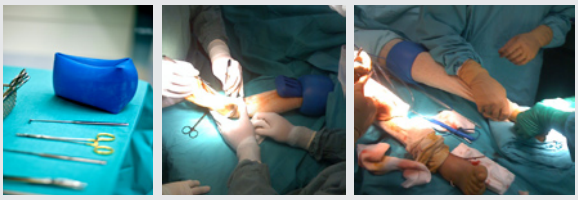
Figure 2

Results and complications

In the period from 01.04.1995 to 31.03.2009, 14,654 varicose vein operations were performed by the Krefeld venous and wound care center. 94% (n=13,775) of the procedures were performed in a relatively bloodless field produced by Hpm™ roll-on cuffs.

Throughout the period, no major intraoperative complications such as acute arterial occlusion or acute severe deep vein thrombosis (DVT) occurred.

Symptomatic and relevant deep vein thrombosis confirmed by duplex ultrasonography occurred only in 0.05% of the procedures. Routine follow-up of all patients by means of duplex ultrasonography was not performed immediately following the procedure. Investigation for thrombosis was performed only in the case of clinical suspicion and postoperative pain. All patients were followed up with duplex ultrasonography after three months. No differences were found in the results.



Postoperative bleeding complications and development of haematoma occurred more seldom in patients who underwent surgery in a bloodless field than with other techniques (e.g. cryo-stripping). The results are based on an analysis of 1,780 patient survey forms recorded as part of a benchmarking project by the Association of Office-Based Vascular Surgeons (ANG). Postoperative haematoma symptoms were given an average grade of 2.89 (range 1-6) in the case of operations in the bloodless technique. In contrast, the grade for cryo-stripping was 3.47.

Use of tourniquet in German vascular centers

If the results of "Varicose veins" quality management, the statistical register of the German Vascular Surgery Society on varicose vein surgery, are analysed, 13,163 operations out of 67,721 varicose vein operations recorded in the period 2001 to 2005 (19.4%) were performed in a bloodless technique. Thus, one procedure in five in Germany takes place with the aid of the bloodless field technique, particularly in centers with a high operation rate. At over 300,000 procedures per year, vein surgery is one of the most frequent procedures in Germany.

Use of Hpm™ roll-on cuffs in obese patients (big cuff)

The problem - The combination of venous disease and obesity is found frequently in clinical practice. The end points are severe forms of chronic venous insufficiency with recalcitrant leg ulcers against the background of obesity and loss of mobility due to reduced exercise. 63% of our patients receiving varicose vein surgery are overweight, obese or extremely obese. The average body mass index (BMI) values in an analysis of 2,077 patients (2004 to 2005) were 26.6 kg/m2 (female) and 28.0 kg/m2 (male). 41% of the women were of normal weight, 36% overweight, 21% obese and 2% extremely obese. Among the male varicose vein patients we found the following distribution: 24% of normal weight, 47% overweight, 26% obese and 3% extremely obese. The men were thus more overweight overall than the women.

Despite the fact that varicose vein surgery is generally a routine procedure for an experienced surgeon, patients with severe obesity are often surgically, as well as anaesthetically, challenging.

There is often marked varicose vein disease, particularly involving the large side branches, with advanced skin changes including ulceration. Longer operating times, an increased tendency to intraoperative bleeding and extensive postoperative haematomas are the result. Just for these patients it has so far not been possible to perform the operation in bloodless technique using a roll-on cuff. Since 2005, a new cuff (big cuff) for thigh circumferences up to 90 cm has been available.

Use of big cuff (pilot study)

In a pilot study in 2005, we performed controlled pressure measurements with the new cuff in 10 extremely obese patients. The study criteria were the intraoperative resistance of the material and evaluation of the technical handling. The pressure levels between the applied cuff and the skin surface were measured through a pressure sensor. The cuff was inflated to 120 mmHg as standard and the intraoperative blood pressure was kept to levels around 100 mmHg. With an average leg circumference of 79.5 cm and an ischaemia time of 35 minutes, a constant cuff application pressure of 218.6 mmHg was achieved, which allowed undisturbed and bloodless surgery. Since then, the big cuff has been in regular use in our centre without any problems.

Discussion

The use of a tourniquet in varicose vein surgery is controversial in the literature. The outcome of studies published so far has ranged from complete rejection to unlimited recommendation. The Cochrane meta-analysis conducted by Rigby et al., which assessed 19 studies and 20 publications on this topic, did not show a high level of evidence for the use of the bloodless procedure because of defective study design, but blood loss and haematoma were significantly reduced in many studies. In addition, there is clear treatment comfort, particularly when massive varicosis and severe obesity are combined. Haematomas can be reduced by bloodless technique with careful postoperative compression therapy. Miniphlebectomy of the side branches can be performed without troublesome bleeding (Figure 3). The required incisions are small and suturing of the individual incisions is not necessary. Adhesive dressings (Steri-Strips) approximate much better when the skin is dry. The achieved aesthetic result in our study group is "good" and is given a grade of 2.1 (1 to 6) after three months when our patients are followed up and surveyed for their opinion. The use of swabs and gauze packs is lower because of the absence of intraoperative bleeding. Current material costs can thus be reduced.

We have not found any specific complications due to use of Hpm™ cuffs either in normal-weight or in obese patients. The symptomatic thrombosis rate of 0.05% is low; a rate of between 0.15 and 0.5% is reported in the literature for

Figure 3

varicose vein surgery. Because of increased fibrinolytic activity after release of the tourniquet, thrombosis appears to occur rather more seldom than without ischaemia. It is important to observe short ischaemia times through short and safe procedures. It should not exceed one hour. Our average ischaemia time was 32 minutes. Evaluation and comparison of haematomas in venous surgery are extremely difficult and inaccurate. There are no exact measurement methods for the individual types of haematoma (canal haematoma, extensive skin haematomas). However, a few studies clearly suggest that haematomas are reduced through use of tourniquet. Postoperative haematomas rarely has clinical significance or lead to follow-up surgery. Thus, a patient self-evaluation regarding the extent of haematoma formation appears to be a quite valuable tool. Patients operated in a bloodless field complain less about haematomas than patients who were treated with other methods. The use of the cryoprobe for trunk extirpation (tourniquet not possible) leads more often in the patients' opinion to haematoma symptoms than techniques that use a bloodless technique.

Conclusions

Strict observation of operation standards such as controlled ischaemia times (maximum 60 minutes), a defined cuff pressure of maximum 120 mm Hg and an intraoperative systolic blood pressure below 120 mm Hg lead to a safe and effective use of Hpm™ roll-on cuffs even in obese patients. If the quality of the cuff diminishes because of increased stretching of the material due to its ageing process, it should be replaced quickly. Otherwise, unpleasant disruption can occur: a reduced cuff pressure and / or a rising blood pressure leads to arterial inflow while venous compression continues. Venous stasis develops, which necessitates immediate removal of the cuff with elevation and compression so that the blood loss and haematomas can be limited. A precondition for long cuff life is careful maintenance according to the manufacturer's recommendations. These include complete deflation at the end of the operation and careful cleaning and sterilisation in autoclaves (rubber programme).

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Advice: article 1 to 5 with English summary

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