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Varicose vein surgery using a pneumatic tourniquet: reduced blood loss and improved cosmesis

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A prospective controlled randomised study has been performed of 100 consecutive patients undergoing varicose vein surgery. One group underwent saphenofemoral flush ligation and multiple lower leg avulsions with the leg exsanguinated with a Rhys-Davies cuff, and ischaemia maintained with a pneumatic tourniquet. The other group underwent identical surgery but with a 30° head down tilt only. Blood loss was significantly less (13.5 ± 12 ml *vs* 133 ± 78 ml; $P < 0.01$) and postoperative cosmesis was significantly improved in patients in the tourniquet group. Operting time was similar (27 ± 11 min *vs* 30 ± 13 min) in the two groups.

A popular technique for the treatment of varicose veins of the leg is flush ligation of the saphenofemoral junction along with avulsion of the associated varicosities *(1,2)*. Bleeding using this technique may occasionally be excessive, despite the Trendelenberg position of up to 30° advocated by Cranley *(3)*. In addition, spilt blood can obscure skin marks or the operative field leading to bruising and a less than perfect result.

The use of an Esmarch tourniquet to control haemorrhage during varicose vein surgery has been described *(4)*, and recently Corbett and Jayakumar *(5)* have shown that this method can significantly reduce bleeding. However, correct application of the Esmarch tourniquet requires care and assistance. In addition, bruising may occur due to venous pooling. Our technique differs significantly from the Esmarch method, and surgeons in this unit have found it to be highly satisfactory.

To determine the efficacy of tourniquet compression we have compared the results of saphenofemoral flush ligation and multiple avulsions of associated varicose veins with that of the same operation performed after first exsanguinating the leg and operating with a pneumatic tourniquet around the upper thigh.

Patients and methods

A series of 100 consecutive patients with clinical evidence of saphenofemoral incompetence and associated varicosities were randomised to either a tourniquet or non-tourniquet group. Patients with vascular insufficiency, cardiovascular disease or chronic venous insufficiency secondary to previous deep vein thrombosis were excluded. (When suspected clinically, deep venous incompetence was identified using venography with the additional assistance of duplex ultrasound if required. Saphenopopliteal reflux is readily excluded using hand-held continuous wave Doppler.)

Twenty-one patients had bilateral varicose veins, providing 121 legs for study. Patients with bilateral disease had the tourniquet applied to the right leg, the left leg acting as the non-tourniquet limb.

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Veins were carefully marked preoperatively by the surgeon. Operative time was recorded from the time the patient entered theatre to the time the dressings were completed, and blood loss was measured by weighing swabs.

Under general anaesthesia, each leg was elevated and, in the tourniquet group, exsanguinated using the Rhys-Davies exsanguinator (*6*). This was rolled onto the surgeons arm; the patient's foot was grasped, and the device rolled up the leg, to the level of a standard orthopaedic pneumatic tourniquet. Care was taken to position the cuff as high as possible on the thigh, but low enough to gain access to the groin in a sterile field. The cuff was inflated to 500 mmHg and covered by a sterile crêpe bandage. The cuff pressure was monitored carefully throughout the operation. The non-tourniquet group were operated upon in the supine position with 30° of head down tilt.

The limbs were prepared and draped identically in both groups. Care was taken to disconnect all tributaries of the saphenous vein, and the saphenofemoral junction was ligated flush with the femoral vein. Prominent varicosities in the thigh and leg were avulsed through small vertical stab incisions made with a number 11 scalpel blade along Langer's lines. A varicosity was pulled through the skin incision with 15.2 cm Kocher forceps and then avulsed with Dunhill or mosquito forceps. Ligation was not employed in the treatment of varicosities. Groin wounds were closed with nylon or PDS® (Ethicon). Stab wounds were closed with 6 mm Steristrip® adhesive plasters; legs were then dressed identically, with gauze, crêpe and tubigrip. Patients were allowed home the next day with written instructions of expectations and suggested levels of activity to be undertaken.

Dressings were removed after 3 weeks. Six weeks postoperatively the result in terms of bruising and cosmesis was assessed by an experienced, but 'blind' observer (our Dermatology Outpatients Sister), using a linear analogue score. At 3 months patients, who were similarly 'blind', also completed a linear analogue score to assess cosmesis. Results were analysed using the Mann–Whitney *U* test.

Results

Complete information at 3 months was obtained on 101 legs, 47 having been operated on using the tourniquet and 54 without. The mean age of the groups was similar. Thirty-seven of the 54 non-tourniquet patients were female (68%) compared with 27/47 in the tourniquet group (57%).

There were no differences between the two groups in terms of indications for surgery (Table I), although patients often gave more than one reason for presentation for surgery. One criticism of the study is the lack of a formal cosmetic assessment of the severity of the veins preoperatively, but we feel that the large number of patients studied should balance this effect. No difference in the grade of surgeon performing the operation was present in the two groups (Table II), most being performed by consultants.

Table I. Main presenting complaint

	Tourniquet (*n* = 47)	*No tourniquet* (*n* = 54)
Cosmetic	25	32
Pain	42	42
Swelling/eczema	12	7
Ulceration	4	4
Bleeding	2	1

Table II. Grade of surgeon performing the operation

	Tourniquet (*n* = 47)	*No tourniquet* (*n* = 54)
Consultant A	11	14
Consultant B	12	17
Senior Registrar	13	15
Registrar	11	8

Blood loss

Mean blood loss was significantly less in the tourniquet group than in the non-tourniquet group: mean 13.5 ± 12 ml (range 1–56 ml) *vs* 133 ± 78 ml (range 5–430 ml) per leg, $P < 0.01$.

Bruising

Using the linear analogue scoring system 0–10 (0 = no bruising, 10 = maximal bruising) the independent observer found no significant difference between the two groups at 3 weeks. Mean score in the tourniquet group was 2.0 ± 2.3 (range 0–10) *vs* 2.6 ± 1.7 (range 0–8), in the non-tourniquet group.

Length of operation

The mean operative time for the non-tourniquet group was 27 ± 11 min (range 15–45 min) and was 30 ± 13 min (range 10–50 min) in the tourniquet group (P = NS).

Cosmetic result

The cosmetic result at 6 weeks as assessed by an independent observer was significantly better in the tourniquet group, $P < 0.01$ (Fig. 1), as was the mean score for cosmesis as assessed by the patient at 3 months, $P < 0.01$ (Fig. 2).

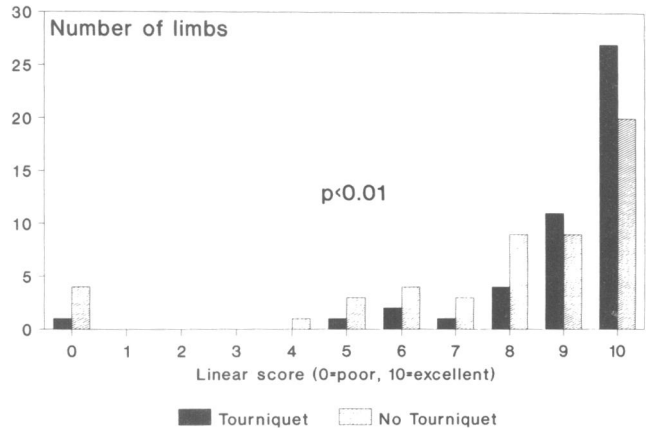

Figure 1. Cosmetic result as assessed by an independent observer at 6 weeks postoperatively.

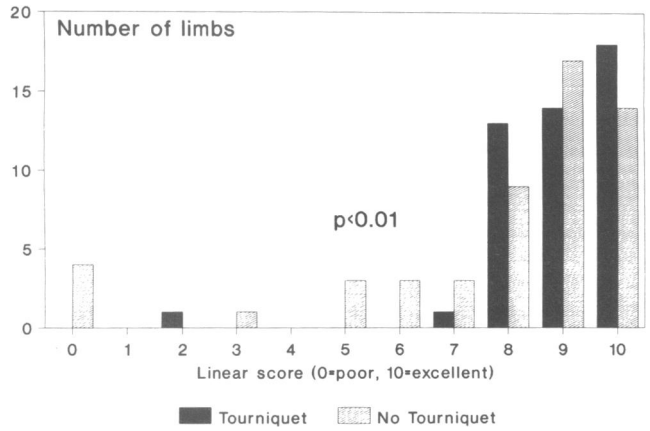

Figure 2. Cosmetic result as assessed by patients at 3 months.

Discussion

The majority of patients (>90%) in both groups were pleased with the results of their operation, scoring 9 or 10 on the linear analogue scale. However, when assessed by the independent observer at 6 weeks and by the patients themselves at 3 months, the tourniquet group scored significantly higher for cosmesis.

These results do not appear to be due to differences in grade of surgeon, as the operations were performed by experienced and less experienced staff with equal frequency in each group. Furthermore, each surgeon performed similar percentages of operations with or without the tourniquet.

There were slightly more female patients in the non-tourniquet group, and it may have been that their cosmetic expectations were higher than that of the men; however, the frequency of patients presenting with cosmesis as the main requirement for surgery was similar in each group. As previously stated, no preoperative grading of varicosities was performed. Similar numbers of avulsions were performed in each group, however, and this suggests that veins were of comparable severity.

Despite the inconvenience of applying the tourniquet, operation time was similar in each group. The 3 min difference is the same as that noted by Corbett and Jayakumar (5) using the Esmarch technique. Positioning of the pneumatic cuff was straightforward and did not interfere with surgery in the groin, and no complications were associated with its use.

The combination of the Rhys-Davies exsanguinator and the pneumatic tourniquet seems particularly safe. Not only does the exsanguinator ensure uniform compression of the leg but a pneumatic tourniquet ensures vascular compression over a large area, and so reduces the danger of neurovascular compression (7). Identification of empty veins in the tourniquet group did not cause difficulties; indeed, in patients with friable veins complete removal was possible because there was no bleeding to obscure the view. This may have resulted in the overall improvement in early cosmesis. Further follow-up studies are required to determine whether this early advantage is sustained.

Blood loss was significantly decreased by the use of the tourniquet, often to very low levels. This may be of use in minimising exposure to blood in patients who are seropositive to HIV or hepatitis. Since the study was completed the tourniquet has been used successfully in two patients who were fully warfarinised (prosthetic aortic valve and atrial fibrillation with previous mild stroke).

Some surgeons feel that recurrent varicose veins may arise from incompetent perforating veins in the thigh. If this is the case, the technique may also be used in combination with stripping of the long saphenous vein to the knee, the pneumatic tourniquet being removed and the lower leg bandaged before stripping the vein from groin to knee.

In summary we feel that this method is a useful and convenient means of improving this common operation.

We would like to thank Sister Creavy for her help in the postoperative assessment of patients.

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