

Surgical Reconstruction of Incompetent Deep Vein Valves

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ABSTRACT

Conventional treatment of deep venous insufficiency results in a rather high failure rate. The introduction of methods for surgical repair of incompetent deep vein valves has implied new possibilities for active treatment and has added increased knowledge to venous pathophysiology. This study summarizes our clinical experience with surgical reconstruction of deep vein valves during a nine-year period.

INTRODUCTION

The clinical symptoms of deep venous insufficiency represent the consequences of increased venous pressure whether caused by valvular incompetence or venous obstruction, or a combination of both. Long-term control of these symptoms may be obtained by compression therapy in combination with surgical measures, including ligation of perforating veins and stripping of the saphenous veins in selected cases.

Despite these efforts, failures are not uncommon and constitute a therapeutic challenge. Recent interest in direct vein valve surgery has been due to the fact that conventional treatment of the sequelae of deep venous insufficiency results in a high failure rate. The introduction of methods for valve reconstruction (4, 5, 8) has implied new possibilities for active treatment. These methods are based on the assumption that the construction of a competent valve in the femoral or popliteal vein will reduce ambulatory venous hypertension of the limb.

The present study summarizes our clinical experience with surgical repair of incompetent deep vein valves during a nine-year period.

PATHOPHYSIOLOGY OF DEEP VENOUS INCOMPETENCE

In primary deep valvular insufficiency (1) no postthrombotic changes are found in the deep veins. Prolaps of the valves may occur due to elongation of the cusp margins resulting in incomplete closure of the valves and a retrograde flow (4). This defect is presumably congenital and leads to early development of varicose veins, sometimes already in the adolescence (2). In some cases the valves are underdeveloped or even missing. A mild degree of reflux lacks functional importance and is often found at retrograde phlebography in patients with varicose veins. Severe reflux to the midcalf or ankle level is found in 3.5 % of patients with varicose veins (2). In such limbs the hemodynamic effects of venous reflux produce the same symptoms as in the postthrombotic state.

The secondary type is more frequent and represents the late sequelae of deep venous thrombosis with recanalization, destruction of the valves, and reflux. The degree of valvular incompetence depends on the extent of the original thrombus. In addition, incomplete recanalization results in permanent flow obstruction and frequently leads to a severely swollen and painful limb.

MATERIAL AND METHODS

Sixty-five limbs in 58 patients underwent venous valve reconstruction between March 1978 and October 1987. There were 28 men and 30 women with a mean age of 48 years (range 32-64). The indications for valve reconstruction were long-standing symptoms of venous disease, failure of conventional therapy, massive reflux, and ambulatory pressure values pointing to severe venous dysfunction. Preoperative investigations included directional Doppler examination, venous pressure measurement, and ascending and descending phlebography.

In 27 limbs with primary deep venous insufficiency direct valve repair was performed according to the method described by Kistner (4). Briefly, the procedure involves a venotomy exactly in the anterior commissure of the valve followed by shortening of the two cusps using fine monofilament sutures and magnification. This type of valvuloplasty was performed on the most proximal valve of the superficial femoral (21 limbs), common femoral (2 limbs), profunda femoral (2 limbs) or popliteal vein (2 limbs).

Transposition of an incompetent superficial femoral vein to a valve competent profunda femoral vein (5, 6) was performed in three limbs with primary valve incompetence.

In 35 limbs with secondary deep venous insufficiency a valve-bearing segment of the axillary or brachial vein was transplanted (8) and sutured end-to-end to a recanalized part of the common femoral vein (6 limbs), superficial femoral vein (6 limbs) or the popliteal vein (23 limbs). Valve surgery was not attempted in limbs with proximal outflow obstruction.

Anticoagulation therapy was used in all patients during the per- and postoperative period. Patients with secondary venous insufficiency were treated with heparin i.v. for five days followed by warfarin for three months, while patients with primary venous disease only received heparin. The duration of follow-up varied from 3 to 113 months. The patency and competence of the reconstructed valves were repeatedly evaluated with Doppler examinations and venous pressure recordings. Postoperative phlebography was performed in 45 limbs.

RESULTS

In primary deep venous insufficiency valvuloplasty resulted in competence of all reconstructed valves on Doppler examination except in two limbs with congenital defects of the valve cusps. Most patients experienced a subjective improvement in the early postoperative period, and relief of various symptoms was noted. Objectively, the venous recovery time was significantly increased to 12.5 ± 9.2 (mean $\pm$ SD) from the preoperative level of 6.5 ± 4.0 sec. ($p < 0.01$). The venous pressure reduction was improved from 40 ± 20 % to 50 ± 14 % ($p < 0.05$). The pressure values remained constant during the follow-up period, and the symptoms also showed lasting improvement. However, late recurrence of incompetence of the reconstructed valve occurred in 6 limbs (24 %) one to five years after surgery followed by return of preoperative symptoms and pressure values.

Following superficial femoral to profunda femoral vein transposition one limb was still valve competent while two limbs showed moderate incompetence.

Some modifications of the surgical technique of valve-bearing segment transplantation were made after an interim analysis of the first 18 cases. Fourteen of these reconstructions were patent and competent during the early follow-up, but constantly developed incompetence within six months after surgery. Control phlebograms demonstrated incompetence of the valves and dilatation of the transplanted segment, probably due to weakening of the arm vein wall. In addition, major differences in lumen size between the transplant and recipient veins were obtained in some cases after transplantation to the proximal veins

of the limb. This was probably the cause of occlusion in four cases. In order to reduce the difference in lumen size, and to eliminate the tendency to dilatation, the last 17 reconstructions were performed exclusively to the popliteal region including a reinforcement of the segment with a thin Dacron mesh. These modifications of the surgical technique improved the results, but still some segments have dilated with subsequent incompetence of the valve which also has been observed by Raju (7).

The long-term results of valvuloplasty and valve transplantation appear from Table I. None of the failed reconstructions during the follow-up period became worse than before operation, but the symptoms and pressure values subsequently returned to preoperative levels.

Table I. Clinical outcome of venous valve reconstruction. Mean follow-up time after valvuloplasty was 49 months and 27 months after valve transplantation.

State of reconstructed valve at follow-up	Valvuloplasty (no. of limbs)	Valve transplantation (no. of limbs)
Competent	19	11
Incompetent	8	16
Thrombosed	0	8

Minor postoperative complications occurred in nine patients, in most cases due to bleeding during the heparin treatment.

In a series of 27 limbs subjected to valvuloplasty or valve transplantation, we observed that the functional state of the profunda femoral vein determines the objective results of reconstructions of the superficial femoral vein (3). A significant improvement in pressure values was obtained in limbs with pre-operative competence of the profunda femoral vein valves, while no pressure changes occurred in limbs with incompetent profunda valves.

COMMENTS

The methods of venous valve surgery have developed during recent years, and the experiences from long-term results are limited to a few centres. During this development period attention has been paid to careful selection of patients and to objective documentation of measurable changes in venous hemodynamics. The ultimate place of deep vein valve surgery in the treatment of deep venous insufficiency remains to be carefully evaluated. At present there is clear evidence that one-level repair of a valve in the superficial femoral-

popliteal vein objectively improves the hemodynamics of limbs with incompetent valves. Furthermore, good long-term results can be expected after valvuloplasty. The late effects of valve transplantation, however, are less good at present. The principle of valve transplantation seems appropriate, but further improvement in surgical management has to be achieved.

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