The Effect of Arteriovenous Fistulas on In Situ Saphenous Vein Bypasses

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Intraoperative identification and later development of arteriovenous fistulas were investigated prospectively in 70 in situ saphenous vein bypass procedures. Surveillance was performed by completion arteriography and intra- and postoperative continuous wave Doppler examination. The intraoperative Doppler examination identified 89% of those branches with sufficient flow to opacify the deep venous system on completion arteriogram. Half of the missed fistulas underwent spontaneous thrombosis, and in only one case did the arteriovenous fistula lead to hemodynamic symptoms demanding surgical closure of the fistula. Pursuing a policy of selectively ligating fistulas that only fill the deep venous system on completion arteriography led to an additional nine arteriovenous fistulas. Developed over an average follow-up of six months, four patients presented symptoms of edema and swelling and were relieved upon closure of the fistulas. The incidence of bypass thrombosis did not differ significantly among patients with remaining arteriovenous fistulas, patients who developed fistulas during follow-up, and patients who had no signs of arteriovenous fistulas. It seems justified to continue selective intraoperative ligation of arteriovenous fistulas based on continuous wave Doppler. (Ann Vasc Surg 1991;5:419-423).

KEY WORDS: Arteriovenous fistula; saphenous vein bypass.

The preparation of the saphenous vein for use as an in situ bypass entails, among other things, interrupting those side branches that become significant arteriovenous (AV) fistulas upon arterialization of the vein. Communication with the deep venous system is either directly through perforators or indirectly through small communicating branches (Fig. 1). When the bloodstream is reversed in the arterialized vein, all perforators should be identified and ligated since the valves in these side branches are oriented in such a way that blood is allowed into the deep system. On the other hand, the valves in the communicators are oriented in the opposite way, and it is believed that these cusps can withstand the arterial pressure, or that, if they break down, they will undergo spontaneous thrombosis manifesting as a superficial phlebitis [1].

Several procedures have been proposed for intraoperative detection of side branches, including complete exposure of the vein [2-6], multiple incisions to sites of valve cusps [7], orthograde [8] and retrograde [3,6,9] saline irrigation of the exposed vein using direct vision, electromagnetic flowmetry [8,10], vascular endoscopy [11], Doppler ultrasound [12-16], and finally (as a standard method) [16,17] completion arteriography.

In 1986 the Department of Vascular Surgery at the Rigshospitalet adopted the in situ bypass technique as described by Leather and associates [17] involving routine completion arteriography. This technique involved ligature of only those side

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branches that were able to opacify the deep venous system on the completion arteriogram. Later we
came to rely upon intraoperative continuous wave (CW) Doppler identification of side branches and
only occasionally performed completion arteriography. After more than 250 in situ bypass procedures,
we felt it necessary to evaluate whether the Doppler ultrasound technique reliably identified all signifi-
cant fistulas. Moreover, we were interested in as-
seeking whether the principle advocated by Leather and associates of only ligating fistulas that were able
to fill the deep venous system was justified.

MATERIALS AND METHODS

From December 1988 to July 1989, we performed
75 in situ saphenous vein bypass procedures in 71 patients (42 men, 29 women) whose ages ranged
from 43 to 88 years (mean 69 years). Associated risk
factors were present in most patients: two (31%) had diabetes, 67 (93%) were smokers, eight (11%) had hypertension, seven (10%) had previous myo-
cardial infarction and 18 (25%) were treated for
heart failure. The indications for surgery were dis-
abling claudication in four (5%), popliteal aneurysm
in one (1%), and critical ischemia as defined by Bell
and colleagues [18] in 70 (94%). Basically, we have
employed the technique described by Leather and Karmody [17]. Proximally, the saphenous vein was
anastomosed to the common femoral artery in all
but three patients, for whom the anastomosis was
performed to the proximal part of the superficial
femoral artery. The site of the distal anastomosis
was determined from the preoperative biplane arte-
riography by choosing the least diseased artery.
The tibial vessels were used in 45 cases, the pero-
neal in 20, the tibioperoneal trunk in four and the
infrageniculate popliteal artery in six.

Intraoperative Doppler examinations were per-
formed with a CW Doppler unit*. A hand-held 8
Mhz pencil probe insonated the vein just distal to
the proximal anastomosis. The vein was then com-
pressed successively at 5 cm intervals, (starting
proximally). The presence of diastolic flow despite
distal obstruction was taken as an indicator of an
AV fistula (Fig. 2), and the side branches were
exposed and ligated. The distal anastomosis was
performed after all fistulas detectable with CW
Doppler had been closed. Shortly thereafter, com-
pletion arteriography was performed through a
proximal side branch using 20 ml of Hexabrix\(^{7}\) (320
mg/ml). One film exposed the thigh and knee region,
and the second film exposed the calf and foot.
Doppler examination was repeated following arteri-
ography. The side branches were ligated only if
arteriography showed filling of the deep veins, and
the side branch could be demonstrated at repeat
Doppler examination.

Postoperative Doppler examinations

Postoperatively, the graft was examined after
diag three hours, the next day, after mobilization of the

*Vasoflow 3, Oxford Sonicaid Ltd.
\(^{7}\)Guerbet, France.