Detection of a Twisted Saphenous Vein Graft During Femoropopliteal Bypass

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A femoropopliteal bypass was constructed with a reversed saphenous vein from the deep femoral artery to the above-knee popliteal artery in the right leg. After reinstitution of blood flow, a twist of the graft was detected by transit-time blood volume flow measurements showing zero flow. After correction of the twist at the distal anastomosis, graft volume flow was 132 ml/min.

CLINICAL HISTORY

This was a 64-year-old woman, former smoker, with a history of myocardial infarction three years earlier and at the time of surgery receiving medical treatment for mild angina pectoris and hypertension. She had no history of diabetes mellitus or cerebrovascular disease, but had a moderate asymptomatic carotid artery stenosis. The symptom in question started three years earlier with bilateral calf claudication, and she had been treated with balloon angioplasty of the right superficial femoral artery and a left-side femoropopliteal bypass reconstruction nine months earlier. She now had recurrent claudication of the right leg for four months with moderate rest pain in the foot for one month. Both femoral pulses and the foot pulses on the left side were normal, but no pulses were palpable at the knee or foot level on the right leg. The ankle/brachial indices were recorded as 0.5 and 1.0 on the right and left leg respectively. Angiography revealed patent aortoiliac, common and deep femoral arteries, but both superficial femoral arteries were occluded. The right popliteal artery was relatively normal with 2-vessel run-off. The left femoropopliteal bypass was patent.

PROCEDURE

A reversed saphenous vein bypass was performed on the patient's right leg, from the profunda femoris artery to the above knee popliteal artery (only a limited length of good-quality vein was available). Intra-operative angiography before flow was re-established revealed a nice distal anastomosis with unrestricted run-off.

FLOW MEASUREMENT

After angiography and reinstitution of flow in the vein graft, the blood volume flow was measured using the CardioMed Flowmeter (CM4000, Medi-Stim AS, Oslo, Norway). A 4 mm transit-time probe without handle was placed around the proximal vein graft providing the true volume flow in ml/min without having to calibrate the probe. Although blood pulses were excellent in the proximal graft, both flow curve and the mean flow value demonstrated no flow in the graft (Figure 1, upper panel).

The distal anastomosis was exposed, revealing a severe twist of the graft, which had been propelled to the distal anastomosis after reinstitution of flow. No pulses were palpable distally to the distal anastomosis. The graft was divided, untwisted, and re-anastomosed end to end. A further flow examination in the graft in the same position as previously now revealed a flow of

132 ml/min (Figure 1, lower panel). The pulses were now excellent at the distal anastomosis and the foot was well perfused.

The pulsatility index (PI) is defined as the difference between the systolic (maximum) flow and the diastolic (minimum) flow divided by the mean value, i.e.

$$PI = \frac{\text{Systolic flow - Diastolic flow}}{\text{Mean flow}}$$

The PI of a given flow curve can be calculated by the flowmeter and was before and after correction 740.0 and 2.8 respectively.

The operation was completed and the post-operative course was uneventful. The graft is still patent and the patient is asymptomatic two years post-operatively.

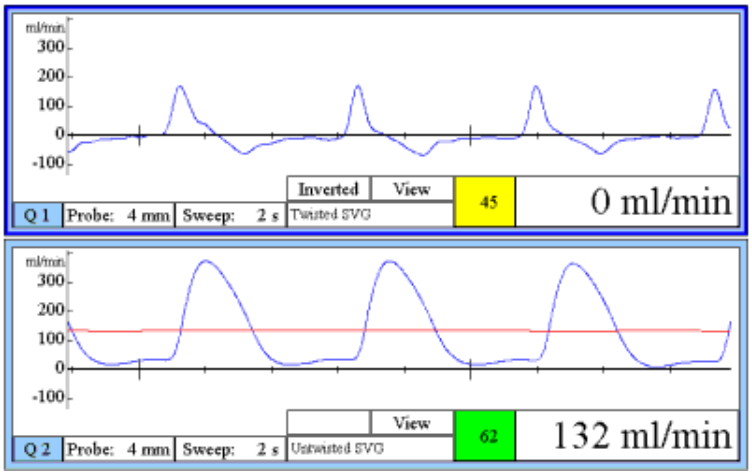

Figure 1. Blood volume flow in the femoropopliteal bypass after reinstitution of blood flow (upper panel) and after correction of the twisted femoropopliteal bypass (lower panel).

FLOW MEASUREMENTS RESULTS AND DISCUSSION

This procedure demonstrated the value of blood volume flow measurements during infrainguinal bypass reconstruction. The operation was initially controlled with intra-operative angiography, which revealed excellent run-off, and good pulses were present in the proximal graft. The twist at the distal anastomosis was detected with flow measurements. It is possible that the problem would have been detected by inspection of the distal anastomosis, but the flow measurements alerted us to this problem which might otherwise have been missed. This also points to the value of combining morphological and physiological examination of any vascular reconstruction in order to demonstrate good technical quality as well as good functioning of a vascular procedure. This has also been stressed in the consensus document produced by the European Working Group on Critical Limb Ischemia1.

Furthermore, this clinical case emphasises the need not only for palpation of the graft, as this will detect the pressure in the graft which is inversely proportional to the blood volume flow.

CONCLUSION

Preferably, any vascular reconstruction procedure should be monitored intra-operatively by morphological (angiography) as well as physiological examination (flow measurements). These quality assurance measures are fairly simple and not very time consuming if performed routinely, and are likely to improve the early as well as long-term results of vascular reconstructions.

References

European Working Group on Critical Limb Ischemia. Consensus document. European J Vasc Surg 1992; 6 (suppl. A): 1-32.

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