## Editorial

# Intraluminal and Subintimal Angioplasty for the Treatment of Claudication and Critical Ischaemia

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Critical ischaemia is a common condition[1] affecting the older generation, particularly those who smoke or who have diabetes. The risk factors for this condition are well known but the treatment options remain limited. In many patients the only treatment available is surgery. The results of surgery can be good but the mortality, especially in patients with critical ischaemia who are old and infirm, remains high[2].

Since the introduction of angioplasty by Dotter[3], the possibility of treating many of the lesions caused by arteriosclerosis by this technique has been suggested. In patients with claudication the larger arteries are in general usually affected. The problem with critical ischaemia is that only in a relatively small number of patients is the lesion caused by obstruction to the larger arteries such as the iliacs or femorals where treatment options are good. The majority are caused by occlusion of the small vessels below the knee.

### INTRALUMINAL ANGIOPLASTY

Intraluminal angioplasty of the infrainguinal vessels has not been a success. In general, the results of angioplasty are relatively poor[4] and intraluminal angioplasty of lesions other than those which are stenotic or occlusions less than 5 cms in length is not very successful except in the iliac arteries where good results can be obtained.

### SUBINTIMAL ANGIOPLASTY

This technique was invented by Bolia and his colleagues in 1988[5] and involves the intentional dissection of the femoral artery, which starts immediately above the occlusion and re-enters the lumen wherever the lumen becomes re-established. Dissections as long as 40 cms are not uncommon.

### TECHNIQUE

Very few pieces of equipment are required, a 0.35 ordinary wire, a terumo wire, a van andel catheter and a 5 french balloon suffice. The wire is passed into the femoral artery in the usual way and a van andel catheter passed over it through a sheath if that is preferred. The catheter and wire are pressed hard against the wall of the artery above the obstruction pointing away from any collaterals until a dissection is created. This is obvious by the way in which the wire suddenly enters a potential space. When this happens the wire is removed, the catheter advanced and the injection of a small amount of contrast confirms that a dissection has occurred. The wire and catheter are then pushed down the artery using forward pressure, the wire itself being the vehicle for causing the dissection. By pushing against the wire a loop of the flexible part is created and the 'hard shoulder' of the wire is the way in which the dissection is advanced. When the lumen is reformed, (this is determined by previous road mapping), the wire is pulled back and the floppy tip used to re-enter the lumen using a twisting motion. When this has been done the wire is advanced down the lumen of the artery and a 5 french balloon passed over it and the whole channel dilated using 5-10 atmospheres. It is important that the process is carried out rapidly, in less than 30 minutes, if success is to be achieved. The patient is usually heparinised and given vasodilators if spasm occurs. The appearance of the dissection is not important, what is important is the speed at which the contrast moves down the artery. Rapid transit is the key to success.

For lesions in the crural vessels the same technique is employed and re-entry is effected into a single crural vessel. It is not necessary to recanalise all three crural arteries, one is usually sufficient.

The results of this technique have been excellent over the years. We have now carried out more than 1000 such procedures in the femoropopliteal segment in patients with claudication. The technical success rate is 85% and in those where we

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are successful, the six year patency is almost 55%[6]. This refers to primary patency without surveillance. Complications have been few, only three patients in this group have had acute worsening of their condition and have been salvaged by fem. pop. grafting. Perforations are not a problem and can usually be sealed with coils or simply by removing the wire. Emboli can occur but except for the iliac arteries the thrombus can be removed by aspiration or by 'parking' the thrombus in an unimportant collateral[7].

In critical ischaemia, the technical success rate in the infrageniculate or crural vessels has been of the order of 85%, limb salvage with abolition of critical ischaemia at 1 year has been 75% and the mortality low (<10%)[8]. Recently we have examined the results at 4 years in those patients surviving. This data is not yet published. These patients do have a high mortality and a number of them die before they reach 4 years. In those patients who survive, the patency rate is only 40% suggesting that the circulation in the legs is maintained through collaterals which are opened up during the procedure and some stay patent.

In our own institution the primary treatment for any patient with critical ischaemia is subintimal angioplasty. Only in those where the technique fails is a fem. distal graft inserted. The numbers of grafts that have been performed has reduced each year and is now about 20-30 per annum in a population of about 1.5 million. Before subintimal angioplasty was used routinely, we operated on more than 100 patients per year. Subintimal angioplasty has significantly reduced our surgical work-load, is inexpensive and gives excellent results in terms of both limb salvage and patient survival. It is to be recommended as the first choice procedure in patients with claudication. For patients with critical ischaemia the complication rate has also been low. Seven patients out of over 400 interventions have required emergency operations because of an acutely worsening ischaemia[8]. In these patients only half of the limbs were salvaged. This is a very low amputation rate in a group of elderly unfit patients who would have lost the leg without intervention. We have learned that patients who have recent thrombus present should not be dealt with by subintimal angioplasty, particularly if a good run off is available as embolisation and conversion to acute ischaemia can occur. Thrombolysis prior to angioplasty could be tried in this group but we have not yet done so.

Subintimal angioplasty should be regarded as the first invasive treatment for patients with claudication for critical ischaemia. The results are good and the complications few. It has not as yet been compared with surgical treatment in a randomised study.

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