Angioplasty of occluded coronary arteries: is it worth the effort?

The angiographic appearance of a coronary stenosis to a large extent determines the chances of success of percutaneous transluminal coronary angioplasty (PTCA). An occluded coronary artery poses problems because the morphology of the lesion cannot be fully assessed. Little or no information is available on lesion length and eccentricity and the vessel distal to the site of occlusion may conceal additional stenoses that can prejudice a successful result. With such imperfect information available before the procedure it is not surprising that the reported primary success rates for angioplasty of occluded coronary arteries are not as good as those for angioplasty of stenotic lesions. Nevertheless, there is evidence that angioplasty is being performed on an increasing proportion of occluded coronary arteries. In the United Kingdom this may be prompted by expanding surgical waiting lists, an increased readiness to perform angiography in patients with recent myocardial infarction, and a reluctance to do bypass surgery on patients with single vessel disease.

The reported primary success varies, but rates approaching 80% have been reported in selected patients by experienced operators. However, the average for published reports is around 65%. It has been reported that the primary success rate has not improved over the years. However, it is likely that there has been some improvement because early reports may have falsely inflated the success rates by including functional occlusions. It is likely that these represent severe coronary stenoses—in which the primary success rates were similar to the results of angioplasty of subtotal stenoses. More recent reports have concentrated on experience with totally occluded arteries. Despite the definition of occlusion becoming more rigorous, the success rates for angioplasty have remained constant, suggesting a net overall improvement.

Angioplasty of occluded coronary arteries is potentially a more lengthy procedure than conventional PTCA. This is reflected by the practice of using a "stepped" approach to equipment selection. Conventional guide wires of increasing stiffness and size are used to cross the occlusion if one fails. While this strategy improves the chances of ultimate success, it is expensive to use two or three wires with assorted probing catheters and balloons.

The use of specially designed equipment has improved the reported primary success rates and reduced procedure time. In a prospective randomised study the Magnum wire/Magnarail system was better than conventional equipment in PTCA of occluded vessels. Such systems are more expensive than conventional equipment but they may work out cheaper than the stepped approach. Recent experience with dedicated equipment by experienced operators seems to have improved the primary success rates to about 70%–75%.

Occlusion angioplasty has been advocated as "safe" based on the premise that a persistently occluded artery is unlikely to produce clinical deterioration. However, Ruocco et al., reporting the experience of National Heart, Lung and Blood Institute (NHLBI), suggested that the serious complication rate was similar to that of PTCA of subtotal stenoses. The risk of death, infarction, or urgent coronary surgery was 6% for single vessel and 9% for multivessel procedures. Others have confirmed that the complication rates are low but not zero. Extensive intimal dissection with occlusion of a side branch, coronary perforation, and distal embolisation have all been reported and may cause ischaemia and haemodynamic collapse. The artery may reocclude but collaterals usually prevent Q wave infarction, though subendocardial infarcts have been reported. Abrupt vessel reclosure may therefore remain undetected. Unlike conventional procedures where failure is usually secondary to abrupt vessel closure, failure after occlusion angioplasty is normally the result of an inability to cross the lesion and usually produces no adverse sequelae.

A collateralised occluded artery is functionally equivalent to a 90% stenosis. Thus the commonest indication for occlusion angioplasty is angina or provokable ischaemia. Successful recanalisation, however, has been shown to improve left ventricular dysfunction and thus a proportion (up to 13%) have been performed in the hope of reviving hibernating myocardium. Not all occluded arteries are suitable for attempted recanalisation. The presence of an arterial "lead" was shown to be a favourable feature as was a relatively recent occlusion. Tapered, short occlusions consist histologically of loose fibrous tissue which may allow a guide wire to pass relatively easily. Long, chronically occluded, calcified arteries with a complex network of bridging collaterals are less suitable. Occluded saphenous vein grafts are rarely reopened even when adjuvant thrombolytic therapy is given. Extensive collateralisation of the index artery has advantages and disadvantages. On one hand, retrograde opacification to the point of the occlusion allows the length of the occluded segment to be assessed and provides information on distal stenoses. However, it also implies a high distal coronary "wedge" pressure which may impede antegrade flow and favour reocclusion. Stone et al, in contrast, reported that neither the duration nor the length of occlusion predicted an unfavourable outcome. Similarly arterial calcium was not an adverse feature in this series.
After a successful procedure 63–66% of patients noted an immediate improvement in symptoms and exercise tolerance. This is comparable to the NHLBI results of multivessel angioplasty but is less than with single vessel PTCA of subtotal stenoses. Long-term efficacy has been measured in terms of angiographic recurrence, and clinical outcome. The studies of angiographic recurrence suggested a high recurrence rate. Between 54% and 77% of lesions returned and 12% to 25% of them were recurrences. The results of long-term clinical studies were generally more encouraging. More than 75% of patients who had a successful procedure had a long-term clinical success (freedom from death, myocardial infarction, or repeat intervention) and around 90% experienced no or only minor angina. Coronary surgery was also less likely to be necessary than in the group in which recanalisation failed. Angina state and myocardial infarction were similar in both groups, presumably because of the use of surgery in the group with unsuccessful angioplasty. The reason for the discrepancy is uncertain. Angiographic studies have tended to be smaller or have relied on incomplete angiographic follow up. Thus they may have overestimated recurrence by concentrating on patients with symptoms.

It is perhaps cautious to consider the NHLBI experience. Patients who had a successful occlusion angioplasty had higher mortality after two years follow up than patients undergoing subtotal occlusion PTCA. The effect persisted despite correction for left ventricular function. This may be the result of asymptomatic recurrence. Others suggested that an isolated occlusion is not benign. Thus, though collaterals may prevent acute infarction, the myocardium may be unable to tolerate an additional occlusion in another vascular territory, particularly if this vessel is feeding the collaterals. However, other large scale studies have suggested that mortality in the group as a whole (after both successful and unsuccessful attempts) is low, with 90–96% alive at four years. Myocardial infarction as a manifestation of recurrence is, however, rare.

In summary, balloon recanalisation of coronary occlusions should be considered in the light as other complex interventional procedures. While the initial success rates are not as high as those for "simple" PTCA, a satisfactory outcome can be achieved in most selected patients. This is particularly true if the operator is experienced and prepared either to change apparatus if unsuccessful or to use dedicated equipment from the outset. Patients should be informed that the serious complication rates are comparable to those of other angioplasty procedures though failure is less likely to produce catastrophe.

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