Coronary artery bypass graft (CABG) surgery is the most frequently performed cardiac surgical operation. Excellent conduit is a vital ingredient, and meticulous surgical technique is crucial. Unfortunately the perfect conduit for CABG is not available. The following criteria have been suggested. The conduit should be easily available in adequate quantity. Harvesting should entail no morbidity. It should not suffer rejection, degeneration or stenosis. It should be cheap. It should have excellent flow characteristics and not be affected in an adverse way by endogenous or exogenous factors.

Well established options include the long and short saphenous vein and internal thoracic artery. The internal thoracic artery in particular is resistant to atherosclerosis with excellent long-term patency even when re-used. Other conduits for which there is variable use are the cephalic vein, radial, gastroepiploic and inferior epigastric arteries. Carpenter first reported use of the radial artery in CABG in 1973. Initial optimism was dampened by the effects of vasoconstriction and high early occlusion rates. Over the last decade the technique has been refined with the artery being gently harvested with its surrounding fascia and veins, minimal iatrogenic distension and the use of pharmacological vasodilators. With these modifications the radial artery has been shown to have an angiographic patency rate of 83% at 5 years.

Advantages associated with the radial artery also include harvest from a site which has good collateral blood supply and nervous innervation and a more favourable microbiological environment than the leg. As a consequence the radial harvest site is less prone to infection, neurological injury, delayed healing and prolonged oedema than the saphenous vein. There is also increasing experience of its use in the elderly, a group in which it may have a satisfactory safety profile and in whom there is often a shortage of other conduit. In addition it appears to share some of the prognostic advantages associated with the internal thoracic artery. As disadvantages it can only be used as a free graft, and as an artery with a high muscle to elastic ratio and alpha adrenoceptor function is prone to spasm, which may have serious consequences particularly in the early postoperative period. Therefore the paper by Harrison et al. in this issue is a welcome investigation of radial artery optimisation for CABG.

In current surgical practice it is well established to use vasodilators peri-operatively in the preparation of conduit and these may be applied topically or endoluminally or both. Popular choices include papaverine, verapamil and to a lesser extent sodium nitroprusside and phenoxybenzamine. Vasodilators may be used at the time of harvesting, for a brief period between harvesting and implantation, and...
topically after implantation. In addition during the postoperative period systemic vasodilators such as glyceryl trinitrate and calcium channel blockers are commonly used with the rationale of preventing graft spasm. A potential adverse effect of these agents, in addition to the persisting effects from pre-operative agents such as angiotensin converting enzyme inhibitors, angiotensin receptor inhibitors and K-channel openers, is vasodilatation leading to clinically important hypotension. Strategies which would allow inotrope use but protect CABG conduit from spasm particularly during this period are likely to be of benefit. In this situation phenoxybenzamine may be an excellent choice since it offers long-acting non-competitive alpha-adrenoceptor blockade, potentially allowing safer use of higher inotrope concentrations. In addition it may be less toxic than papaverine, to which it has been compared in this investigation. Papaverine is known to be highly acidic, and even the dilutions used in clinical practice have a pH which ranges from 4·55 when diluted in isotonic crystalloid solution to 7·33 when advantage is taken of the buffering offered by dilution in the patients own whole blood[8].

Even though this paper elegantly demonstrates the basis for vasodilatation observed with phenoxybenzamine it is still important to evaluate and implement the optimal conditions required for long-term patency. Antiplatelet therapy, beta-blockade, HMG CoA reductase and ACE inhibitors have all been associated with a reduction in post CABG event rates and with improved survival. It will be important to evaluate whether peri-operative use of vasodilators or other agents are beneficial in vivo and in terms of prognosis. New strategies to prevent conduit stenosis also include molecular therapies using peptide or gene therapy. Using a variety of transfer methods these agents may be delivered to the conduit itself or delivered locally to the myocardium or to the distal vascular bed. Several strategies have been pursued which seek to prevent the proliferative response which may lead to early graft failure from neointimal hyperplasia or accelerated graft atherosclerosis[9].

Returning to Harrison’s paper supporting the role of phenoxybenzamine, it now becomes important to complete the relevant safety studies for this agent in this role and to evaluate any longer term benefits conferred on graft patency. The benchmark that the other innovations discussed in this editorial will have to meet before they become part of routine CABG will also be the long-term graft patency and patient outcome of ideally prepared autologous conduit, a process which itself is in evolution. These operative steps could be supported by surgically delivered adjuvant myocardial salvage and neo-vascularization using stem cell and molecular therapy[10]. Together these may reduce the duration of hospital stay, morbidity, be cost effective, and provide excellent long-term results.

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References