Editorial

Should balloon angioplasty be used instead of surgery for native aortic coarctation?

Several groups have used transluminal balloon angioplasty of native aortic coarctation to treat aortic coarctation since the technique was first described in the early 1980s. Arguments about whether balloon angioplasty is an effective and safe alternative to surgery have been intensified by reports that aneurysms develop at the site of coarctation dilatation. This editorial sets out the evidence that supports the use of balloon angioplasty as an alternative to surgery.

Is it effective?
The effectiveness of balloon angioplasty can be evaluated by examining the immediate and follow up results in neonates, infants, and children. The immediate effectiveness is judged on the basis of relief of pressure gradients across the coarctation, the lack of need for immediate surgical intervention, and improvement in symptoms. In 67 patients treated by us, peak-to-peak systolic pressure gradients were significantly reduced from 48 (17) (mean (SD)) to 11 (9) mm Hg immediately after balloon angioplasty. Our results accord with the results of other workers. The reduction in gradient was impressive in all age groups: neonates (<30 days), infants (1 to 12 months), and children (>1 year). Symptoms related to congestive heart failure and/or hypertension, the indications for balloon angioplasty, were relieved and only three (6%) of 47 neonates and infants described in published reports, and none from our group, required immediate surgical intervention.

The results of intermediate term follow up indicate that the excellent reduction in gradient was maintained for the group as a whole, but when results of individual patients were scrutinised, recurrence (generally defined as peak-to-peak gradient >20 mm Hg) was found to be more common in neonates and infants. The restenosis rate was particularly high in the neonates; in a pilot study in 10 consecutive neonates Redington et al found recoarctations in 5 (71%) of the 7 patients in whom there had been excellent relief of obstruction immediately after balloon angioplasty. They concluded that balloon angioplasty for native aortic coarctation was an unrewarding procedure and that their data did not support the continued use of this technique in neonates. In infants the recoarctation rate was high (about 40%) but is not as high as that seen in neonates. I believe that though the rate of recurrence in neonates and infants is high, balloon angioplasty relieves symptoms and spares the infant a thoracotomy. Recoarctation can be treated with repeat balloon angioplasty or surgery at a later date when the patient is older and in a stable condition. Recurrence in children is low.

There are only two long-term (>5 years) follow up studies, and these showed that there was little further recurrence beyond what was observed in the intermediate term (<1 year follow up), an occasional need for re-intervention, and generally well controlled blood pressure.

Our experience and a review of published reports suggest that balloon angioplasty is effective in relieving aortic coarctation.

Is it safe?
The safety of the procedure may be evaluated by examining the mortality and complication rates, both immediately after the procedure and at follow up. Both immediate and late deaths have been reported in neonates undergoing balloon angioplasty of aortic coarctation. With rare exceptions, these were caused by the associated cardiac defects and not the balloon angioplasty. There were no deaths in older patients.

Arterial complications are likely because balloon-carrying catheters have to be inserted into the femoral artery. Surprisingly, acute arterial compromise (loss of pulse or decreased perfusion) has been minimal. Follow up evaluation showed partial (6%) or complete (8%) occlusion of femoral arteries but without limb growth abnormalities. The arterial complication rate may be further reduced by the recent availability of smaller sized and low-profile balloon catheters. When feasible the umbilical artery should be used in the neonate.

Aneurysms formed at the site of aortic coarctation dilatation in 5-10% of patients. Some were related to angioplasty, but most were probably the result of structural abnormalities of the aortic wall and/or our inability to deliver “controlled injury” to the coarctate aortic segment. The development of aneurysms after balloon therapy is a cause of concern, but aneurysms also occur after coarctation surgery. Late aneurysms have developed most often after repair with synthetic onlay patch grafts, but also have been reported after all other types of repair. In an excellent study Pinzon et al reviewed 215 angiograms performed 4-2 (4.1) years after surgical repair of aortic coarctation. They found aneurysms in 64 (30%). The incidence was similar in all three types of commonly used repair methods: 27% (26 of 97) with resection and end-to-end anastomosis, 32% (29 of 92) with subclavian flap repair, and 35% (9 of 21) with synthetic onlay patch repair. These data show that aneurysms occur after all forms of treatment, not solely after balloon angioplasty. They also occur without intervention.

Mortality and complication rates after balloon angioplasty are within an acceptable range and the procedure may be regarded as safe.

Comparison with surgery
The number of studies comparing the balloon angioplasty procedure with surgical intervention is limited. In an attempt to compare the safety and efficacy of balloon angioplasty with that of surgical correction of aortic coarctation, we scrutinised 49 papers (published 1980–1991) reporting on the results of surgery in infants <1 year of
Some of the complications, namely, recoarctation, aneurysm formation, and femoral artery compromise, have been discussed above. Other complications such as paraplegia and paradoxical hypertension are often seen after surgical repair whereas such complications are rare if present, very mild and inconsequential after balloon angioplasty.

The review of published studies17,31 suggests that mortality is similar (and probably related to the associated cardiac defects rather than the type of intervention performed) and morbidity and complication rates are lower with angioplasty than with surgery. Balloon angioplasty seems to be an effective alternative to surgery for the relief of aortic coarctation.

Conclusions
The data that I have reviewed show that balloon angioplasty is an effective procedure in relieving the obstruction and the attendant symptoms caused by native coarctation. Mortality and complication rates after balloon angioplasty are not high, and therefore the procedure may be considered safe. There is a significant incidence of recoarctation in the neonate and young infant. But the important feature of balloon angioplasty in the neonate and young infant is that, because it relieves symptoms of heart failure and hypertension, it helps to avoid immediate surgery. Recurrence, should it occur, can be treated by repeat balloon angioplasty or even surgery when the infant is stable and less acutely ill. The development of aneurysms at the site of balloon angioplasty is a cause for concern and patients in whom aneurysms develop should have periodic evaluation of their size or surgical resection should be performed. Aneurysms, though of concern, have also been seen after all varieties of surgical correction. Comparison with surgery, though limited, has similar mortality and recurrence rates but with less morbidity in the balloon group than in the surgical group. Because balloon angioplasty requires fewer days in hospital it is likely to cost less. These data indicate that balloon angioplasty is an effective and safe alternative to surgical treatment of native coarctation.

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