Comparison of hospital charges for balloon angioplasty and surgical repair in children with native coarctation of the aorta


Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
Balloon angioplasty in children with native coarctation of the aorta.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Children with native coarctation of the aorta. Patients were excluded if they were aged under 1 year, had coexisting cardiac pathology that required concurrent surgical repair, or had long-segment coarctation of the aorta not amenable to balloon angioplasty even if they underwent surgical repair.

Setting
Secondary care, namely CS Mott Children's hospital. The economic study was conducted in Ohio, USA.

Dates to which data relate
Effectiveness data were collected between January 1990 and December 1994. Cost data relate to the same period. The price year was not given.

Source of effectiveness data
Effectiveness data were derived from a single study.

Link between effectiveness and cost data
Costing was undertaken retrospectively on the same patient sample as that used in the effectiveness analysis.

Study sample
45 children treated for native coarctation were divided into 3 treatment groups according to the preference of the patient's cardiologist: 26 underwent balloon angioplasty only (BA), 15 underwent primary surgical repair (SR1) and 4 underwent elective surgical repair after a previous balloon angioplasty (SR2). Groups were similar in age, weight and pre-procedural blood pressure gradients, (p<0.05). No power calculations related to the sample size were performed.

Study design
The study was a non-randomised retrospective trial with concurrent controls.

**Analysis of effectiveness**
The analysis of effectiveness was based on treatment completers only. The main health outcomes used in the analysis were postprocedural peak systolic blood pressure gradients, satisfactory gradient relief rate, length of hospital stay, and complications. Peak systolic pressure gradients were measured from ascending to descending aorta pressure tracings before and after balloon angioplasty or by cuff blood pressure measurements in the upper and lower extremities at admission and discharge for those who underwent surgical repair.

**Effectiveness results**
The effectiveness results were as follows:

Postprocedural systolic blood pressure gradient after balloon angioplasty (expressed as mean +/- SE) was 14+/- 2 mm Hg, which was significantly higher, (p<0.001) than in the surgical groups (3+/-1 for SR1 and 1+/-1 for SR2).

Satisfactory gradient relief (defined as residual gradient <20 mm Hg) was observed in 18 of 26 patients (69%) who underwent balloon angioplasty, compared to satisfactory gradient relief in all surgical patients.

The average length of stay was significantly shorter, (p<0.001) in the balloon angioplasty group (1+/-0 days) than in the two surgical groups (SR1 7+/- 1 days and SR2 5+/- 1 days).

In the BA group, a decreased femoral pulse was noted in 3 patients who required heparin therapy and 1 patient developed a small aortic aneurysm at the site of the coarctation, which was not progressed in the follow-up.

In the SR1 group, 4 patients had paradoxical hypertension requiring antihypertensive therapy, and there was one episode each of postoperative seizure, chylothorax, and haemorrhage requiring re-operation. Transient Horner’s syndrome occurred in 3 patients in group SR1 and 1 patient in SR2 (the only complication noted in SR2).

**Clinical conclusions**
The authors conclude that balloon angioplasty was associated with fewer complications than surgical repair, thus making it a safe procedure.

**Modelling**
The authors propose a treatment strategy consisting of balloon angioplasty followed by surgery if necessary. To evaluate the estimated hospital charges associated with this strategy, the following model was assessed: strategy charge = $3,995 + ($21,393 x 31%), where the strategy charge equals the mean hospital charge for patients treated with balloon angioplasty and the mean hospital charge for surgery in the proportion who failed balloon angioplasty with a residual gradient >/= 20 mm Hg. The key assumptions used in the model are detailed under Key Assumptions.

**Estimates of effectiveness and key assumptions**
The model used for estimating the proposed strategy charge was based on 4 key assumptions: previous balloon angioplasty does not adversely affect the outcome of subsequent surgical repair, surgical repair is 100% successful in relieving coarctation, diagnostic catheterisation is never performed before primary surgical repair, and balloon angioplasty charge, surgical repair charge and balloon failure rate are representative of the true charge and failure rate.

**Measure of benefits used in the economic analysis**
The authors did not provide a summary measure of benefits; as such, a cost consequences analysis was conducted and the reader is referred to the effectiveness results reported above.
Direct costs
Direct health service costs were considered in the analysis, namely hospital charges. These included room rates and nursing care, operating room or catheterisation laboratory charges, anaesthesia supplies and recovery room charges and miscellaneous charges. Professional fees (cardiologists, surgeons, anaesthesiologists and radiologists) were not included in the analysis. Costs were not discounted.

Statistical analysis of costs
Group comparisons were performed using analysis of variance. A p value <0.05 was considered to be statistically significant.

Indirect Costs
Indirect costs were not considered.

Currency
US dollars ($).

Sensitivity analysis
A one-way sensitivity analysis was performed in order to determine the break-even point at which the hospital charge of the proposed strategy was no longer lower than with the strategy of surgery alone.

Estimated benefits used in the economic analysis
The reader is referred to the effectiveness results reported above.

Cost results
Hospital charges per patient were $3,995 +/- $233 for BA, $21,393 +/- $1,515 for SR1 and $16,166 +/- 1,719 for SR2 (this latter result includes only the surgical repair charge). The mean hospital charge per patient would be $10,627 for the strategy proposed by the authors of balloon angioplasty followed by surgery where necessary. The break-even point, at which the hospital charge was no longer lower than with the strategy of surgery alone ($21,393) occurred at a balloon rate failure of 81%.

Synthesis of costs and benefits
Costs and benefits were not combined due to the cost-consequences approach adopted.

Authors' conclusions
Balloon angioplasty for native coarctation of the aorta in childhood is associated with significantly lower hospital charges, shorter length of stay and fewer complications than surgical repair. Satisfactory gradient relief occurs less often with balloon angioplasty than with surgery. Previous balloon angioplasty does not increase hospital charges or complications of surgical repair if required. Therefore, a treatment strategy of balloon angioplasty as the initial procedure and subsequent surgical repair if necessary appears to be justified.

CRD COMMENTARY - Selection of comparators
The reason for the choice of the comparator was clear (balloon angioplasty versus surgical repair), as both health technologies are widely used in the authors' setting. You, as a database user, should consider if the same applies to your own setting.
Validity of estimate of measure of benefit
The authors did not provide a summary measure of benefits; as such, a cost consequences analysis was conducted and the reader is referred to the effectiveness results reported above. These effectiveness results should be viewed with caution due to the fact that no power calculations relating to the sample size were performed, the allocation of patients to different groups was not randomised and the study was retrospective.

Validity of estimate of costs
Costs were presented in detail, but not discounted. Also, professional fees, which are likely to have impacted significantly on the cost results, were excluded from the analysis.

Other issues
The cost results may not be generalisable to other settings or countries. In terms of comparisons with other studies, a prospective randomised trial referenced (Shaddy et al. 1993) reported different results regarding complications, and concluded that there was a higher risk of aneurysm formation and possibly restenosis after balloon angioplasty compared to surgery.

Implications of the study
Further follow-up is necessary to determine the long-term risks of post-angioplasty aneurysms.

Source of funding
None stated.

Bibliographic details

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Other publications of related interest

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Subject indexing assigned by NLM

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