Bicaval versus standard technique in orthotopic heart transplantation: a systematic review and meta-analysis

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CRD summary
This review, which compared the effectiveness of the bicaval and the biatrial (standard) techniques in orthotopic heart transplantation, concluded there was evidence of beneficial effects favouring the bicaval technique. The authors' conclusions should be interpreted somewhat cautiously due to the limitations of the studies included in the review.

Authors' objectives
To compare the efficacy of the bicaval and the biatrial (standard) techniques in orthotopic heart transplantation surgery.

Searching
MEDLINE and EMBASE were searched from inception to August 2006. Search terms were reported. The Cochrane Database of Systematic Reviews was also visited. The following journals were handsearched from 1999 to June 2005: Annals of Thoracic Surgery, European Journal of Cardio Thoracic Surgery, Journal of Heart and Lung Transplantation, and Journal of Thoracic and Cardiovascular Surgery. Reference lists of recent reviews were examined for further studies. An experienced cardiovascular surgeon advised on further literature and research groups not covered by other searches. Studies were restricted to those published in German or English.

Study selection
Studies of patients of any age that evaluated orthotopic heart transplantation using the bicaval technique were eligible for inclusion. Randomised controlled trials (RCTs), and observational, prospective, and retrospective studies were all eligible. Case reports and series were excluded.

In included studies, the techniques used were either standard or bicaval on mostly male (80%) patients whose ages ranged from 14.8 to 58 years. The most common underlying illnesses were ischaemic or dilated cardiomyopathy and valvular heart diseases. Intra-operative ischaemic time, use of temporary pacemaker, and assessment of tricuspid valve regurgitation, were commonly reported as outcomes.

Two reviewers independently selected studies for inclusion.

Assessment of study quality
Studies were assessed by one reviewer using a standardised form which recorded details of randomisation, eligibility criteria, allocation concealment, blinding, statistical methods, baseline characteristics, and handling of losses to follow-up.

Data extraction
Data were extracted by one reviewer and the odds ratios (OR), or weighted mean differences (WMD), were calculated with 95% confidence intervals (CI).

Methods of synthesis
Where possible, studies were pooled in a meta-analysis using a fixed-effect model, or a random-effects model when significant heterogeneity was found. Heterogeneity was assessed using the Cochran Q test. Sensitivity analyses were performed omitting influential studies. When meta-analysis was not appropriate, a narrative synthesis was undertaken. A funnel plot was used to assess publication bias.

Results of the review
Forty-one studies were included in the review. Twenty three studies were retrospective (n=1,473 patients). Eighteen studies were prospective (n=623 patients). In the prospective studies, around half the studies stated they were randomised, but nearly all had inadequate methods for randomisation/concealment of allocation. Prospective study
sample sizes were generally small and, in all but two studies, the treatment groups were comparable at baseline. Most of the retrospective studies provided eligibility criteria and had a control group.

**Prospective studies meta-analysis:** The bicaval technique appeared superior to the standard biatrial technique for early atrial pressure (WMD -3.95 mmHg, 95% CI: -6.50 to -1.40; three studies), perioperative mortality (OR 0.41, 95% CI: 0.17 to 0.98; three studies), tricuspid valve regurgitation (OR 0.23, 95% CI: 0.15 to 0.36; seven studies), and sinus rhythm (OR 7.01, 95% CI: 2.57 to 19.13; two studies). The analysis of early atrial pressure was the only one to show any heterogeneity. There was no statistically significant difference in intra-operative ischaemic time.

**Retrospective studies meta-analysis:** Results of the meta-analyses were largely non-significant, apart from achievement of sinus rhythm, which favoured the bicaval technique over the standard technique (OR 2.69, 95% CI: 1.55 to 4.66; three studies).

**Narrative synthesis outcomes:** The narrative synthesis results found the bicaval technique to be superior to the standard technique for the following outcomes: need for temporary pacemaker, right atrial pressure one year after transplantation, pulmonary artery pressure after one year, cardiac index at first postoperative day, mitral valve regurgitation, tricuspid valve regurgitation, and left atrial thrombosis. No differences were seen for pulmonary vascular resistance, systolic blood pressure, cardiac output, and intensive care unit stay.

A funnel plot indicated no obvious effect of publication bias. Further results were reported.

**Authors' conclusions**
This review provided evidence of clinically relevant beneficial effects of the bicaval technique compared to the standard biatrial technique in orthotopic heart transplantation.

**CRD commentary**
The review addressed a clear question and was supported by appropriate inclusion criteria. Attempts to identify relevant studies were undertaken by searching databases and several other methods, but the restriction to studies written only in English or German means some relevant studies may have been missed. Study quality was assessed and was used in the discussion of the results of the review. The extraction of data and assessment of study quality was performed by only one reviewer, which left these processes open to the possibility of reviewer error and bias (although two reviewers did select studies for inclusion). Sufficient study details were provided. An appropriate synthesis of the data was undertaken. Generally, the included studies were of fairly poor quality and had small sample sizes; in light of these limitations, the authors' conclusions should be interpreted somewhat cautiously.

**Implications of the review for practice and research**
**Practice:** The authors did not state any implications for practice.

**Research:** The authors stated that future studies should be longer term, and should use a minimum set of clinically relevant outcomes, measured in a standardised and comparable way.

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