Long-term outcomes after the atrial switch for surgical correction of transposition: a meta-analysis comparing the Mustard and Senning procedures

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CRD summary
The authors concluded that the results were not consistent across all outcomes for patients who had undergone Mustard and Senning procedures. Despite limitations to this review, the authors’ cautious conclusions appear to reflect limited data from potentially biased observational studies.

Authors' objectives
To compare the long-term outcomes of the Mustard and the Senning procedures for correction of transposition of the great arteries.

Searching
MEDLINE and EMBASE were searched from 1966 to August 2003 without any language restrictions; the search terms were reported. In addition, reference lists of primary studies and chapters in relevant textbooks were screened.

Study selection

Study designs of evaluations included in the review
Comparative observational studies with at least 10 patients in each treatment group were eligible for inclusion. Case series reporting results for only one procedure and case reports were excluded. In the included studies, the duration of follow-up, where reported, ranged from 13 to 201 months.

Specific interventions included in the review
Studies that compared the Mustard and the Senning procedures for correction of transposition were eligible for inclusion.

Participants included in the review
Studies of patients who had undergone the specified procedures for regular transposition (defined as the combinations of concordant atrioventricular and discordant ventriculo-arterial connection) were eligible for inclusion. Where reported, the age of participants undergoing surgery ranged from less than 2 weeks to 55.5 months. Some of the included studies involved patients with complex concordant atrioventricular and discordant ventriculo-arterial connection; other studies excluded this group of patients or provided no details.

Outcomes assessed in the review
The studies had to report rates of overall survival or sufficient data to permit their calculation for each treatment group. The review also assessed obstructions and residual shunts related to the baffle, bradydysrhythmias, atrial tachydysrhythmias, right ventricular (systemic) failure and functional capacity.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The studies were assessed for study design (prospective or retrospective), sample size, number of centres participating, reporting of the inclusion and exclusion criteria, accounting for losses to follow-up, and classification of survival according to the presence or absence of a ventricular septal defect. The authors did not state how the validity assessment was performed.
Data extraction
Two reviewers independently extracted the data and resolved any disagreements through consensus with the review group. For each study, the hazard ratio (HR) with 95% confidence interval (CI) for time to event of interest was extracted, indirectly calculated or estimated from survival curves.

Methods of synthesis
How were the studies combined?
Pooled HRs with 95% CIs for time to events data were calculated using the random-effects model of DerSimonian and Laird. Publication bias was assessed using Egger's publication bias plot and Begg's funnel plot. Secondary outcome categorical data, reported in fewer than 5 studies, were weighted by sample size and compared using chi-squared tests.

How were differences between studies investigated?
Statistical heterogeneity was assessed using the Q statistic. Meta-regression was used to examine the influence on survival of individual quality criteria.

Results of the review
Seven comparative observational studies (n=885) were included: 2 prospective studies (n=381) and 5 retrospective studies (n=504).

All of the included studies included consecutive patients.

Overall survival.
Overall post-operative mortality ranged from 3.1 to 10.0%. Actuarial survival at 8 to 16 years ranged from 78 to 84%. Heterogeneity was considered to be present (p=0.191). There was a non statistically significant reduction in mortality in patients who had undergone the Mustard procedure compared with the Senning procedure (HR 0.63, 95% CI: 0.35, 1.14, p=0.13). A larger sample size was associated with increased benefit from the Mustard procedure (p=0.004). Other quality criteria did not appear to influence the results. The funnel plot was asymmetrical, suggesting the potential for publication bias.

Patients who had undergone the Mustard procedure were significantly more likely to experience obstruction of the systemic venous pathway (risk ratio 3.5, 95% CI: 1.8, 7.0, p<0.001), non statistically significantly more likely to experience obstruction of the pulmonary venous pathway (7.6% versus 3.8%, p=0.27), more likely to experience bradydysrhythmias (based on significant increases in the incidence in 2 studies), and patients with Mustard baffles were non statistically significantly less likely to require residual shunts (7.0% versus 14.1%, p=0.10) than patients who had undergone the Senning procedure. Data on atrial tachydysrhythmias, systemic cardiac failure and functional capacity were inconclusive.

Authors' conclusions
The results were not consistent across all outcomes for patients who had undergone Mustard and Senning procedures. The results suggested that the Mustard procedure was associated with a trend towards increased survival and fewer residual leaks across the baffle, but was also associated with an increase in the risk of sinus node dysfunction and obstruction within the venous pathways.

CRD commentary
The review addressed a clear question that was defined in terms of the participants, intervention, outcomes and study design. Several relevant sources were searched and attempts were made to minimise language bias. No attempts were made to minimise publication bias and funnel plots suggested that publication bias may be present. Methods were used to minimise reviewer errors and bias in the extraction of data, but it was not clear whether similar steps were taken at the study selection or validity assessment stages. The quality of the included studies was assessed using specified criteria.
Statistical variation between the studies was assessed and potential sources of variation, including individual quality criterion, were explored. The authors' cautious conclusions appear to reflect limited data from potentially biased observational studies, but incomplete reporting of review methods means it is not possible to assess the reliability of the results.

**Implications of the review for practice and research**

The authors did not state any implications for practice or further research.

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