Pulmonary function following surgical repair of pectus excavatum: a meta-analysis

CRD summary
The review assessed the efficacy of surgical repair of pectus excavatum on pulmonary function. The authors’ conclusion, that surgical repair of pectus excavatum does not significantly improve pulmonary function, follows from the results presented. However, poor reporting of the review process and the uncertain quality of the included studies limit interpretation.

Authors' objectives
To determine the efficacy of surgical repair of pectus excavatum on pulmonary function.

Searching
Current Contents, EMBASE, Health Periodicals Database, MEDLINE, CINAHL and SPORTDiscus were searched from 1960 to September 2005; the search terms were reported. Handsearches of selected journals related to general medicine and surgery were conducted, and references from relevant papers were also checked. Only articles published in English were included in the review. Conference abstracts, doctoral dissertations and Masters theses were excluded.

Study selection
The authors did not state what study designs were eligible for inclusion in the review, although it appears that all included studies were of a before-and-after design. Studies that assessed surgical repair of pectus excavatum were included in the review. Where reported, the surgical procedures used were the Ravitch surgical repair procedure, the Nuss procedure, the Daniel procedure, sternal elevation and sternocostal elevation. Studies of individuals with pectus excavatum were eligible for inclusion. The mean age of the included participants ranged from 4.6 to 19.6 years. The authors reported that the study participants were healthy and/or physically active. Studies that quantitatively assessed pre- and post-operative pulmonary function, and reported the duration between these assessments and the pulmonary assessment procedure used, were eligible for inclusion. The primary outcome was change in pulmonary function following surgical repair. A number of different indices were used, all of which represent standard pulmonary function characteristics used routinely in clinical settings (a full list was reported in the review). The duration between pre- and post-operative assessment ranged from 1 month to 12.2 years.

The authors did not state how the papers were selected for the review, or how many reviewers performed the study selection.

Assessment of study quality
The authors did not state how the papers were assessed for validity, or how many reviewers performed the validity assessment.

Data extraction
Data were extracted onto a coding sheet developed for the review. As indices of pulmonary function varied between the studies, the authors created a global category labelled ‘pulmonary function’. The standardised mean change was calculated for each outcome. As each study produced multiple effect sizes (ESs), the average ES for each study was calculated following the recommendation of Lipsey and Wilson.

The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

Methods of synthesis
The studies were combined in a meta-analysis using a random-effects model when statistical heterogeneity was found. Summary estimates were presented as a weighted ES with corresponding 95% confidence interval (CI). Statistical
heterogeneity was assessed using the Q statistic and the \( I^2 \) statistic. Publication bias was investigated by funnel plot. Regression analysis was used to assess the influence of specific variables: surgical procedure, age and duration between pre- and post-operative assessment.

**Results of the review**

Twelve studies (n=313) were included in the review.

Fifty-two ESs for pulmonary outcomes were generated from the 12 included studies. Of these, 87% were reported as being non-statistically significant and 42% were in a negative direction. When pooling the overall weighted mean ES for pulmonary function for all the included studies, significant statistical heterogeneity was found, thus a random-effects model was used. A very small, non-statistically significant change in pulmonary function was found (ES 0.08, 95% CI: -0.20, 0.35). Surgical procedure, age and duration between pre- and post-operative assessment did not significantly alter the results. The funnel plot analysis showed no evidence of publication bias.

**Authors’ conclusions**

Surgical repair of pectus excavatum does not significantly improve pulmonary function. However, these findings may be a result of testing pulmonary function under conditions in which pectus excavatum does not manifest itself.

**CRD commentary**

The review question was supported by broad inclusion criteria with regard to the intervention and participants. Inclusion and exclusion criteria were not clearly defined for the study design. Several sources were searched in order to locate relevant studies for inclusion in the review, although the search was limited to publications in English. Publication bias was assessed. The methods undertaken to select studies and extract the data were not fully reported, thus the likelihood of reviewer error or bias having been introduced at these stages cannot be clearly assessed. It does not appear that the validity of the included studies was assessed. Standard meta-analytic methods were used and statistical heterogeneity was assessed. The authors also made some attempts to examine the impact of potentially moderating variables. The authors' main conclusion follows from the results presented, but lack of reporting of the review process and the uncertain quality of the included studies limit interpretation.

**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 consider examining pulmonary function in response to an incremental exercise test rather than using only measures taken at rest.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.