Postoperative pulmonary function in open versus laparoscopic cholecystectomy: a meta-analysis of the Tiffenau index

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CRD summary
This review compared postoperative pulmonary function after open cholecystectomy versus laparoscopic cholecystectomy and concluded that postoperative pulmonary function was better preserved after laparoscopic cholecystectomy than after open cholecystectomy. Given concern in the review methods (pooling of different study designs) and high levels of statistical heterogeneity between studies, a degree of caution is required in interpreting the authors' conclusions.

Authors' objectives
To compare postoperative pulmonary function relating to the Tiffenau Index after open cholecystectomy versus laparoscopic cholecystectomy.

Searching
PubMed, EMBASE, Cochrane Central Register of Controlled Trials (CENTRAL) and DARE databases were searched from 1990 to 2007. Search terms were reported. Google Scholar and Vivisimo were searched. Reference lists of relevant publications were screened. Experts in the study area were contacted. Only studies in English, Italian, French and German were considered for inclusion.

Study selection
Experimental studies that compared open cholecystectomy versus laparoscopic cholecystectomy in patients of at least 18 years old were eligible for inclusion. Studies of patients who underwent acute cholecystectomy or mini-laparoscopic cholecystectomy were excluded. Studies in which patients' forced expiratory volume in one second (FEV$_1$) and forced vital capacity (FVC) values were evaluated in percentages were excluded. The primary outcome measure was postoperative pulmonary function in terms of FVC and FEV$_1$ or the Tiffenau Index.

The included studies were published between 1992 to 2005. Studies were conducted in USA, India and several European countries. The type of spirometer used varied between included studies.

The authors did not state how many reviewers assessed studies for inclusion.

Assessment of study quality
Study quality was assessed using a 10-point rating scale to evaluate methods of allocation to study groups, appropriateness of statistical analyses, presence of baseline differences between intervention and control groups, type of outcome measure and completeness of follow-up. Only studies with a quality score of at least 6 out of 10 were included.

Two reviewers independently performed validity assessment; any disagreements were resolved by consensus or a third reviewer.

Data extraction
Data were extracted on means and standard deviations (SDs) to enable calculation of mean differences (MDs) with 95% confidence intervals (CIs). As the included studies evaluated FVC and FEV$_1$ using different spirometer devices, standardised mean differences (SMDs) with 95% CIs were calculated for each study.

Two authors independently performed data extraction.
Methods of synthesis
The studies were combined in meta-analyses. Pooled standardised mean differences with 95% CIs were calculated using a random-effects model. Statistical heterogeneity was assessed using X² test and I² statistics. Sensitivity analyses were performed by excluding the study with a higher weight and the study with the largest effect size. Publication bias was assessed using a funnel plot.

Results of the review
Thirteen studies (five randomised controlled trials and eight cohort studies) were included in the review (n=680; 297 underwent open cholecystectomy and 383 underwent laparoscopic cholecystectomy). Sample sizes ranged from 20 to 118. The quality score in all studies ranged from 6 to 10 and was at least 8 in eight studies.

Compared with open cholecystectomy, laparoscopic cholecystectomy was associated with a significant improvement in postoperative pulmonary function relating to the Tiffenau Index (SMD 0.53, 95% CI 0.04 to 1.02; 13 studies). Significant heterogeneity was observed for this outcome (I²=88%).

Sensitivity analysis did not significantly alter the results. There was no evidence of publication bias.

Authors' conclusions
Postoperative pulmonary function was better preserved after laparoscopic cholecystectomy than after open cholecystectomy.

CRD commentary
This review's inclusion criteria were clear. Relevant databases were searched. Efforts were made to find both published and unpublished studies, which minimised potential for publication bias. Only studies in four popular languages were considered for inclusion, so the risk of language bias could not be ruled out. Steps were taken to minimise reviewer errors and biases by having more than one reviewer independently undertake validity assessment and data extraction; it was unclear whether study selection was performed in duplicate. Relevant criteria were used to assess study quality. There was a lack of details on patient characteristics from the primary studies and so the generalisability of findings remained unclear. Given the diversity of the included studies, pooling results from studies with different study designs might be not have been appropriate. High levels of statistical heterogeneity between studies further indicated caution in the interpretation of the pooled effect size.

Implications of the review for practice and research
Practice: The authors stated that the findings from this review promoted adoption of laparoscopic cholecystectomy as a safer alternative to traditional open surgery.

Research: The authors stated that randomised controlled trials (RCTs) with large sample sizes were required to investigate patients’ postoperative pulmonary function after laparoscopic cholecystectomy in comparison with open cholecystectomy. In order to provide better and updated evidence on this topic, further systematic reviews based on individual patient data for adequate pooling of results and addressing heterogeneity were required.

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Record Status
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.