Smoking cessation reduces postoperative complications: a systematic review and meta-analysis


CRD summary
This review found that smoking cessation interventions in surgical populations decreased the incidence of postoperative complications. Although little information was provided on the interventions in the review, the results and the authors' conclusions are likely to be reliable.

Authors' objectives
To evaluate the effect of preoperative smoking cessation interventions on postoperative complications and to determine if there was an optimal cessation period prior to surgery.

Searching
MEDLINE, EMBASE, the Cochrane Central Register of Controlled Trials (CENTRAL), AMED, TOXNET, Development and Reproductive Toxicology, Hazardous Substances Databank, PsycINFO and Web of Science were searched from inception to September 2009 without language restriction. Science Direct and Ingenta were also searched to identify studies. The bibliographies of published relevant reviews and health technology assessments were also checked for additional studies.

Study selection
Studies were eligible if they assessed the incidence of postoperative complications in patients who had achieved abstinence of smoking prior to surgery. The studies were required to report the proportions of smokers and non-smokers in the populations under evaluation. The primary outcome was postoperative complications defined as total complications. A range of secondary outcomes were also reported.

Most included studies were conducted in the United States; other studies were conducted in Denmark, Australia, Japan, Israel and Sweden. Where reported, the mean age of the patients ranged from 39 to 66 years, and the proportions of male patients in the studies ranged from 0 to 97% of the patient populations. The patients presented with a heterogeneous range of surgical requirements including lung, heart, orthopaedic, abdominal, breast, head/neck surgery and elective surgical procedures. There was little information provided on the interventions. Where specified, pre-surgery smoking cessation periods ranged from two weeks to 12 months prior to surgery. Perioperative complications included wound complications, and any morbidity that required treatment within 30 days post-surgery. Follow-up in the studies ranged from one day to 57 months.

Two independent reviewers performed the study selection.

Assessment of study quality
Methodological quality was assessed with the Cochrane Risk of Bias tool using allocation concealment, sequence generation, blinding status, the use of intention-to-treat analyses, sources of funding and appropriate descriptions of loss to follow-up. For the non-randomised studies, the reviewers assessed methodological quality with the Newcastle-Ottawa scale using participant selection, comparability of cases and controls, exposure and outcomes.

Two reviewers independently assessed methodological quality. Any discrepancies between the reviewers were resolved by discussion and third-party arbitration.

Data extraction
Data were extracted to calculate relative risks (RR) and 95% confidence intervals (CI) for the estimates.

Data were extracted by two reviewers. Any disagreements between the reviewers were resolved by discussion and a third party.
Methods of synthesis
Pooled relative risks and 95% confidence intervals were calculated using a DerSimonian and Laird random-effects model. Statistical heterogeneity was estimated using $I^2$. Sensitivity analyses were conducted to evaluate short-term (less than four weeks) and long-term (more than four weeks) effects and on the basis of intervention type (intensive compared to passive interventions). For the analysis of observational studies that reported total complications, the reviewers pooled proportions of past and current smokers using the Freeman-Tukey method and applied a random-effects model.

Results of the review
Twenty-one studies were included in the review; six randomised controlled trials (RCT, 648 patients) and 15 observational studies (10 prospective comparisons and five retrospective analyses of patients with complications). Four trials reported methods of sequence generation and allocation concealment methods, and five trials reported blinding status of groups or researchers. All the trials used intention-to-treat analyses and were free of selective reporting. The funding sources of all the trials were public, with industry-provided drugs.

There were significantly fewer complications observed in patients who had ceased smoking prior to surgery in the RCTs (RR 0.59, 95% CI 0.41 to 0.85; $I^2=14\%$). Each week of cessation resulted in a larger effect size (effect size-coefficient -0.191, 95% CI -0.368 to -0.014). Studies of a longer duration showed significant effects on complications (RR 0.45, 95% CI 0.30 to 0.68; $I^2=0\%$) but studies of duration less than four weeks did not significant effects on complications. Intensive interventions also had a significant benefit on postoperative complications (RR 0.55, 95% CI 0.31 to 0.98; $I^2=61\%$), although the use of less intensive interventions were not associated with significant differences compared to control groups.

The pooled results from 12 observational studies showed statistically significant reductions in former smokers in total postoperative complications (RR 0.76, 95% CI 0.69 to 0.84; $I^2=15\%$), pulmonary complications (RR 0.81, 95% CI 0.70 to 0.93; $I^2=7\%$), and wound healing (RR 0.73, 95% CI 0.61 to 0.87; five studies; $I^2=0\%$). There were no differences between past and current smokers in mortality.

Authors' conclusions
Smoking cessation interventions that lead to abstinence in surgical patients were associated with significantly decreased rates of post-surgical complications.

CRD commentary
The review addressed a clear question and criteria for the inclusion for studies in the review were defined and reproducible. A range of appropriate databases were searched without language restriction for relevant studies. There were no attempts to search for unpublished studies so there was some risk of publication bias. Steps were taken to minimise errors and bias by the reviewers at each stage of the review process. There were no descriptions of how intensive interventions were defined compared to less intensive interventions. This meant it was difficult to determine the components of successful interventions.

There were separate analyses for the included RCTs and observational studies, which was appropriate because of the number of potential risks and biases associated with the results of observational studies. The authors acknowledged the limitations of the review such as heterogeneous reporting of outcomes and the inconsistent definitions of past smoking status. In general, although there was insufficient information provided on the interventions, particularly the descriptions of "intensive" and 'less intensive" the results and the authors' conclusions appear to be reliable.

Implications of the review for practice and research
Practice: The authors stated that the review finding that each additional week of smoking cessation had a significant impact on the reduction of postoperative complications shows the importance of designing appropriate secondary care smoking-cessation interventions. The early ascertainment of smoking status in surgical patients and rapid referrals to cessation programmes could maximise the cessation period prior to surgery.

Research: The authors did not state any implications for research.

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