Ventilation strategies in obese patients undergoing surgery: a quantitative systematic review and meta-analysis

Aldenkortt M, Lysakowski C, Elia N, Brochard L, Tramer MR

CRD summary
The review concluded that there was some evidence that alveolar recruitment manoeuvre in the presence of positive end-expiratory pressure may improve some outcomes in obese patients undergoing surgery but the evidence base was weak. The authors’ conclusions were cautious and generally appeared appropriate but the presence of several review limitations makes their reliability somewhat uncertain.

Authors' objectives
To determine the impact of different intra-operative ventilation strategies in obese patients undergoing surgery.

Searching
MEDLINE, Cochrane Central Register of Controlled Trials (CENTRAL) and EMBASE were searched to March 2012 for published studies. There were no language restrictions. Search terms were reported. Reference lists of retrieved articles were examined to identify further studies.

Study selection
Randomised controlled trials (RCTs) that compared different ventilation strategies in obese patients – defined as body mass index (BMI) of 30kg/m² or more – who underwent surgery under general anaesthesia were eligible for inclusion. Studies had to report on intra-operative gas exchange, pulmonary mechanics or postoperative respiratory complications.

Various interventions were studied. Positive end-expiratory pressure (at various levels) was the most frequent intervention; others were pressure-controlled ventilation, volume-controlled ventilation, pressure support ventilation, large tidal volumes (increase in normal tidal volume by 35%) and recruitment manoeuvre. In some studies interventions were combined. The median of the mean BMIs was 43kg/m². Types of surgery (listed in decreasing order of frequency) were laparoscopic bariatric, open bariatric, open colectomy and non-abdominal. Studies were published between 1978 and 2011.

One author screened abstracts. It appeared that the same reviewer screened full papers and referred to another reviewer when deemed necessary.

Assessment of study quality
A modified version of the Jadad scale was used to assess study quality. Maximum scores for each criterion were randomisation (2), allocation concealment (1), intra-operative blinding (1), postoperative blinding (1) and drop-outs (2). The maximum total score was 7.

One reviewer assessed study quality and the results were checked by a second reviewer. Disagreements were resolved by a third reviewer.

Data extraction
Data were extracted to enable calculation of mean differences with 95% confidence intervals (CI). Authors were contacted for missing data where necessary.

One reviewer extracted data which were checked by a second reviewer.

Methods of synthesis
Meta-analysis was performed only when data from at least three studies or 100 patients were available. Pooled weighted mean differences (WMD) with 95% confidence intervals were calculated using a fixed-effect model when heterogeneity was not significant, otherwise a random effects model was used. Heterogeneity was assessed using the I² statistic and X² test.
Results of the review
Thirteen RCTs (505 participants) that reported 15 comparisons were included. The median score on the modified Jadad scale was 3 (range 1 to 5). Five studies reported adequate randomisation and four studies reported adequate allocation concealment. One study used intra-operative blinding, one used postoperative blinding and one had a crossover design.

Meta-analysis was possible for two comparisons.

Positive end-expiratory pressure alone versus positive end-expiratory pressure plus recruitment manoeuvre: The combined intervention improved the intraoperative ratio of partial pressure of arterial oxygen to fraction of inspired oxygen (WMD 16.2kPa, 95% CI 8.0 to 24.4; I²=69%; four RCTs) and increased respiratory system compliance (WMD 14mL/cm H₂O⁻¹, 95% CI 8 to 20; I²=0%; three RCTs). There was no difference between groups in arterial pressure.

Pressure-controlled ventilation versus volume-controlled ventilation (three RCTs): There were no significant differences between groups in intraoperative ratio of partial pressure of arterial oxygen to fraction of inspired oxygen, tidal volume, airway pressure, arterial pressure and heart rate.

Data on postoperative complications were rarely reported.

Authors’ conclusions
There was some evidence that alveolar recruitment manoeuvre in the presence of positive end-expiratory pressure may improve intraoperative oxygenation and respiratory system compliance without adverse haemodynamic effects. There was a lack of evidence of any difference between pressure-controlled ventilation and volume-controlled ventilation. The evidence base concerning the most efficacious intraoperative ventilation strategy in this specific patient population remained weak.

CRD commentary
The review addressed a clear question and was supported by reproducible eligibility criteria. Electronic databases were searched for relevant studies in any language. Only published studies were sought so it was possible some relevant studies were missed.

Suitable methods were employed to reduce risks of reviewer error and bias during data extraction and quality assessment but not during study selection. Study quality was scored using a basic tool that made it difficult to assess risk of bias properly and the results were used little when interpreting the pooled results. Sufficient study details were provided and appropriate methods were used to pool data and to assess heterogeneity. Where heterogeneity was found the possible sources were not investigated using further analyses but the issue of small sample sizes was discussed briefly.

The authors’ conclusions were cautious and generally appeared appropriate but the presence of several review limitations makes their reliability somewhat uncertain.

Implications of the review for practice and research
Practice: The authors stated that there was no gold standard intraoperative ventilation strategy for obese patients.

Research: The authors stated that the research agenda should start with randomised comparisons of a single intervention with no intervention control. Combinations of strategies should then be tested with interventions that showed efficacy in no intervention-controlled trials. Standardised endpoint reporting was important. Ideally, reporting of surrogate endpoints should be avoided. Relevant clinical endpoints such as postoperative respiratory complications, atelectasis, pneumonia and intervention-related adverse events should be reported.

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