Chest physiotherapy with positive expiratory pressure breathing after abdominal and thoracic surgery: a systematic review
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CRD summary
This review concluded that there was little evidence that positive pressure (PEP) breathing was better than other physiotherapy breathing techniques in patients who underwent abdominal or thoracic surgery; however, studies that compared PEP with placebo and no treatment were lacking. These cautious conclusions appeared to reflect the evidence presented, but relevant data may have been missed.

Authors' objectives
To investigate the effect of chest physiotherapy with positive expiratory pressure (PEP) breathing after an open upper abdominal or thoracic surgery.

Searching
MEDLINE, CINAHL, AMED, PEDro and Cochrane Central Register of Controlled Trials (CENTRAL) were searched for full papers published in English up to November 2008. Search terms were reported. Reference lists of the retrieved articles were screened for further studies.

Study selection
Randomised-controlled trials (RCT) that compared the effects of the PEP using a mechanical device with the effects of other chest physiotherapy technique or no treatment in spontaneously breathing adult patients after an open upper abdominal or thoracic surgery via thoracotomy were eligible for inclusion in the review. Studies were excluded if the study population had undergone thoracic surgery via sternotomy. All outcome measures were eligible for inclusion.

Included studies evaluated PEP treatments using a PEP-mask or a blow-bottle system. PEP-mask treatment was compared with other breathing treatments that included: CPAP (10-15cm H2O), inspiratory resistance-positive expiratory pressure (IR-PEP), incentive spirometry and placebo PEP (no resistance). In most studies PEP was given in addition to conventional chest physiotherapy. Blow-bottle treatment was compared with conventional chest physiotherapy (breathing exercises and postural drainage, plus physiotherapist visits) or combined with preoperative and postoperative physiotherapy and compared with preoperative and postoperative physiotherapy. Two thirds of included participants had undergone abdominal surgery and the others had undergone thoracic surgery. Studies were mostly performed in Scandinavia and published between 1979 and 1993. Follow-up periods ranged from one to nine days post procedure.

The main reported outcome was atelectasis (evaluated in chest roentgenograms); other outcomes included temperature, expectoration, time to chest tube removal, subjective experiences, postoperative complications, alveolar-arteriolar oxygen difference, cough, dyspnoea, pain, antibiotic use, bronchodilator use, pulse rate, oxygen and pulmonary auscultation.

Two reviewers independently assessed each study for inclusion in the review.

Assessment of study quality
Two reviewers independently assessed the validity of the included studies using the PEDro scale. Criteria included randomisation, allocation concealment, baseline comparability, blinding (subjects, therapists and assessors), adequate follow-up and point and variability measures. Each study was awarded a total score (zero to 10 points). Studies with a score of 5 or more were considered to be of moderate or high quality and scores of 4 or less were considered to be of low quality. Discrepancies were resolved through discussion.

Data extraction
Two reviewers independently extracted the main study outcomes and the significance of any effects with p-values.
Methods of synthesis
Studies were synthesised using a narrative synthesis grouped by surgery type and comparator.

Results of the review
Six RCTs (463 patients) were included in the review. PEDro scores ranged from 4 (low quality; two RCTs) to 5 to 6 (medium quality; four RCTs). Four studies used blinded assessors, one used blinded participants and none used blinded therapists. None of the studies reported using concealment of allocation. Sample sizes ranged from 43 to 144.

Only one RCT (43 patients; PEDro score 6) reported a significant difference between the PEP intervention and control groups. This study was of patients who had undergone abdominal surgery compared PEP-mask treatment (10cm to 15cm H₂O), 30 breaths every waking hour, with CPAP and included a control group who received basic physiotherapy with incentive spirometry. On the second postoperative day, significant differences in favour of the PEP intervention were reported in comparison with the control groups for the alveolar–arteriolar oxygen difference (p<0.001) and PaO₂ (p<0.01) and forced vital capacity (p<0.05). In addition, atelectatic consolidation was significantly lower in the PEP group in comparison with the control groups on the third postoperative day.

Authors' conclusions
There was little evidence that PEP treatment was better than other physiotherapy breathing techniques in patients who underwent abdominal or thoracic surgery. Studies that compared PEP with placebo and no treatment were lacking.

CRD commentary
This review answered a clearly defined review question. Relevant data may have been missed by searching only for studies published in English; therefore, the review was at risk of language and publication biases. Risks of reviewer error and bias were low as two independent reviewers were involved in each stage of the review process. Study quality was assessed using relevant criteria and the quality of each study reported. None of the studies was assessed as high quality and some of the studies were reported as low quality. This and the small sample sizes suggested that study data was at risk of bias. Given the differences between the studies (particularly with respect to outcomes and comparators) the decision to combine the studies using narrative methods appeared appropriate.

The authors' cautious conclusions appeared to reflect the evidence presented.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.
Research: The authors stated that further large randomised controlled trials that compared positive pressure (PEP) breathing after an open upper abdominal or thoracic surgery with other physiotherapy breathing techniques, placebo and no treatment were required. Studies should investigate long-term outcomes.

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