Is there a preferred technique for weaning the difficult-to-wean patient: a systematic review of the literature

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Authors' objectives
To investigate which of the three commonly used techniques of weaning leads to the highest proportion of successfully weaned patients and the shortest weaning time in difficult-to-wean patients.

Searching
Computerised literature searches were conducted in MEDLINE (1975 to 1997), CINAHL (1982 to 1997), and Healthplan (1985 to 1997) exploding all MeSH terms pertaining to mechanical ventilation and weaning. The searches were restricted to English language, adults and humans. Personal files were handsearched and references of selected articles were reviewed.

Study selection
Study designs of evaluations included in the review
Controlled clinical trials.

Specific interventions included in the review
At least two of the following three modes of weaning from mechanical ventilation must have been compared: T-piece, synchronised intermittent mandatory ventilation (SIMV), or pressure support ventilation (PSV).

Participants included in the review
Participants required a gradual weaning process from the ventilator (either requiring prolonged initial ventilation of >72 hours or a failed trial of spontaneous breathing after >24 hours of ventilation). Participants came from mixed medical-surgical populations and chest trauma patients.

Outcomes assessed in the review
At least one of the following: weaning time (time from initiation of weaning to extubation) or successful weaning rate (successfully off the ventilator for >48 hours).

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many of the reviewers performed the selection.

Assessment of study quality
The validity of primary studies was assessed according to the following: random allocation, eligibility criteria, description of weaning process, criteria to determine when patients were ready for extubation, criteria for reintubation, criteria to define successful weaning, standardisation of co-interventions, use of an intention-to-treat analysis and completeness of follow-up. Validity of selected studies was assessed independently by two authors. Disagreement was resolved by consensus.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the reviewers performed the data extraction. The following categories of data were extracted from each study included in the review: population, number of patients, mode of weaning studied and outcomes included.
Methods of synthesis
How were the studies combined?
Pooled risk differences (RD (expressed as the difference in proportions of successfully weaned between respective weaning modes)) and 95% CIs were calculated using the DerSimonian and Laird random-effects model. No attempt was made to pool weaning time because the average weaning time was expressed differently.

How were differences between studies investigated?
Trials were inspected for clinical heterogeneity and tested for statistical heterogeneity. The sources of heterogeneity examined were population, application of interventions and assessment of outcomes. When heterogeneity was found, attempts were made to determine potential explanations for these differences.

Results of the review
Three randomised controlled clinical trials (n = 279) and one quasi-randomised trial (n = 200) were included.

Two trials satisfied seven of the nine validity criteria, one trial satisfied five of the criteria and one trial satisfied three of the criteria.

Although individual trials reported outcomes in favour of a specific weaning mode, no mode was demonstrated as being consistently superior to the others across all relevant studies.

Proportion successfully weaned: Pooled RD for T-piece vs. PSV was -3 (95%CI: -36,30), pooled RD for T-piece vs. SIMV was 3 (95%CI: -11, 18) and pooled RD for PSV vs. SIMV was 8 (-7, 23). Weaning time: In the three studies that individually reported statistically significant differences between modes, SIMV consistently led to longest weaning time: Mean (SD) time to extubation was 9.9(8.2) and 9.9 (2.7) days in two of the trials, and median (range) was 5 (3-11) days in the other study.

Inspection of the studies showed heterogeneity in the application of interventions regarding levels of respiratory rates tolerated and extubation criteria.

Heterogeneity was also found in the assessment of outcomes regarding weaning time (which was variably expressed as mean or median) and definition used for weaning success.

Authors’ conclusions
The review was unable to demonstrate the superiority of any one weaning technique (T-piece, PSV or SIMV) in the difficult-to-wean patient. However, SIMV may result in a longer weaning time than either T-piece or PSV. It would appear, on closer scrutiny of these trials, that how the technique was applied was at least as important as the technique itself.

CRD commentary
The review question and inclusion criteria were clearly stated. The literature search is limited to English language papers hence relevant studies are likely to have been excluded. There was also no attempt to identify unpublished research. Validity assessment of primary studies was adequate. Inspection of trials indicated the presence of clinical heterogeneity, hence the pooled results may not have produced a sensible synthesis. For this reason, as the authors themselves comment upon, results should be interpreted cautiously. The authors investigated the sources of heterogeneity, which was appropriate. However, although they state that they tested for statistical heterogeneity, the methods and results for this were not reported. There was also no attempt to provide a synthesis of weaning time, although results are clearly presented in a table. The authors provided no details concerning how data were extracted. There was no attempt to assess publication bias by the authors.

The authors’ conclusions appear to follow from the results but should be treated with some caution given the above mentioned limitations.
Implications of the review for practice and research

Practice: The authors do not report any implications for practice.

Research: The authors state that the first step to expedite the weaning process would appear to be ensuring that there is a well-defined approach guided by an agreed upon protocol. They also state that further carefully designed, randomised controlled trials are needed to address whether the technique used to wean patients in this setting results in a clinically relevant improvement in the outcomes considered in this abstract.

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