An evidence-based approach to acute respiratory distress syndrome

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Authors' objectives
To describe an evidence-based approach to the management of patients with acute lung injury (ALI) and acute respiratory distress syndrome (ARDS).

Searching
MEDLINE (from 1966 to 2000), CINAHL (from 1982 to 2000) and the Cochrane Database of Systematic Reviews were searched for publications in the English language. The search terms for MEDLINE were 'respiratory distress syndrome, acute', 'human', and 'randomized controlled trials'. Further search strategies for the databases were provided in the review. The reference lists of retrieved studies were checked for additional papers.

Study selection
Study designs of evaluations included in the review
The inclusion criteria specified randomised controlled trials (RCTs), cohort studies, and all studies reporting long-term follow-up in adult survivors of ARDS (excluding studies evaluating only long-term mortality). Studies of less than 5 participants were excluded.

Specific interventions included in the review
The inclusion criteria specified interventions of pressure- and volume-limited ventilation strategies, high-PEEP (positive end expiratory pressure) strategies, prone ventilation, inhaled nitric oxide, and systemic corticosteroids for late-phase ARDS. The control intervention was conventional care.

Participants included in the review
The inclusion criteria for the participants specified critically ill adults with ALI and ARDS.

Outcomes assessed in the review
The inclusion criterion for the outcomes was mortality.

How were decisions on the relevance of primary studies made?
One author selected the papers for the review.

Assessment of study quality
The authors used two guides to critical appraisal in assessing the included studies. The appraisal focused on randomisation, concealment, blinding, baseline similarity of the study groups, reporting the use of cointerventions, rates of follow-up, and intention-to-treat analysis. For studies assessing long-term follow-up, the authors looked for the inclusion of a representative sample (high rates of follow-up) and unbiased outcome criteria. One author assessed the included papers for validity.

Data extraction
One author extracted the data.

Methods of synthesis
How were the studies combined?
The authors statistically pooled data only where it seemed appropriate. The reports were summarised in tabular format and were discussed in a narrative review.
How were differences between studies investigated?
The authors only pooled data where appropriate, based on examination of the populations, interventions and control interventions in the original studies, visual inspection of the study results, and formal tests for heterogeneity among the study results.

Results of the review
The overall number of studies was not stated in the review. The majority of trials described in the review were RCTs. Where the data were available, the numbers of trials and participants were listed in the 'Results' section.

Lung protection ventilation strategies.

Pressure and volume-limited ventilation: 4 RCTs (n=1,149) were included in the review. Only one trial (861 participants) found a significantly lower mortality in association with the experimental strategy. The relative risk (RR) of mortality associated with low tidal volume ventilation was 0.78 (95% confidence interval, CI: 0.65, 0.93). This means that for every 12 study patients ventilated using the pressure- and volume-limited approach, one death was prevented at day 28 of the study.

'Open lung' ventilation: one RCT was included for this intervention. The study was stopped early. Investigators found a quicker recovery of lung function associated with the 'open lung' approach and, more importantly, a large and statistically significant reduction in the risk of mortality: 71% for control versus 38% for the experimental group (95% CI: 0.31, 0.91).

Inhaled nitric oxide: 4 trials (n=427) were included for this intervention, but only one was blinded. Due to a lack of perceived heterogeneity, these trials were pooled; the RR was 1.12 (95% CI: 0.90, 1.40), which was not statistically significant. The authors stated that this finding was consistent with the findings of a recent Cochrane review.

Prone positioning: 14 case series (260 ARDS patients) were included for this intervention. Sixty-nine per cent of these patients responded with an acute improvement in oxygenation. The reproducibility of this response was variable. One completed RCT and 2 ongoing RCTs were also reported in the discussion. The completed RCT with 300 patients found no difference between the groups in terms of the duration of mechanical ventilation or patient mortality.

Late-phase corticosteroids: one poor-quality RCT of only 24 patients (20 intervention, 4 placebo) compared methylprednisone with placebo. At day 10, patients in the steroid group were progressing significantly better with respect to severity of lung injury, extubation rates and survival rates. Three of the 4 placebo patients died. There were no deaths in the steroid group.

Long-term follow-up studies.

Pulmonary function: 18 studies (392 participants) were identified. Overall, the rates of important abnormalities in pulmonary function test results were not high in ARDS survivors, although a few studies found that a persistent reduction in diffusion capacity was very common. The heterogeneity of the ARDS population may directly impact the degree of reported pulmonary morbidity and may account for the differences.

Functional exercise capacity: 2 studies found functional capacity was moderately limited, but not as a result of respiratory problems. In a study of ambulatory patients, only 1% of the patients were seen to desaturate to less than 88% during exercise at 1 year.

Health-related quality of life (HRQOL): 8 studies found mixed results and demonstrated the difficulty in applying a disease-specific HRQOL measure to patients for whom the instrument was not validated, leading to possibly misleading results.

Neuropsychological morbidity: 4 studies found substantial cognitive and affective impairment at hospital discharge, with cognitive impairment persisting after one year.
Authors' conclusions
Pulmonary dysfunction is probably not a major source of morbidity for ARDS survivors. Global functional disability may relate to the most profound muscle wasting, and deconditioning associated with surviving an episode of critical illness, neuropsychological dysfunction is prominent. Ongoing research may suggest interventions to improve the outcome of ARDS and of critical illness in general.

CRD commentary
This systematic review was fairly well conducted. The research question was clearly stated, as were the inclusion and exclusion criteria. The literature search appears to have been thorough, although it was limited to English language publications and there was no mention of including unpublished material. The review process was good but only one reviewer performed each stage of the process (i.e. study selection, validity assessment and data extraction). The authors assessed the validity of the studies and assessed heterogeneity. A statistical analysis was performed when appropriate. The conclusions appear to follow from the results of the review.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.
Research: The authors stated that ongoing research is being conducted. No further statements about future research were made.

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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.