Use of the prone position in the management of acute respiratory distress syndrome

Ball C

Authors' objectives
To review the effectiveness of the prone position to improve oxygenation.

Searching
The author searched the electronic databases of Medscape, MEDLINE (1966-1999), CINAHL (1966-1999), Cochrane Database of Systematic Reviews, and NHS CRD's DARE using the MeSH search terms: 'respiratory distress syndrome', 'adult/acute/epidemiology/aetiology/physiopathology/therapy', 'positioning', 'prone position', 'acute respiratory failure', and 'acute lung injury'. The authors also accessed secondary references from the bibliographies of retrieved literature. The search was limited to English language publications and this excluded two studies. No unpublished reports were accessed.

Study selection
Study designs of evaluations included in the review
Studies of adults in intensive care units which identified the appropriate aetiology, indicated the length of survival, had an adequate and consistent description of study design, appropriately used statistical tests, and which showed a clinical significance of findings. Three of the studies were clinical follow-up studies, 1 was an open, prospective study, and 1 was a prospective study. No randomised controlled trials (RCTs) were found for the review.

Specific interventions included in the review
The prone position which involves nursing the patient 'face down' with gel or foam pads/pillows positioned so that the forehead, chin, shoulders, pelvis, knees and ankles are supported. The mode of ventilation had to be pressure limited with or without inverse respiratory:expiratory (I:E) ratio ventilation, with a consistent measure of oxygenation. Studies prior to the 1994 definition of terms, risk factors, prevalence and relevant outcomes were excluded. Studies which also evaluated therapeutic interventions using nitric oxide or nitric oxide with almitrine bismesylate were excluded because of possible confounding.

Participants included in the review
Adult patients 15 years of age and older with acute respiratory distress syndrome (ARDS). The degree of lung injury standardised by PaO2/FIO2 had to be less than 200. Patients with left atrial hypertension were excluded. The mean age range of participants was 38-56 years.

Outcomes assessed in the review
Oxygenation, as measured by arterial oxygen tension divided by fractional concentration of oxygen in inspired air (PaO2/FIO2), and percentage rate of survival to the end of the study, discharge from hospital, or at 6 months.

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

Assessment of study quality
No formal assessment of quality was undertaken.

Data extraction
The author does not state who, or how many of the reviewers, performed the data extraction.

Data were extracted for the categories of study identification, country, number of participants, age of sample group.
mode of ventilation, stage at which placed in prone position, diagnosis, study design, lag time, methods and duration of study, statistical tests used to compare supine and prone oxygenation indices, numbers of responders and non-responders, oxygenation indices in responders, mortality and conclusions.

Methods of synthesis
How were the studies combined?
The studies were combined in a qualitative narrative review.

How were differences between studies investigated?
The author does not state how differences between the studies were investigated.

Results of the review
Five studies were included in the review with 113 participants.

In all 5 studies, evidence suggests the prone position improves oxygenation indices in the majority of patients. The studies in this review report mortality rates from 6 to 60% with a mean percentage of 29% (if the non-responders are excluded from the data). The authors state that this represents a considerable reduction which should be treated with caution owing to the methodological flaws in the included studies. It is unclear whether use of the prone position increases the chance of survival to discharge from hospital or beyond.

The authors report that use of the prone position has been associated with adverse events such as accidental removal and compression of intravenous lines, some cutaneous damage to the chest wall, facial oedema, and contractures of the hip and shoulder (which responded to physiotherapy).

Authors’ conclusions
Review findings indicate that use of the prone position does improve oxygenation, as measured by PaO2/FIO2 indices, and appears to reduce mortality. However, caution should be taken in applying these results to practice. First, the studies available for review demonstrated various methodological flaws. It is also apparent that untoward incidences associated with the prone position have yet to be investigated systematically.

CRD commentary
The author clearly stated the research question and inclusion and exclusion criteria. The literature search appears thorough however the author did miss at least two additional studies excluded by language restrictions and may have missed other studies by excluding unpublished data. Although the authors did not include unpublished data in the review, an on-going trial is mentioned for possible inclusion in future reviews. The quality of the included studies was not formally assessed and the author has not reported on how the articles were selected, or how many of the reviewers were involved in the data selection and extraction.

The data extraction is reported in tables and text and the narrative combining of the studies was appropriate. No tests for heterogeneity were reported but the authors did discuss the methodological and data limitations of the studies included in the review.

The author's conclusions appear to follow from the results but, as stated, these should be viewed with caution and are not generalisable because of the methodological limitations of the included studies in the review.

Implications of the review for practice and research
Practice: The author states that nurses working in intensive care should take a more active part in the investigation and safe utilisation of the prone position in the management of ARDS.

Research: The author states that further, multicentre, randomised controlled trials are needed and that these trials should also address a definition for the severity of lung injury for ARDS. Further studies should also investigate the adverse
events associated with this form of treatment. The author also states that mortality should be measured at the end of the study and at discharge and that a longitudinal study is needed to evaluate outcome and quality of life in the long term.

**Bibliographic details**

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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.