Review: several techniques optimise oxygenation during suctioning of patients


QUESTION: Which methods or techniques optimise benefits and reduce complications when suctioning the airways of intubated, non-intubated, or tracheotomised patients?

Data sources
Published, English language studies were identified by searching Medline (1966–98), EMBASE/Excerpta Medica (1974–96), and CINAHL (1982–97) using the search terms trachea, pharynx, tracheostomy, suction, artificial airway, inflation, and endotracheal, and by searching the Cochrane Library. Bibliographies of retrieved studies were reviewed.

Study selection
Studies were included if they were randomised controlled trials (RCTs), randomised or non-randomised crossover studies, cohort studies, case series, or animal studies (only used to identify adverse effects of suctioning; not used in the development of recommendations).

Data extraction
Data were extracted on study type and date, allocation methods, patient inclusion and exclusion criteria, adequacy of follow up, comparison of baseline characteristics, specific interventions, outcome measures, and results. No formal tool was used to assess quality of individual studies.

Main results
161 RCTs, non-randomised controlled trials, randomised or non-randomised crossover studies, and cohort studies were included. Meta-analysis was not done because of differences among studies. Selected results of RCTs and randomised crossover studies of adult patients are summarised in the table.

Conclusion
Several techniques have beneficial effects during suctioning of ventilated and intubated patients.

Effectiveness of selected techniques during suctioning (randomised controlled trials only)

<table>
<thead>
<tr>
<th>Technique</th>
<th>Results (number of trials, number of patients)</th>
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<tr>
<td>Preoxygenation</td>
<td>Improved arterial oxygen saturation (Sao2) (2 trials, n=12 and n=17)</td>
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<tr>
<td>Hyperoxygenation + hyperinflation</td>
<td>Maintained O2 levels in mechanically ventilated patients (4 trials, n=10–24)</td>
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<td>Double lumen insufflation catheters</td>
<td>Maintained O2 levels throughout suctioning at flow rates of 10–15 l/min (4 of 5 trials, n=10–38)</td>
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<td>Hyperinflation alone</td>
<td>Unclear benefits on O2 levels after cardiac surgery; increase in blood pressure (4 trials, n=8–34). Increase in volume may result in increased intracranial pressure in patients with head injury (2 trials, n=10–37)</td>
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<td>Oxygenation using a manual resuscitation bag v ventilator</td>
<td>Ventilators were more effective for oxygen delivery (greater increases in PaO2) (3 of 4 trials, n=10–33)</td>
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<td>Open v closed suctioning systems</td>
<td>No difference for nosocomial pneumonia (3 trials, n=20–84, all had insufficient power) or mortality (1 trial, n=84). Greater decrease in PaO2 (1 trial, n=8, not clinically significant)</td>
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<tr>
<td>Saline instillation</td>
<td>No difference for oxygenation, gas exchange, heart rate, or blood pressure in ventilated and non-ventilated patients with tracheostomies (5 trials, n=15–45)</td>
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</table>

COMMENTARY
Suctioning intubated patients aids in removing secretions and maintaining a patient airway, while promoting optimal ventilation and oxygenation. The development of guidelines by Brooks et al supports clinical decision making by taking into consideration both the benefits and complications associated with the procedure. Recommendations for preoxygenation, hyperoxygenation, hyperinflation plus method of delivery, swivel adapter use, and others were reported.

The authors noted that insufficient evidence exists regarding several aspects of suctioning. For example, instillation of normal saline is thought to thin and loosen secretions, lubricate the suction catheter, and stimulate coughing. However, normal saline instillation may also cause a decrease in oxygen saturation and dislodge more bacteria in endotracheal tubes than use of suction catheters alone. Brooks et al highlight the paucity of scientific evidence to support saline instillation.

Subsequent guidelines need to address the evidence for the heated humidification of the inspired gas, monitoring of patient hydration status, and use of mucolytic agents or nebulisers. Patients receiving 100% humidity heated to core temperature (37°C) are reported to be at the optimal level for mucosal function, maximising mucous clearance. Brooks et al provide recommendations useful to healthcare providers engaged in the care of ventilated and intubated patients. These guidelines for suctioning can be applied to all ventilated patients, including those who are on volume control, synchronised intermittent mandatory ventilation, or pressure support. However, guidelines do not pre-empt sound clinical decision making. Clinicians still need to pay close attention to patient oxygenation levels, haemodynamic status, and responses to suctioning, especially if patients are unstable or have thick and tenacious secretions.

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