Review: several techniques optimise oxygenation during suctioning of patients

Brooks D, Anderson CM, Carter MA, et al. *Clinical practice guidelines for suctioning the airway of the intubated and nonintubated patient*. *Can Respir J* 2001 May;8:163–81.

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

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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 cross-over 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.

COMMENTARY

Suctioning intubated patients aids in removing secretions and maintaining a patent 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 adaptor 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.¹ However, normal saline instillation may also cause a decrease in oxygen saturation² and dislodge more bacteria in endotracheal tubes than use of suction catheters alone.³ 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.⁴

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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- 1 Blackwood B. Normal saline instillation with endotracheal suctioning: primum non nocere (first do no harm). *J Adv Nurs* 1999;29:928–34.
- 2 Ackerman MH. The effect of saline lavage prior to suctioning. *Am J Crit Care* 1993;2:326–30.
- 3 Hagler DA, Traver GA. Endotracheal saline and suction catheters: sources of lower airway contamination. *Am J Crit Care* 1994;3:444–7.
- 4 Williams R, Rankin N, Smith T, et al. Relationship between the humidity and temperature of inspired gas and the function of the airway mucosa. *Crit Care Med* 1996;24:1920–9.

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

Technique	Results (number of trials, number of patients)
Preoxygenation	Improved arterial oxygen saturation (SaO ₂) (2 trials, n=12 and n=17)
Hyperoxygenation	Maintained O ₂ levels in mechanically ventilated patients (4 trials, n=10–24)
Hyperoxygenation + hyperinflation	Added value of hyperinflation unclear in mechanically ventilated patients (4 trials, n=10–24)
Double lumen insufflation catheters	Maintained O ₂ levels throughout suctioning at flow rates of 10–15 l/min (4 of 5 trials, n=10–38)
Hyperinflation alone	Unclear benefits on O ₂ 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)
Oxygenation using a manual resuscitation bag v ventilator	Ventilators were more effective for oxygen delivery (greater increases in PAO ₂) (3 of 4 trials, n=10–33)
Open v closed suctioning systems	No difference for nosocomial pneumonia (3 trials, n=20–84, all had insufficient power) or mortality (1 trial, n=84). Greater decrease in PaO ₂ (1 trial, n=8, not clinically significant)
Saline instillation	No difference for oxygenation, gas exchange, heart rate, or blood pressure in ventilated and non-ventilated patients with tracheostomies (5 trials, n=15–45)