The Impact of a Unique Airway Clearance System on Airway Mechanics in Ventilated Patients

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Abstract

Background: The adherence of secretions along the endotracheal tube (ETT) lumen in mechanically ventilated (MV) patients results in airway narrowing and concomitantly may increase patients’ work of breathing. Biofilm accumulation may also promote the development of ventilator-associated pneumonia. Routine suctioning does not address the potential risks associated with secretions and biofilm that collect within the ETT lumen. A unique mucus shaver system (endOclear®) facilitates removal of secretions and biofilm.

Methods: This study retrospectively identified all subjects having their ETT cleared at a single institution prior to beginning a SBT between Jan 2012-Jul 2013. All subjects had received at least 24 hrs of MV prior to the SBT, and all underwent routine suctioning with a closed in-line system prior to use of the mucus shaver. Peak airway pressures before and after the additional use of the mucus shaver along with changes in airway resistance served as our co-primary endpoints. The study also compared changes in these variables as function of the ETT lumen size.

Results: The median peak airway pressure measured 29 cmH₂O before use of the mucus clearance system and fell to 23 cmH₂O (p<0.001). There was a similar decline in the median airway resistance (27 cmH₂O/lps to 15 cmH₂O/lps, p<0.001). The average percent decline in peak airway pressure equaled 17.6±13.3% while the mean drop in airway resistance was greater, 33±18.9%. Seventy-five percent of subjects experienced a greater than 10% and 19% fall in peak airway pressure and airway resistance, respectively. Differences in ETT lumen size did not alter the magnitude of the fall seen in either of the co-primary endpoints.

Conclusions: The addition of a unique mucus shaving and tube cleaning system (endOclear®) to routine suctioning prior to an SBT significantly reduces both peak airway pressure and airway resistance.

Our findings provide a physiologic rationale to explain the impact of this system on duration of MV noted in other reports.

Study Objective

To describe the effect of routine, protocolized use of endOclear® device on physiologic measures of airway resistance and peak pressures during efforts to liberate patients from the ventilator

Methods

Design: Prospective, observational quality assurance study, January 2012 through July 2013

Setting: Community hospital mixed medical-surgical ICU

Subjects: Mechanically ventilated patients on the ventilator over 24 hours

Protocol:

• Prior to SBT, the patient undergoes standard closed suctioning
• Peak airway pressure (PAP) and resistance are measured while the patient is still on the ventilator
• Prior to an SBT, patients undergo endOclear® (Figure 1) and measurements on the same settings are repeated

Endpoints: PAP and airway resistance

Statistics:

• Endpoints from before and after period compared with either Student’s t test (paired)
• p < 0.05 assumed to represent statistical significance

Results:

- Cohort
  a = 109 patients, 18 beds mixed surgical / medical ICU
  11,050 MV patient days

- In 2013, to improve ventilator mechanics, endOclear® was added as step 1 of our airway clearance protocol. The hypothesis was: Application of a mucus shaver system in addition to routine suctioning prior to spontaneous breathing trials (SBTs) lowers both peak airway pressures and airway resistance.

- The addition of a unique mucus shaving and tube cleaning system (endOclear®) to routine suctioning prior to an SBT significantly reduces both peak airway pressure and airway resistance.

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References

1. Wilson, A., Gray, D., Thomas, J., 2009, Increases in Endotracheal Tube Resistance Are Unpredictable Relative to Duration of Intubation, CHEST October 2009 vol. 136 no. 4 4206-4201
2. The Use of a Unique Mucus Shaving Device to Keep the Endotracheal Tube Free from Secretions, Crit Care Med Jan(4):119-24
4. Ntoumenopoulos, G., 2013, Endotracheal Suctioning May or May Not Have an Impact, But It Does Depend on What You Measure!, RESPIRATORY CARE October 2013 vol. 58 no. 10 1006-1010

Conclusion

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