

Airway Clearance: Physiology, Pharmacology, Techniques, and Practice

Clinicians and patients are troubled by airway secretions. Although many techniques for airway clearance are available, and, despite anecdotal associations between airway clearance and improvements in respiratory function, there is a dearth of high-level evidence to support any secretion clearance technique. Yet airway clearance therapy takes a great deal of the typical respiratory therapist's time. For the most effective therapy for our patients and for the efficient use of health care resources, we must understand and advance the scientific basis for airway clearance techniques. We designed this RESPIRATORY CARE Journal conference to review the scientific basis and clinical evidence for airway clearance therapy to guide the most appropriate approach to airway clearance. We present the papers from this important conference in this and the next issue of RESPIRATORY CARE.

At this conference we brought together a distinguished and diverse international group of clinicians and scientists, including respiratory therapists, physical therapists, adult and pediatric pulmonary physicians, basic scientists, and epidemiologists to highlight the state of the art for what is known, as well as new directions and opportunities for the study of mucus and sputum. The proceedings kick off with papers by Duncan Rogers and Cees van der Schans, who address the physiology of mucus secretion, cough, and airway clearance. This forms the scientific background for understanding airway clearance mechanisms and how airway clearance is changed in disease.

Next come papers on the pharmacology of airway clearance. Ruben Restrepo discusses adrenergics and anticholinergics, and Duncan Rogers covers the mucolytic and mucokinetic medications.

Most of the conference dealt with airway clearance techniques, their proposed mechanisms, the evidence for these techniques, and adverse effects and contraindications for these techniques. There are papers on conventional chest physiotherapy, by Cees van der Schans; forced expiratory technique, directed cough, and autogenic drainage, by Jim Fink; high-frequency assisted airway clearance, by Rob Chatburn; positive expiratory pressure and oscillatory positive expiratory pressure, by Tim Myers; and the mechanical in-exsufflator cough-assist, by Doug Homnick.

The conference wrapped up with 4 papers on the practice of airway clearance. Rich Branson covers specific

issues related to airway clearance in mechanically ventilated patients. Bruce Rubin describes appropriate outcome measures for evaluating mucus clearance therapy in individual patients and in clinical trials. Carl Haas presents applications in the elderly and in patients with neurologic or neuromuscular compromise. Michael Schechter reviews airway clearance applications in infants and children.

The speakers at this conference were challenged to find evidence to support or refute a number of "mucus myths" (Table 1). At the end of the conference there was consen-

Table 1. Mucus Myths

1. If there is a wet cough, this means that there is mucus in the airway.
2. The most common cause of atelectasis is a mucus plug.
3. Milk ingestion will increase mucus secretion in patients with a respiratory infection.
4. Mist tents and vaporizers improve mucus clearance.
5. Mucomyst improves mucus clearance.
6. Anticholinergics will dry secretions.
7. Cough suppressants are useful for patients with a dry cough.
8. β agonists (eg, albuterol) improve mucociliary clearance.
9. Guaifenesin is safe and effective for patients with sinus disease or cough due to upper respiratory tract infection.
10. Pulmozyme is effective in some patients with COPD or asthma.
11. Pulmozyme or mucomyst should be instilled into the airway when there is a mucus plug.
12. Normal saline nebulizer treatments help to clear mucus from the lungs.
13. Astringents such as Vicks VapoRub improve cough and mucus clearance.
14. Postural drainage makes CPT more effective.
15. Clapping on the chest helps to loosen mucus.
16. CPT prevents postoperative atelectasis.
17. CPT is of proven benefit in COPD or asthma.
18. Oscillating PEP devices (eg, Flutter, Acapella) are as effective as CPT.
19. Deep suctioning is good for mucus clearance, especially if it provokes a cough.
20. Saline instillation and bagging makes endotracheal suctioning more effective.
21. You can tell if suctioning is effective by listening to the patient's chest.

COPD = chronic obstructive pulmonary disease
CPT = chest physical therapy
PEP = positive expiratory pressure

sus that 13 of the 21 items listed in the table are indeed myths and folklore, 2 are probably appropriate practice, and for the remainder there are insufficient data to strongly support as truth or fable. Rather than identify which of these statements the speakers debunked, we suggest instead that the reader study these issues of RESPIRATORY CARE and think about how the conclusions should affect daily practice.

Good science and good clinical practice go hand-in-hand. How much time do respiratory therapists and other clinicians devote to performing chest physical therapy and other airway clearance techniques on patient groups where this has been shown to be ineffective? How often do we administer acetylcysteine, aerosolized normal saline, saline instillation for suctioning, cough suppressants, and expectorants—each of which are not only ineffective, but in many cases dangerous when used in patients with airway inflammation? We hope that these papers will provoke discussion, comment, and practice change, as well as ignite the curiosity of the next wave of clinical scientists seeking answers to the many questions that remain regarding the effectiveness of mucus clearance drugs, devices, and techniques.

It was a pleasure to chair this 39th RESPIRATORY CARE Journal Conference, which is the first on airway clearance physiology, pharmacology, techniques, and practice. No other professionals are as enthusiastic about mucus and sputum as respiratory therapists. One of the speakers at

this conference referred to them as our “bread and butter,” and, although some outside the field might see this as indelicate, we believe that a group of professionals whose annual competition for the best and brightest is referred to as the “Sputum Bowl” would find this a very appropriate description. Yet, with all the jokes that could be made about sputum, it is an incredibly complex and fascinating subject that influences all that respiratory therapists do, whether it is airway clearance, aerosol deposition, or mechanical ventilation.

We would like to thank the speakers, whose superb presentations and discussions were at the highest academic level. We also thank the sponsors who, through their generosity and unrestricted educational grants, have allowed us to bring together this outstanding faculty. Finally, we wish to thank the American Respiratory Care Foundation for their ongoing support of these conferences.

Bruce K Rubin MEngr MD MBA FAARC

Department of Pediatrics
Wake Forest University School of Medicine
Winston-Salem, North Carolina

Dean R Hess PhD RRT FAARC

Department of Respiratory Care
Massachusetts General Hospital
Department of Anesthesia
Harvard Medical School
Boston, Massachusetts