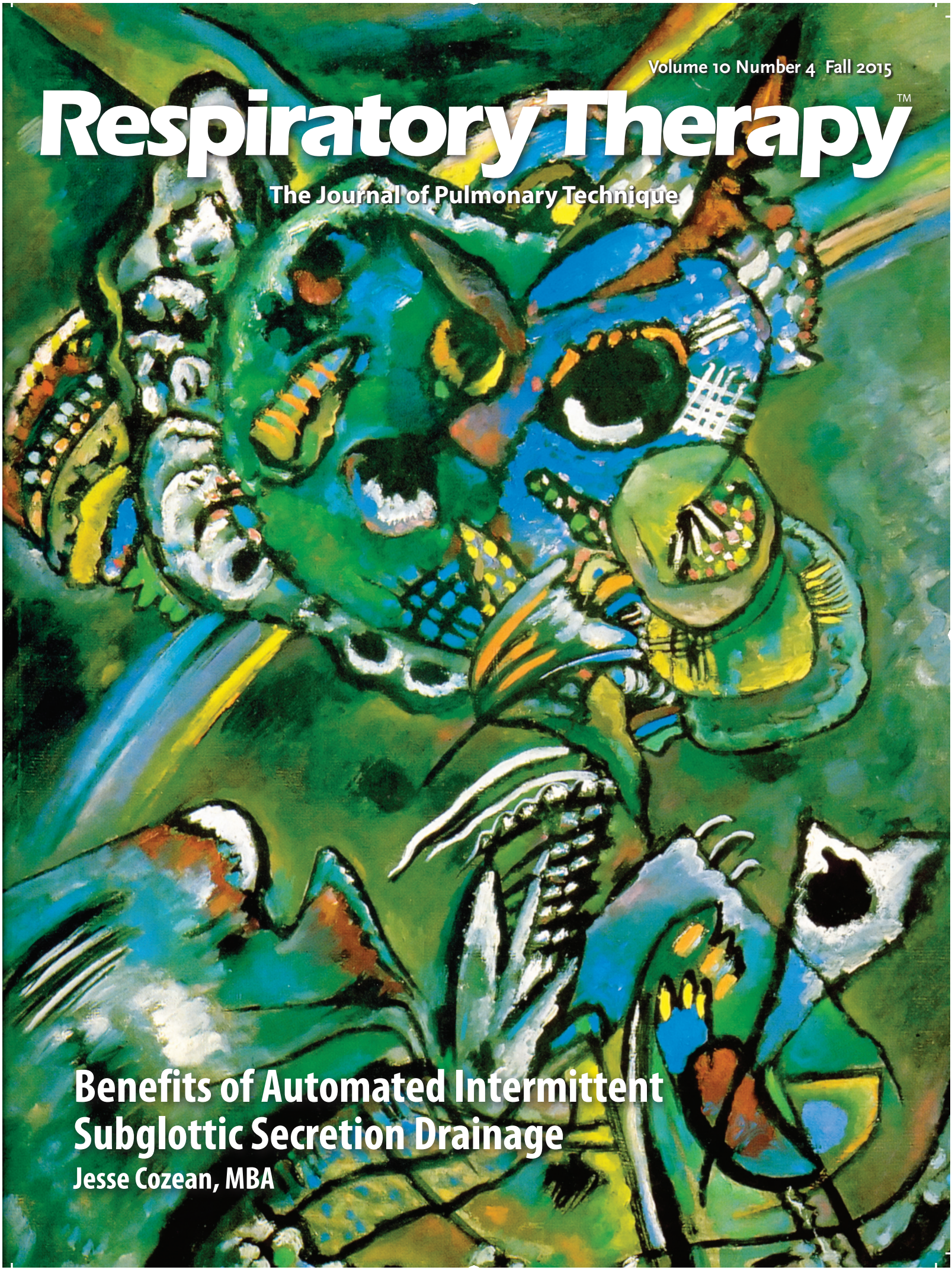
Volume 10 Number 4 Fall 2015

Respiratory Therapy™

The Journal of Pulmonary Technique



Benefits of Automated Intermittent Subglottic Secretion Drainage

Jesse Cozean, MBA

Benefits of Automated Intermittent Subglottic Secretion Drainage

Jesse Cozean, MBA

Nosocomial infections due to Ventilator-Associated Pneumonia (VAP) are common, costly, and dangerous to patients in ICU settings. The cause of VAP is clear, resulting from the presence of bacteria in the typically clean areas of the lower respiratory tract. The mechanical ventilator causes subglottic secretions to accumulate above the ballooned cuff of the inflated tracheal tube, which then leak or are aspirated into the lungs.

VAP is an extremely common and serious type of hospital-acquired infection (HAI), with an incidence rate ranging from 1-3 VAP/1,000 ventilator-days in the United States, and significantly higher (12-18 VAP/1,000 patient-days) in Europe, in large part due to differences in VAP definition (Damas et al, 2015). These nosocomial infections are highly dangerous, with a mortality rate associated with VAP of 13%, and infections prolong ICU stay by 6-9 days for the patient.

Multiple studies have shown the benefit of draining subglottic secretions before they can enter the lungs and cause infection. In a randomized, controlled clinical trial, Subglottic Secretion Drainage (SSD) reduced the rate of VAP from 17.6% to 8.8%, cutting nosocomial infections in half (Damas et al, 2015). The authors concluded, "Subglottic secretion suctioning resulted in a significant reduction of ventilator-associated pneumonia prevalence." Another clinical trial confirmed these results, demonstrating a 42% reduction in VAP in the patients who had their subglottic secretions drained regularly (Lacherade et al, 2010). In a meta-analysis of clinical trials conducted on ventilated patients, it was shown that SSD minimizes both the length of ventilation and stay in the ICU (Dezfulian et al, 2005). Regular secretion drainage has been shown to be a vital component in reducing nosocomial infection, duration of ventilation, and stay in the ICU.

Despite the clinical benefits, there are significant challenges associated with proper and regular secretion drainage. Respiratory therapists are instructed to drain the secretions for each patient on ventilation every hour, which is often difficult to accomplish with the volume of patients and high patient to staff ratio. Draining the secretions by hand is time-consuming and difficult to ensure that each patient receives SSD every hour. Furthermore, it causes patient discomfort, where an invasive procedure is repeated hourly for days. Commonly the SSD causes an inflammatory response, actually increasing the amount of subglottic secretions. If the subglottic secretions are not drained properly they can then enter the lungs and necessitate a painful bronchial or endotracheal drainage procedure. According to a poster presented by the University of Texas, "Endotracheal suctioning has been associated with adverse events that include tachycardia, hypertension, hypoxemia, and atelectasis." (Acevedo et al, 2013).

There is also disturbing evidence that the manual draining of these secretions is not within the recommendations of the American Association for Respiratory Care (AARC) Clinical Practice Guidelines. The AARC specifies a pressure of 150 mmHg, but studies have found that 97.7% of observed manual suctionings exceeded these force levels, putting greater strain on the patient's trachea. The average force from wall-mounted suction was found to be 123% higher than recommended. Using a syringe is even more forceful, with average pressure of 578-722 mmHg (depending on syringe size). Current methods for subglottic drainage put between 2 and 5 times more force on the airway than is recommended.

A potential solution to the problems with current SSD techniques may be automated intermittent secretion drainage. With these devices, the suction device is permanently connected with the suction port of the tracheal or endotracheal tube, and activated automatically to drain secretions. Rather than hoping for drainage each hour, a smaller amount of fluid can be drained every 5-15 minutes, depending on the amount and viscosity of subglottic fluid accumulating.

In automating the process, the respiratory therapist gains significantly more control over the procedure. The therapist can customize the timing of the automated suctioning for the patient. The pressure of the system can be substantially lower,

Jesse Cozean is a clinical researcher who has overseen the design and operation of six different clinical trials totaling more than 15,000 patients, has received FDA approval for Stage III clinical trials on both OTC and prescription drugs, and is the author of many peer-reviewed articles. A research team that he led was just awarded the winner of the Fighting Ebola Grand Challenge from USAID, the White House Science and Technology Office, the CDC, and the Department of Defense. Jesse received his Bachelor of Science in Physics from Westmont College, and his MBA from Western Governor's University. He has served as the Vice President of Research and Development for several companies, including Abela Pharmaceuticals and Innovative BioDefense, heading research teams into pharmaceutical and OTC drug products. Jesse holds multiple patents on medical device and drug products. The author consults with Flosure Technologies.

within the AARC Guidelines, and tailored to the needs of the patient and without putting unnecessary force on the airway. By collecting the secretions at smaller intervals, even with lower pressure levels, a larger volume of the subglottic secretions can be removed, lowering the risk of VAP.

An automated intermittent subglottic aspiration system has the advantage of being specifically designed for the removal of subglottic secretions, rather than wall suction or general-purpose suction pumps that are not intended for that purpose and put substantially higher force on the patient. Wall suction have on/off cycles that are too short to be ideal for removal of subglottic secretions, pressure levels are difficult to control, and they are very noisy. Using manual suction with a syringe places even more force on the airway of the patient, requires the staff to glove up hourly and use a new syringe for suction, and handling the contagious material which can increase the risk of cross-contamination.

Automated intermittent systems have been extensively tested and widely used in Europe, and the first such product to gain FDA clearance is now available in the United States. One doctor and researcher, Dr. Markus Wolf, has used automated intermittent subglottic suctioning for more than three years in the Department of Pneumology and Intensive Care (Asklepios Klinik Barmbek, Hamburg, Germany). The 18 bed ICU ward, with all patients ventilated on admission, has treated approximately 300 patients with automated devices.

"We have seen many advantages of the automated intermittent subglottic drainage," says Dr. Wolf. "In our experience, the amount of material drained increases by 10 times over what we were seeing with manual suctioning by our staff. It has saved time for our staff and reduced our contact with infectious material. And it has been beneficial to our patients, with less force put on the tracheal wall and no trauma from repeated endotracheal suctioning."

Dr. Wolf divides the patients he treats into two major groups for automated subglottic drainage. The first set of patients have a massive aspiration of saliva-type fluid, more than 500 ml per day. For this group, the settings of the automated intermittent device are for low pressure, which is sufficient to extract the fluid, on short intervals to remove as much of the secretions as possible. The second group experiences a smaller amount of thick mucopurulent material, typically less than 200 ml per day. For this group, a higher pressure setting (still within AARC Guidelines) is utilized, with longer intervals between suctioning.

One of the first clinicians to adopt an FDA-cleared automated intermittent device in the United States, Jerry Gentile, BSHA, BSRC, MBA, EdD(c), RT, RRT, has been impressed by the new equipment. "As one of the first respiratory clinicians to adopt the automated intermittent subglottic drainage devices in the United States, I have been impressed by the new equipment. We have been trialing the device on 5 patients and the results have been clinically significant. Further clinical trials are needed to assess efficacy and overall cost effectiveness" says the Director of Respiratory Care Services, Eastchester Rehabilitation and Healthcare Center (Bronx, NY).

Subglottic drainage is a vital tool in the fight to prevent VAP and nosocomial infection, and automating the process with specialized equipment may have significant advantages for both the healthcare facility and the patient. The automated process requires less time from the staff and minimizes contact with infectious material. For patients, more secretions can be drained with less trauma and force on the airway, and the process can be customized for the individual needs of the patient while minimizing noise in the patient room. With the first FDA clearance for these devices already granted, automated intermittent subglottic secretion drainage seems to be the wave of the future.

References

- Acevedo D, Restrepo R, Gonzalez L et al, Are We Suctioning the Life Out of Our Ventilator Patients, American Association for Respiratory Care Congress, 2013.
- Damas P, Frippiat F, Ancion A et al, Prevention of Ventilator-Associated Pneumonia and Ventilator-Associated Conditions: A Randomized Controlled Trial with Subglottic Secretion Suctioning, Critical Care Medicine Journal, 2015; 43(1).
- Dezfulian C, Shojania K, Collard H et al, Subglottic Secretion Drainage for Preventing Ventilator-Associated Pneumonia: a Meta-Analysis, The American Journal of Medicine, 2005; 118: 11-18.
- Lacherade JC, Jonghe B, Guezennec P et al, Intermittent Subglottic Secretion Drainage and Ventilator-Associated Pneumonia, American Journal of Respiratory Critical Care Medicine, 2010; 182: 910-917.

Benefits of Automated Intermittent Subglottic Secretion Drainage
Jesse Cozean, MBA

Reprinted from Respiratory Therapy, The Journal of Pulmonary Technique
Volume 10 Number 4 Fall 2015