Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

American Journal of Emergency Medicine 48 (2021) 361–362

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

How healthcare must respond to ventilator-associated pneumonia (VAP) in invasively mechanically ventilated COVID-19 patients

To the Editor,

New research indicates that the incidence of Ventilator-Associated Pneumonia (VAP), in patients infected with SARS-CoV-2 requiring invasive mechanical ventilation, exceeds 50% [1]. While VAP is a common nosocomial infection with almost 8% to 28% of critically ill patients admitted to intensive care units (ICUs), the extremely high incidence rate in SARS-CoV-2 patients is a wakeup call [2]. This new research refutes the previous low reported rates of VAP in SARS-CoV-2 infected patients and outlines a critical need to examine current clinical practices.

VAP is defined as pneumonia that develops after 48 h or longer of invasive mechanical ventilation. It increases hospital length of stay, time on mechanical ventilation, ventilator weaning time, mortality and morbidity, and causes a significant burden on medical resources. VAP is frequently caused by Gram (−) bacteria and *Staphylococcus aureus* strains in the oropharynx and gut colonize the nasopharynx of intubated patients, resulting in the formation of biofilms around the cuff and body of the endotracheal tube, which serves as a reservoir for the development of bronchial tree infections [3]. During mechanical ventilation, secretions pooling above an endotracheal tube cuff results in distal tracheal microsaspiration, contamination of the endotracheal tube, and enter the lungs with the air forced through the ventilator projection of microbial pathogens to distal airways facilitated by positive pressure ventilation [4]. The formation of biofilms inside and around the endotracheal tube, shield pathogens from pharmaceutical intervention and gives rise to bacterial colonization and antibiotic resistance.

With high rates of morbidity and mortality attributed to VAP, implementing any intervention that can mitigate or prevent these infections will have significant benefits for SARS-CoV-2 infected patients, healthcare capacity, and economic outcomes for hospitals. Existing VAP prevention strategies include diligent hand hygiene, inclining the head of the bed, chlorhexidine mouthwashes, sedation breaks, subglottic secretion drainage, early ventilator weaning, and prophylactic antibiotics. Variability in these strategies relies in the use of prophylactic antibiotics and subglottic suction endotracheal tubes.

While prophylactic antibiotics can result in complications and propagate antibiotic resistance, the use of subglottic suction endotracheal tubes (SSETs) is an underused efficient measure [5]. Recent meta-analysis data on the use of SSETsshows reductions in VAP incidence, duration of mechanical ventilation, antibiotic use, and mortality [6]. Additionally, outside of critical care settings, SSETs have also demonstrated reductions in VAP risk during short-term intraoperative intubations. Nam et al. demonstrated that routine subglottic secretion drainage in patients undergoing cardiac surgery led to 600% reduction in postoperative VAP incidence [7]. Yuzkat et al. showed that endotracheal tubes with SSETs in rhinoplasty reduced the incidence of postoperative respiratory complications as well as the incidence of VAP, agitation, sore throat and swallowing difficulty [8].

Given the strong supporting evidence for subglottic suctioning in critical care and intraoperative settings, further investigation and adoption of SSETs as an essential component of VAP prevention strategies is urgently needed in the era of the COVID-19 pandemic. Use of SSETs early in mechanically ventilated SARS-CoV-2 infected patients is likely to reduce the incidence of VAP and lead to improved outcomes. It is also reasonable to explore the use of subglottic suctioning in emergent and pre-hospital care settings, as an inciting microaspiration event may occur at any time following intubation, and to minimize provider exposure from subsequent endotracheal tube exchanges. Early utilization of subglottic suctioning may also reduce the need for closed suctioning of the endotracheal tube lumen, thus reducing additional aerosolizing procedures.

Advances in subglottic suctioning, such as the use of multiport suction endotracheal tubes have overcome the difficulties of continuous suction encountered with earlier SSET designs. Single suction port endotracheal tubes are frequently obstructed by tracheal mucosa and result in accumulation of subglottic secretions leading to microaspiration [9]. Furthermore, continuous suctioning of secretions can lead to potentially harmful invagination of tracheal mucosa into the suction port [4,10]. Indeed, anatomic pathologies of the airway, including subglottic stenosis, are highly associated with long-term intubation: Mucosal damage as a result of trauma or inflammation may be the etiology [11].

Multiport suction endotracheal tubes such as the NeVap Aspire Subglottic Suction Endotracheal Tube (NeVap Inc., San Jose, CA, USA; Fig. 1), use multidirectional suction ports and tissue spacing to overcome this problem. . This new generation of SSET accommodates high continuous vacuum pressure (>200 mmHg) and avoids mucosal injury. Early evidence supports continued investigation of multiport SSETs as tools for VAP prevention, particularly in the management of severe SARS-CoV-2 infection.

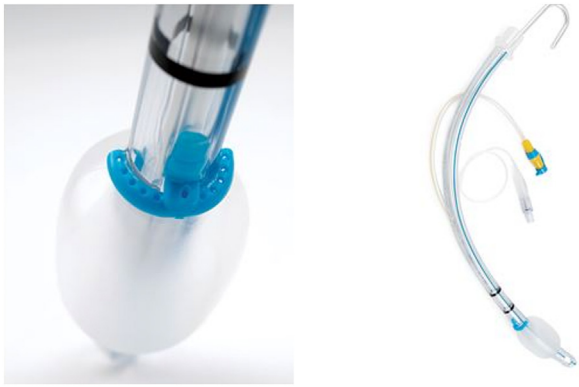

Fig. 1. Multiport suction ports in the NeVap Aspire Subglottic Suction Endotracheal Tube.

https://doi.org/10.1016/j.ajem.2021.01.074

Declaration of Competing Interest

None.

Acknowledgements

NIH/NIDCD R01DC009616.

References

[1] Rouzé A, et al. Relationship between SARS-CoV-2 infection and the incidence of ventilator-associated lower respiratory tract infections: a European multicenter cohort study. Intensive Care Med. 2021:1–11. https://doi.org/10.1007/s00134-020-06323-9 (Online ahead of print).
[2] Tablan OC, Anderson LJ, Besser R, et al. Guidelines for preventing health-care--associated pneumonia, 2003: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee. MMWR Recomm Rep. 2004;53 (RR-3):1–36.
[3] Wiener-Kronish JP, Dorr HI. Ventilator-associated pneumo- nia: problems with diagnosis and therapy. Best Pract Res Clin Anaesthesiol. 2008;22:437–49.
[4] Pneumatikos IA, Dragoumanis CK, Bouros DE. Ventilator-associated pneumonia or endotracheal tube-associated pneumonia? An approach to the pathogenesis and preventive strategies emphasizing the importance of endotracheal tube. Anesthesiology. 2009;110(3):673–80. https://doi.org/10.1097/ALN.0b013e31819868e0.
[5] Lacherade JC, Azais MA, Pouplet C, Colin G. Subglottic secretion drainage for ventilator-associated pneumonia prevention: an underused efficient measure. Ann Transl Med. 2018;6(21):422. https://doi.org/10.21037/atm.2018.10.40.
[6] Pozuelo-Carrascosa DP, Herráiz-Adillo A, Alvarez-Bueno C, Manuel Añón J, Martínez-Vizcaíno V, Cavero-Redondo I. Eur Respir Rev. 2020;29:190107. https://doi.org/10.1183/16000617.0107-2019.
[7] Nam K, Park JB, Park WB, et al. Effect of perioperative subglottic secretion drainage on ventilator-associated pneumonia after cardiac surgery: a retrospective, before-and-after study. J Cardiothorac Vasc Anesth. 2020;S1053-0770(20):31044-2. https://doi.org/10.1053/j.jvca.2020.09.126.
[8] Yuzkat N, Demir CY. Effect of using the suction above cuff endotracheal tube (SACETT) on postoperative respiratory complications in rhinoplasty: a randomized prospective controlled trial. Ther Clin Risk Manag. 2019;15:571–7. https://doi.org/10.2147/TCRM.S200662.
[9] Dragoumanis C, et al. Investigating the failure to aspirate subglottic secretions with the Evac endotracheal tube. Anesth Analg. 2007;105(4):1083–5 (table of contents) https://doi.org/10.1213/01.ane.0000278155.19911.67.
[10] Suys E, Nieboer K, Stiers W, De Regt J, Huyghens L, Spapen H. Intermittent subglottic secretion drainage may cause tracheal damage in patients with few oropharyngeal secretions. Intensive Crit Care Nurs. 2013;29(6):317–20. https://doi.org/10.1016/j.iccn.2013.02.007.
[11] Singh T, Sandulache VC, Otteson TD, Barsic M, Klein EC, Dohar JE, et al. Subglottic stenosis examined as a fibrotic response to airway injury characterized by altered mucosal fibroblast activity. Arch Otolaryngol Head Neck Surg. 2010 Feb;136(2): 163–70. https://doi.org/10.1001/archoto.2009.175 (PMID: 20157063; PMCID: PMC3000122).

Lukasz Szarpak PhD, MBA
[c]*Maria Sklodowska-Curie Bialystok Oncology Center, Bialystok, Poland*
E-mail address: lukasz.szarpak@gmail.com

Jonathan Wisco PhD
[a]*Department of Anatomy and Neurobiology, Laboratory for Translational Anatomy of Degenerative Diseases and Developmental Disorders (TAD4), Boston University School of Medicine, Boston, MA, USA*
*Corresponding author at: Department of Anatomy and Neurobiology, Laboratory for Translational Anatomy of Degenerative Diseases and Developmental Disorders (TAD4), Boston University School of Medicine, 72 E Concord St, L-1004, Boston, MA 02118, USA.
E-mail address: jjwisco@bu.edu

Richard Boyer PhD, MD
[b]*Department of Anesthesiology, Weill Cornell Medicine, New York, NY, USA*
E-mail address: rbb9007@med.cornell.edu

22 January 2021