The Defenseless Tracheal Conduit: Can a Team Work Together to Improve Airway Protection?

Patients who become intubated are some of the most vulnerable and defenseless that we care for in the hospital. They rely on processes that are standard practices to protect them from lower-airway contamination. Colonization of the tracheobronchial tree with microorganisms almost always follows tracheal intubation.[1] Tracheal intubation affects the cough reflex, compromises mucociliary clearance, injures the tracheal epithelial surface, allows microaspiration of bacteria into the lower respiratory tract, reduces local host defenses, and allows the formation of biofilm on the ETT surface.[2] The biofilm facilitates bacterial colonization of artificial airway surfaces and is not affected by antibiotic administration. Approaches that retard biofilm production may decrease the risk of nosocomial pneumonia.[3-5]

Handling and insertion of the endotracheal tube aseptically is not clearly identified as a risk factor for nosocomial pneumonia, but it is a source of contamination of the lower respiratory tract. However there are insufficient data to determine whether sterile handling of endotracheal tubes impacts the incidence and prevalence of pneumonia in the emergency, urgent, or elective clinical scenarios.[6] Nonetheless, intubation is a potential risk factor for developing early-onset ventilator-associated pneumonia (VAP).[7] VAP is the most common nosocomial infection in critically ill patients.[8-10] VAP occurs in a considerable proportion of patients who are intubated and require mechanical ventilation. This is associated with increased morbidity, mortality, and cost.[11] Given these effects, strategies that prevent VAP are needed. Elimination of all possible sources of infection may have benefit for our patients, including those related to the intubation process.[12]

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The paper by Wilcox et al in this issue of RESPIRATORY CARE[13] addresses the issue of contaminated intubation equipment and offers a process improvement through more effective cleaning, stocking, and supply organization. The paper provides an analysis that involves all stakeholders, including personnel who decontaminate and restock the equipment, infectious disease experts, and end-users. The implemented process promotes less opportunity to transport contaminated equipment, thereby decreasing a probable introduction of tracheal bacterial contaminants.

Wilcox et al[13] identified their hospital's historical process for emergency airway equipment storage and transport as a potential source of contaminated equipment. Carried throughout the hospital, the original emergency airway equipment bag was a possible source for bacterial transmission. The analysis and implemented changes improved practice, which has eliminated bacterial contaminants from being transported through the hospital.

Wilcox et al[13] addressed multiple areas of concern and, with the implemented changes, lessened the risk of lower-airway inoculation by pathogens as the source for VAP. In addition, streamlining redundancies, standardizing equipment, and reorganization of storage have the potential for improving quality. The authors introduced the use of smaller bags that improved the transport of emergency airway equipment. Enhanced equipment recognition and acquisition time allowed an important reduction in the time required to intubate a manikin.

Wilcox et al[13] are to be commended for identifying a problem, taking a multidisciplinary approach to the solution, defining measurable end points, dissecting the existing system, reconstructing the system, implementing a consensus-driven strategy, and evaluating the effect of the intervention. I encourage future studies that address whether these steps have an impact in lowering VAP rates.

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REFERENCES

1. Brook I. Role of anaerobic bacteria in infections following tracheostomy, intubation, or the use of ventilatory tubes in children. Ann Otol Rhinol Laryngol 2004;113(10):830-834.
2. 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):673-680.
3. Feldman C, Kassel M, Cantrell J, Kaka S, Morar R, Goolam Mahomed A, Philips JI. The presence and sequence of endotracheal tube

colonization in patients undergoing mechanical ventilation. Eur Respir J 1999;13(3):546-551.
4. Zur KB, Mandell DL, Gordon RE, Holzman I, Rothschild MA. Electron microscopic analysis of biofilm on endotracheal tubes removed from intubated neonates. Otolaryngol Head Neck Surg 2004; 130(4):407-414.
5. Rello J, Kollef M, Diaz E, Sandiumenge A, del Castillo Y, Corbella X, Zachskorn R. Reduced burden of bacterial airway colonization with a novel silver-coated endotracheal tube in a randomized multiple-center feasibility study. Crit Care Med 2006;34(11):2766-2772.
6. Cheung N, Betro G, Luckianow G, Napolitano L, Kaplan LJ. Endotracheal intubation: the role of sterility. Surg Infect (Larchmt) 2007; 8(5):545-552.
7. Sirvent JM, Torres A, Vidaur L, Armengol J, de Batlle J, Bonet A. Tracheal colonisation within 24 h of intubation in patients with head trauma: risk factor for developing early-onset ventilator-associated pneumonia. Intensive Care Med 2000 Sep;26(9):1369-1372.
8. Safdar N, Dezfulian C, Collard HR, Saint S. Clinical and economic consequences of ventilator-associated pneumonia: a systematic review. Crit Care Med 2005;33(10):2184-2193.
9. Levine SA, Niederman MS. The impact of tracheal intubation on host defenses and risks for nosocomial pneumonia. Clin Chest Med 1991;12(3):523-543.
10. Hirsch N, Beckett A, Collinge J, Scaravilli F, Tabrizi S, Berry S. Lymphocyte contamination of laryngoscope blades–a possible vector for transmission of variant Creutzfeldt-Jakob disease. Anaesthesia 2005;60(7):664-667.
11. Warren DK, Shukla SJ, Olsen MA, Kollef MH, Hollenbeak CS, Cox MJ, Cohen MM, Fraser VJ. Outcome and attributable cost of ventilator-associated pneumonia among intensive care unit patients in a suburban medical center. Crit Care Med 2003;31(5): 1312-1317.
12. Goldstein S, Wolf GL, Kim SJ, Sierra MF, Whitmire C, Tolentino EM. Bacteraemia during direct laryngoscopy and endotracheal intubation: a study using a multiple culture, large volume technique. Anaesth Intensive Care 1997;25(3):239-244.
13. Wilcox SR, Bittner E, George E, Buckley VF, Schmidt UH. Improvement in emergency airway equipment transport. Respir Care 2010;55(7):852-857.

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