

CLINICAL REFERENCE

Ballard™ ET Tube Clearing Catheters

The following clinical articles study the efficacy and impacts of practices that clear ET Tubes of secretions, mucus, and biofilm.

*Some studies explicitly reference the Ballard™ Liberator or Ballard™ Restore2 ET Tube Clearing Catheters (formerly endOclear).**

ARTICLE	AUTHOR(S)	PUBLICATION	LINK
ET Tube Clearance Studies			
A Clinical Assessment of the Mucus Shaver: a Device to Keep the Endotracheal Tube Free From Secretions	Berra L., et al.	Critical Care Med, Jan 2012; 40(1):119-24	Pubmed Link: PMID: 21926595 Abstract
Tracheal Tube Biofilm Removal Through a Novel Closed-Suctioning System: an Experimental Study	Aguilera Xiol E., Li Bassi G., Wyncoll D., et al.	British Journal of Anesthesia, 115 (5): 775-83 (2015)	Pubmed Link: PMID: 26475806 Abstract
Removal of Endotracheal Tube Obstruction with a Secretion Clearance Device*	Mietto C., et al.	Respiratory Care, 2014; 59(9): e122-e126	Open Access Link
Endotracheal Tubes Cleaned with a Novel Mechanism for Secretion Removal: A Randomized Controlled Clinical Study*	Pinciroli R., et al.	Respiratory Care, 2016; 61(11):1431-1439	Open Access Link
Agency for Healthcare Research and Quality, AHRQ Safety Program for Mechanically Ventilated Patients	Johns Hopkins Medicine Armstrong Institute for Patient Safety and Quality, et al.	AHRQ Publication No. 16(17)-0018-1-EF January 2017	Open Access Link
Ex Vivo Evaluation of Secretion-Clearing Device in Reducing Airway Resistance within Endotracheal Tubes*	Waters C., et al.	Critical Care Research and Practice, Volume 2018, Article ID 3258396	Open Access Link
Antibacterial-Coated Tracheal Tubes Cleaned with the Mucus Shaver: a Novel Method to Retain Long-Term Bactericidal Activity of Coated Tracheal Tubes	Berra L., Curto F., Li Bassi G., Laquerriere P., et. al	Intensive Care Med, 2006; 32: 888-93	Pubmed Link: PMID: 16601964 Abstract
Efficacy Study on Silvercoated ETT Cleaned with a Novel Device	Massachusetts General Hospital	Clinical Trial NCT02120001	Clinical Trial Link: GovID: NCT02120001
Ballard™ Liberator And Restore2 ET Tube Clearing Catheter Study Abstracts			
Two Year Study to Evaluate Daily Endotracheal Tube (ETT) Cleaning Protocol*	Wicker B., et al.	SCCM Annual Meeting (San Diego, CA) February 17-19, 2019	Abstract Link
Five Year Study to Evaluate Cleaning Endotracheal Tube Prior to Weaning Trials*	Wicker B., Schofield L., Salem G.	AARC Annual Meeting (Indianapolis, IN) October 4-7, 2017	Link Not Available
The Use of endOclear® Catheter Device to Improve Ventilator Weaning*	Schofield L., Sauris G.	Chest Annual Meeting (Chicago, IL) October 30-31, 2013	Abstract Link
The Impact of a Unique Airway Clearance System on Airway Mechanics in Ventilated Patient*	Schofield L., Shorr, A., et al.	SCCM Annual Meeting (San Francisco, CA) January 9-13, 2014	Abstract Link
Comparison of Two Endotracheal Tube Cleaning Devices in Reducing Airway Resistance for the Mechanically Ventilated Patient*	Schofield L., et al.	AARC Annual Meeting (Tampa, FL) November 9-11, 2015	Open Forum Poster Link
Use of endOclear® Restore Device to Decrease ICU Ventilator Days*	Solis M., Schofield, L.	ATS Annual Meeting (Washington D.C.) May 19-23, 2017	Abstract Link
The endOclear® Liberator Cleaning Device in Decreasing Airway Resistance*	Schofield L.	AARC Annual Meeting (Indianapolis, IN) October 4-7, 2017	Link Not Available
Decreasing Duration of Mechanical Ventilation with endOclear®*	Karales R.	AARC Annual Meeting (Las Vegas, NV) December 4-6, 2018	Abstract Link
Evaluation of a Closed Suction System with Integrated Tube-Scraping Technology*	Kaur R., et al.	Respiratory Care. 2023 Aug; 68(8):1023-1030.	Open Access Link



Ballard™ ET Tube Clearing Catheters, Cont.

ARTICLE	AUTHOR(S)	PUBLICATION	LINK
Biofilm			
Description and Microbiology of Endotracheal Tube Biofilm in Mechanically Ventilated Subjects	Danin PE., et al.	Respiratory Care, 2015; 60(1):21-29	Open Access Link
Implications of Endotracheal Tube Biofilm in Ventilator Associated Pneumonia Response: a State of Concept	Gil-Perotin S., et al.	Critical Care, 2012; 16:R93 doi:10.1186/cc11357	Open Access Link
Advanced Endotracheal Tube Biofilm Stage, Not Duration of Intubation, is Related to Pneumonia	Wilson A., Gray D., Karakiozis J., Thomas J.	Journal of Trauma and Acute Care Surgery, April 2012; Volume 72 – Issue 4 – p 916–923	Pubmed Link: PMID: 22491605
Tracheal Tube Biofilm as a Source of Bacterial Colonization of the Lung	Inglis T., Millar M., Jones G., Robinson D.	Journal of Clinical Microbiology, 1989 Sep, Vol. 27, No. 9, p. 2014-2018	Pubmed Link: PMID: 2778064
Airway Resistance			
Increases in Endotracheal Tube Resistance Are Unpredictable Relative to Duration of Intubation	Wilson, et al.	Chest. 2009 Oct; 136(4):1006-1013	Open Access Link
Tube Volume Loss			
Endotracheal Tube Intraluminal Volume Loss Among Mechanically Ventilated Patients	Shah C., Kollef MH.	Critical Care Med, Jan 2004; 32(1):120-5	Pubmed Link: PMID: 14707569
Different Tracheostomy Tube Diameters Influence Diaphragmatic Effort and Indices of Weanability in Difficult to Wean Patients	Valentini I., Tonveronachi E., Gregoretti C., et al.	Respiratory Care, 2012; 57(12): 2012-2018	Open Access Link
“Narrow” Thinking About Difficult Weaning: Don’t Forget the Endotracheal Tube	Epstein SK.	Respiratory Care, 2012; 57(12): 2130-2132	Open Access Link
Closed Suctioning			
AARC Clinical Practice Guidelines: Artificial Airway Suctioning*	Blakeman TC., et al.	Respiratory Care. 2022 Feb; 67(2): 258-271	Open Access Link
AARC Guidelines: Endotracheal Suctioning of Mechanically Ventilated Patients with Artificial Airways	AARC	Respiratory Care, 2010; 55(6):758 –764	Pubmed Link: PMID: 20507660
Mechanical Ventilation With or Without Daily Changes of In-Line Suction Catheters	Kollef MH., Prentice D., Shapiro SD., et al.	American Journal of Respiratory Critical Care Medicine. 1997 Aug; 156 (2 Pt 1):466-72	Open Access Link
Infection Control			
Strategies to Prevent Ventilator-Associated Pneumonia, Ventilator-Associated Events, and Nonventilator Hospital-Acquired Pneumonia in Acute-Care Hospitals: 2022 Update	Klompas M., et al.	Infection Control Hospital Epidemiology. 2022 Jun; 43(6):687-713.	Open Access Link
Strategies to Prevent Ventilator-Associated Pneumonia in Acute Care Hospitals: 2014 Update	Klompas M., Branson R., Eichenwald EC., et al.	Infection Control & Hospital Epidemiology, 35, pp 915-936 doi:10.1086/527363	Open Access Link
Use of endOclear® Restore Device to Decrease ICU Ventilator Days	Solis M., Schofield L.	ATS Annual Meeting (Washington D.C.) May 19-23, 2017	Abstract Link
Silver Coated ET Tubes			
Silver-Coated Endotracheal Tubes Associated with Reduced Bacterial Burden in the Lungs of Mechanically Ventilated Dogs	Olson ME., Harmon BG., Kollef MH.	Chest. 2002; 121: 863–70	Abstract Link
Endotracheal Tubes Coated with Antiseptics Decrease Bacterial Colonization of the Ventilator Circuits, Lungs, and Endotracheal Tube	Berra L., De Marchi L., Yu ZX., Laquerriere P., Baccarelli A., Kolobow T.	Anesthesiology, 2004; 100: 1446–56	Open Access Link
Silver-Coated Endotracheal Tubes and Incidence of Ventilator-Associated Pneumonia: The NASCENT Randomized Trial	Kollef MH., Afessa B., Anzueto A., et al.	JAMA. 2008; 300(7):805-813. doi:10.1001/jama.30 0.7.805	Pubmed Link: PMID: 18714060