A Review of **Tracheostomy Management** Core Concepts

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Conflict of Interest: **None**

I have no perceived conflicts of interest and am not affiliated with any pharmaceutical, equipment, or manufacturing company.

Learning Objectives

After the course, participants will be able to:

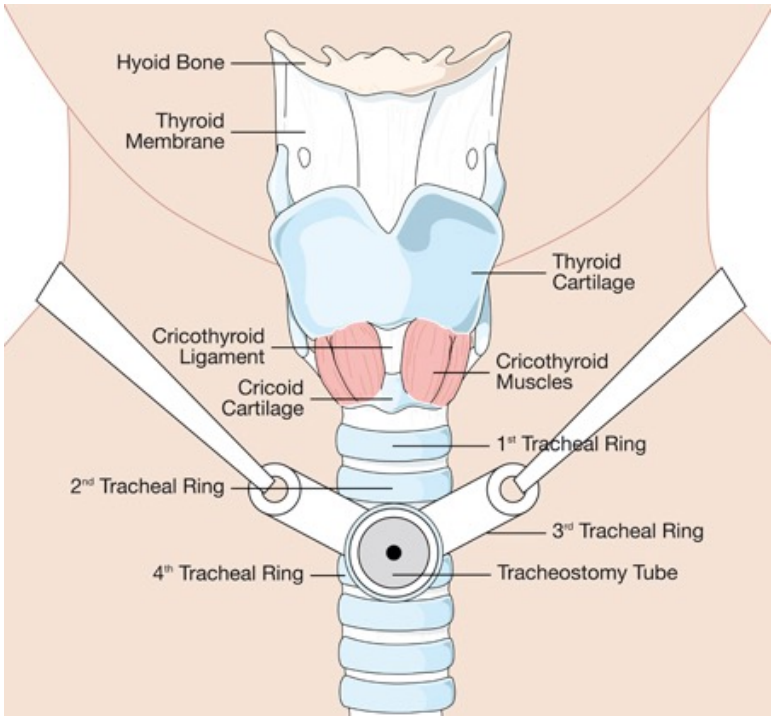
1) **Identify** and **describe** commonly used **artificial airway equipment** in tracheostomy care.

2) Discuss the **clinical implications and evidence-based best practices** for managing patients with a tracheostomy.

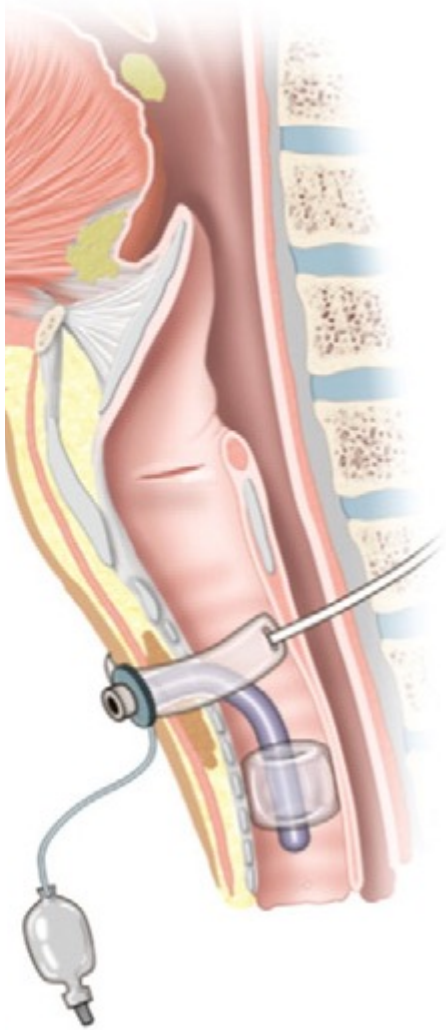
3) Recognize situations that require **troubleshooting** and apply effective strategies to address common **tracheostomy-related issues**.

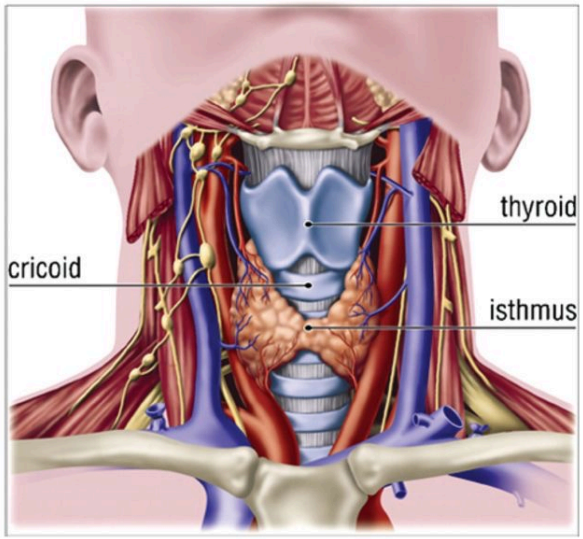
The “Trach”

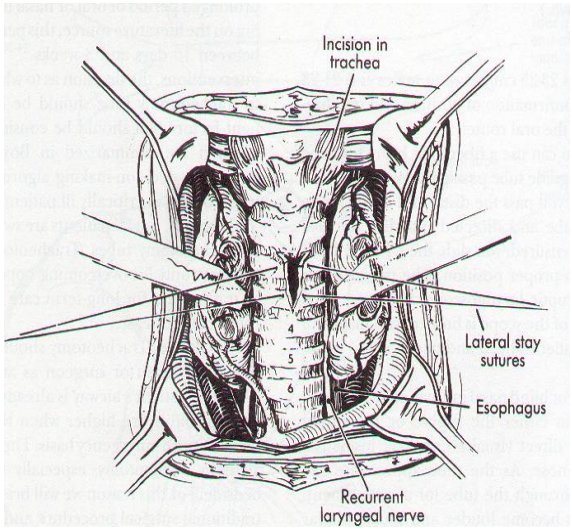
- Stoma – end of a tube, the hole
- Tracheostomy – surgically-created opening
- Tracheotomy – an incision or cut

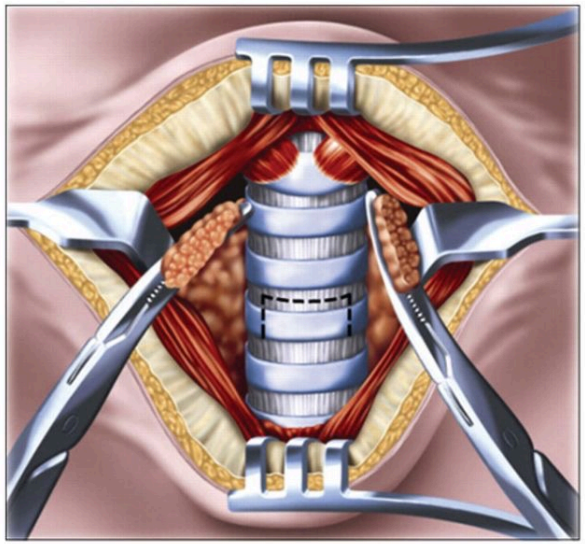


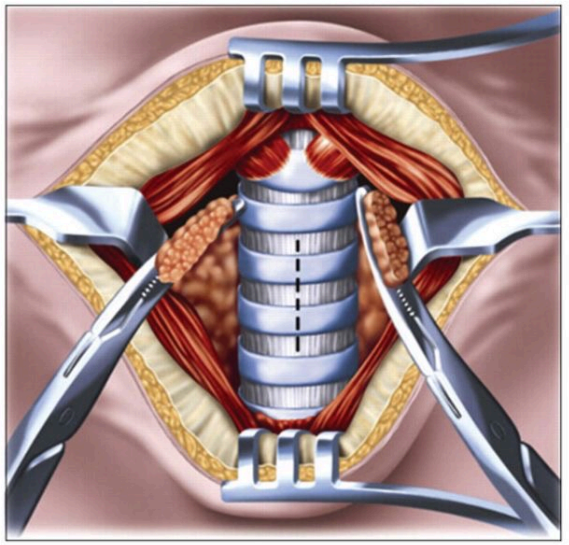
Anatomy *Review*



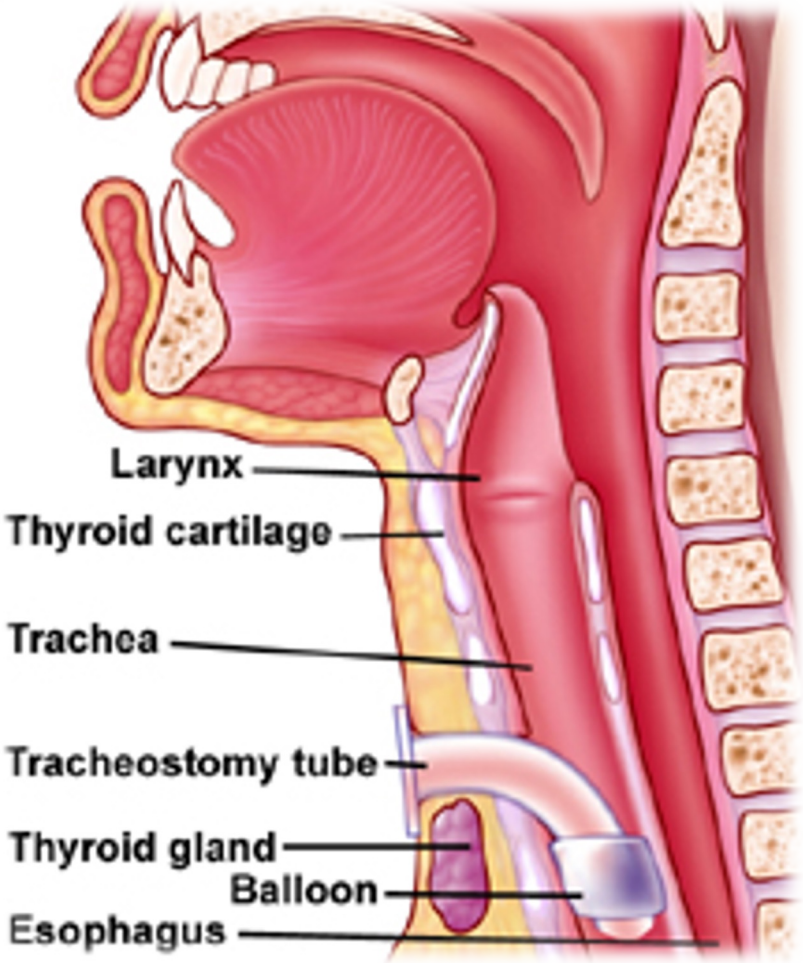








Anatomy *Review*

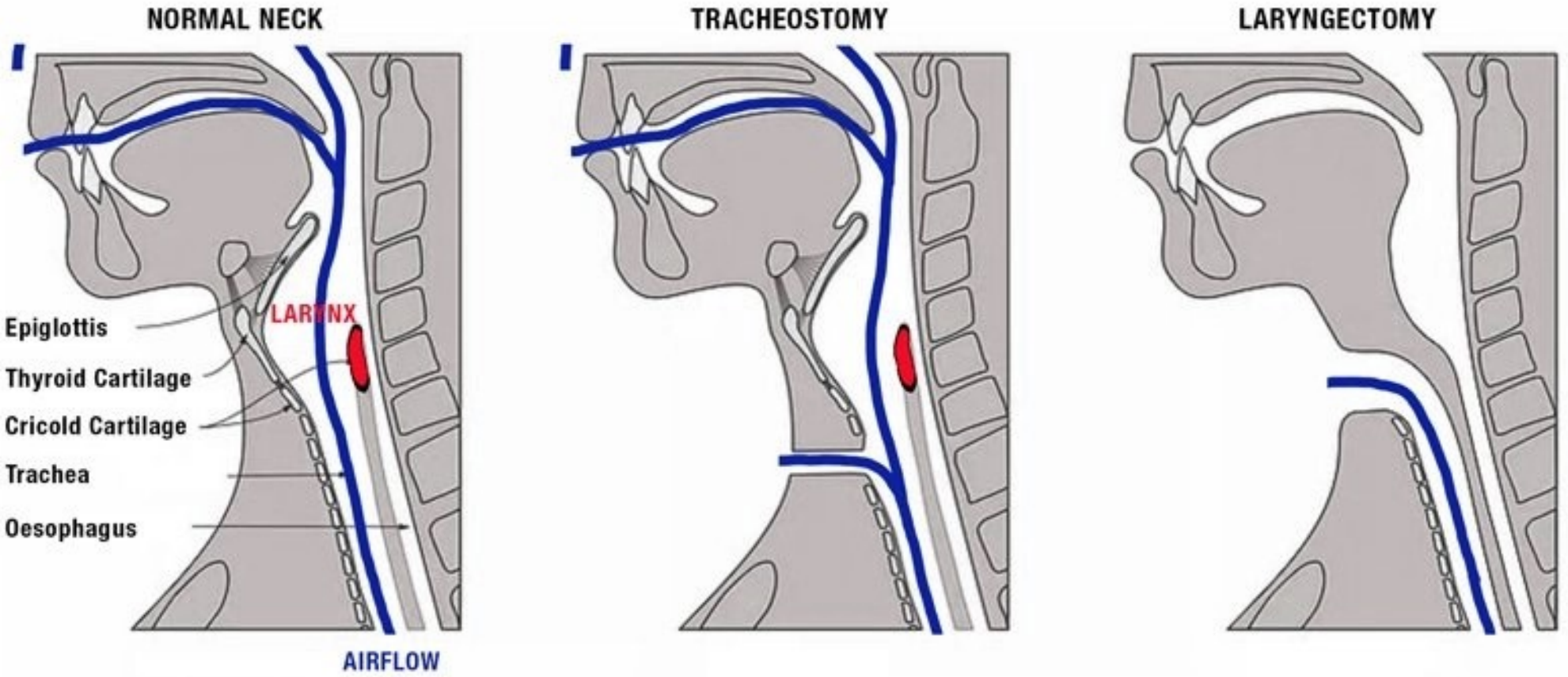


Why a Tracheostomy?

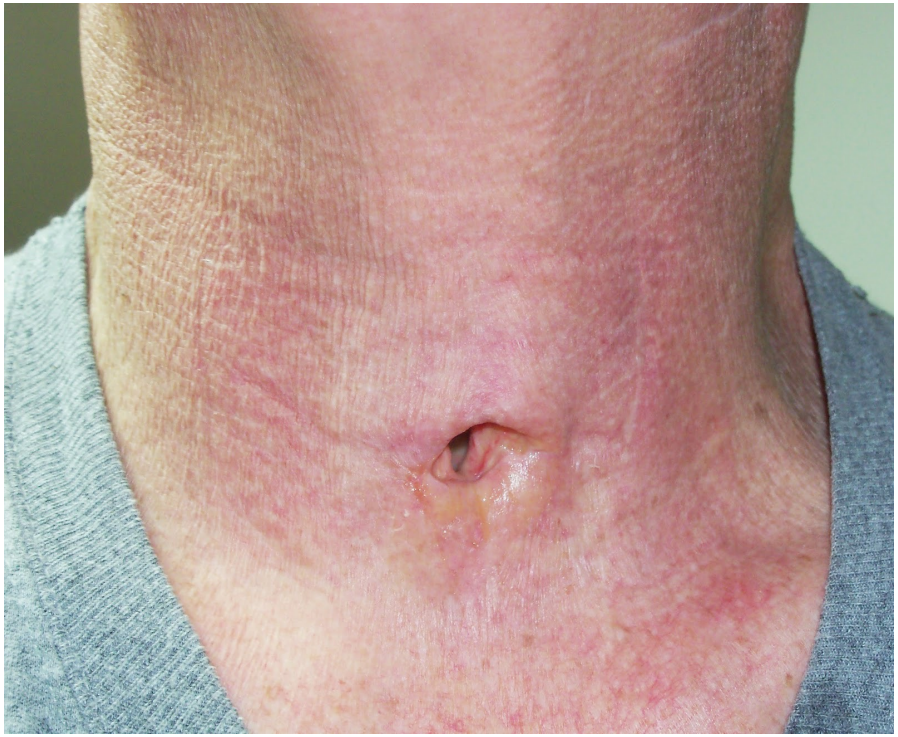
- Urgent/Emergent
  - *Temporary vs. Permanent*
- Elective/Therapeutic
  - *Temporary vs. Permanent*
- *Prophylactic?*

Key Points of Consideration

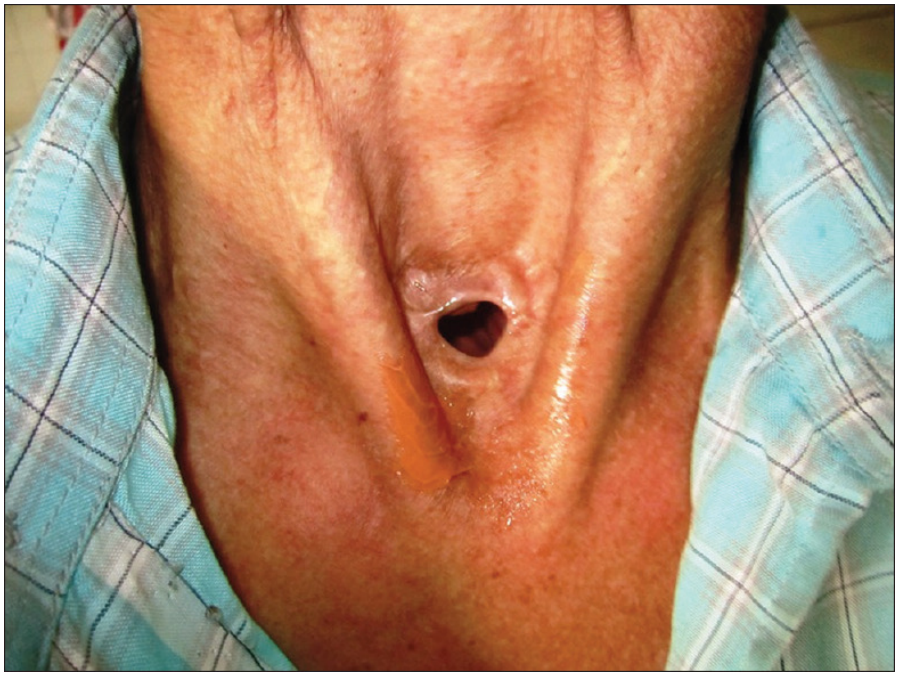
- A ‘temporary’ tracheostomy is often performed when patients require **prolonged mechanical ventilation** (i.e., failed extubation ≥ 1x)
- There is no research consensus whether tracheostomies require **humidification**, although lack of humification can potentially affect patient comfort and secretion clearance since you are bypassing the upper airway
- Patients who require continuous mechanical ventilation may not be good candidates for **talk valves**
- A talk valve may empirically cause **coughing** until a patient acclimates

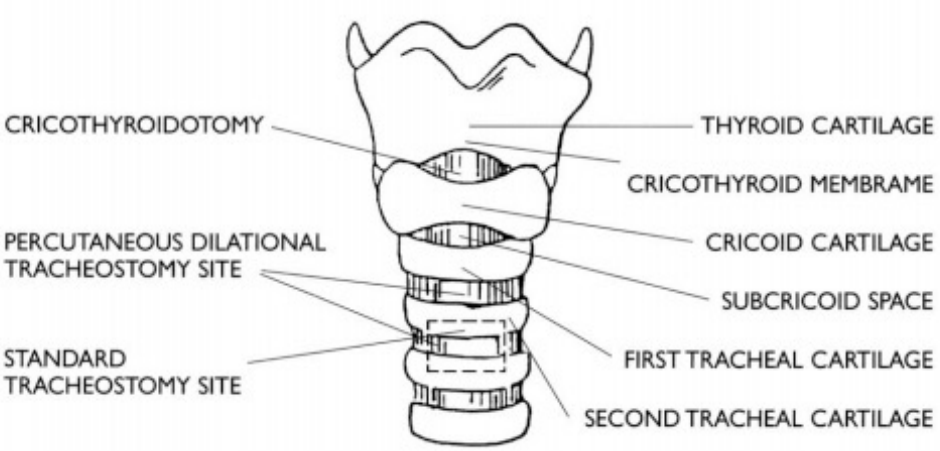

NORMAL NECK
TRACHEOSTOMY
LARYNGECTOMY
Epiglottis
LARYNX
Thyroid Cartilage
Cricold Cartilage
Trachea
Oesophagus
AIRFLOW

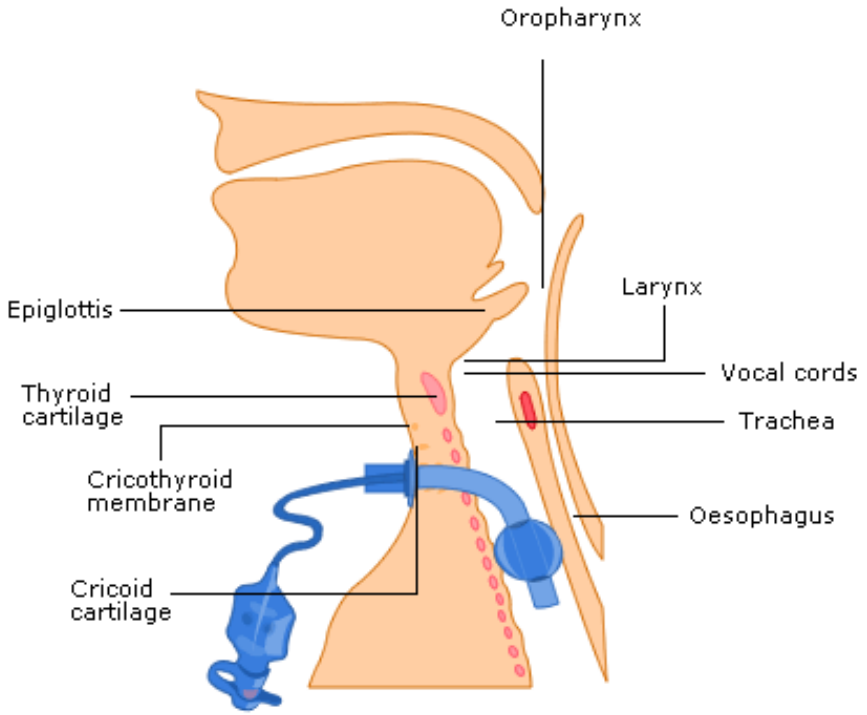
Tracheostomy Stoma



Laryngectomy Stoma




CRICOTHYROIDOTOMY
THYROID CARTILAGE
CRICOTHYROID MEMBRAME
CRICOID CARTILAGE
PERCUTANEOUS DILATIONAL TRACHEOSTOMY SITE
SUBCRICOID SPACE
STANDARD TRACHEOSTOMY SITE
FIRST TRACHEAL CARTILAGE
SECOND TRACHEAL CARTILAGE


Oropharynx
Larynx
Epiglottis
Vocal cords
Thyroid cartilage
Trachea
Cricothyroid membrane
Oesophagus
Cricoid cartilage

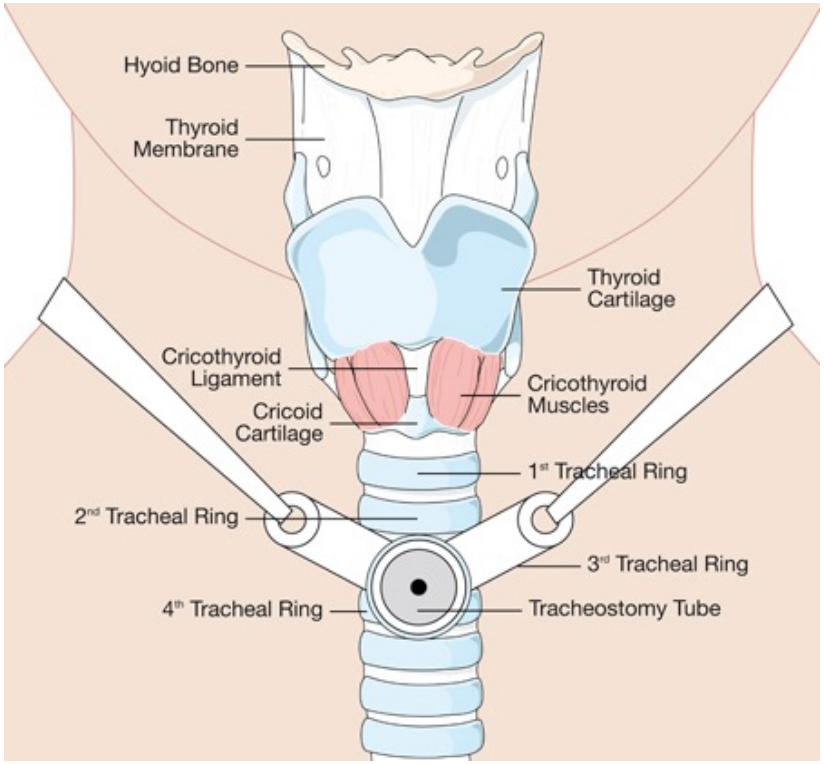
Equipment

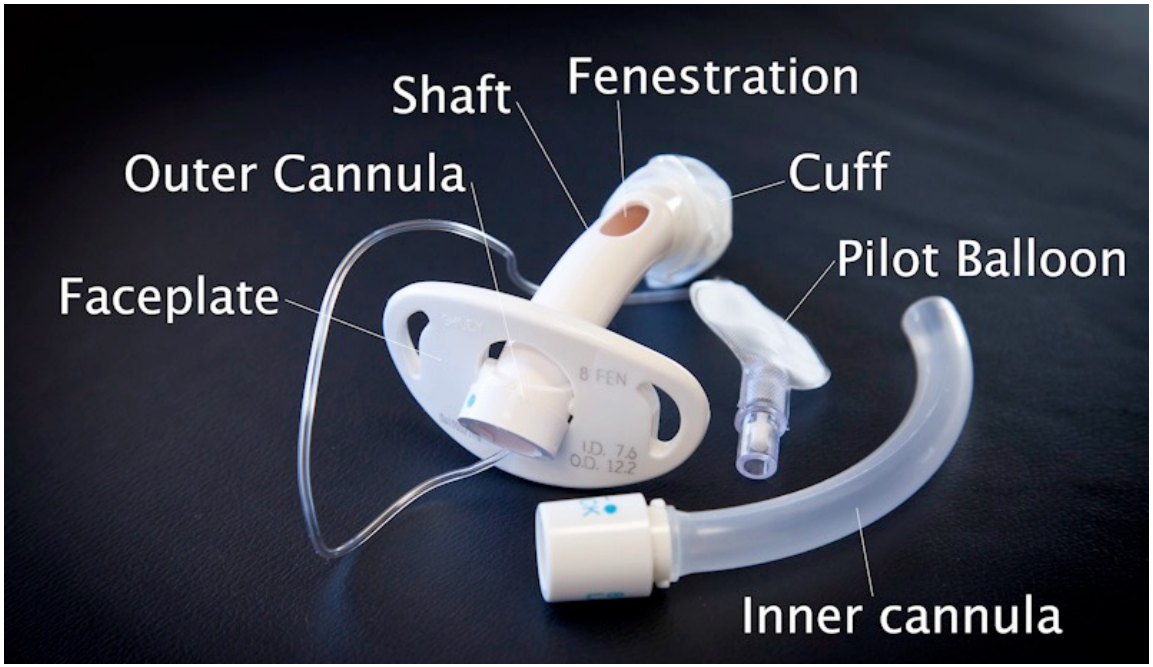
Obturator

Inner Cannula

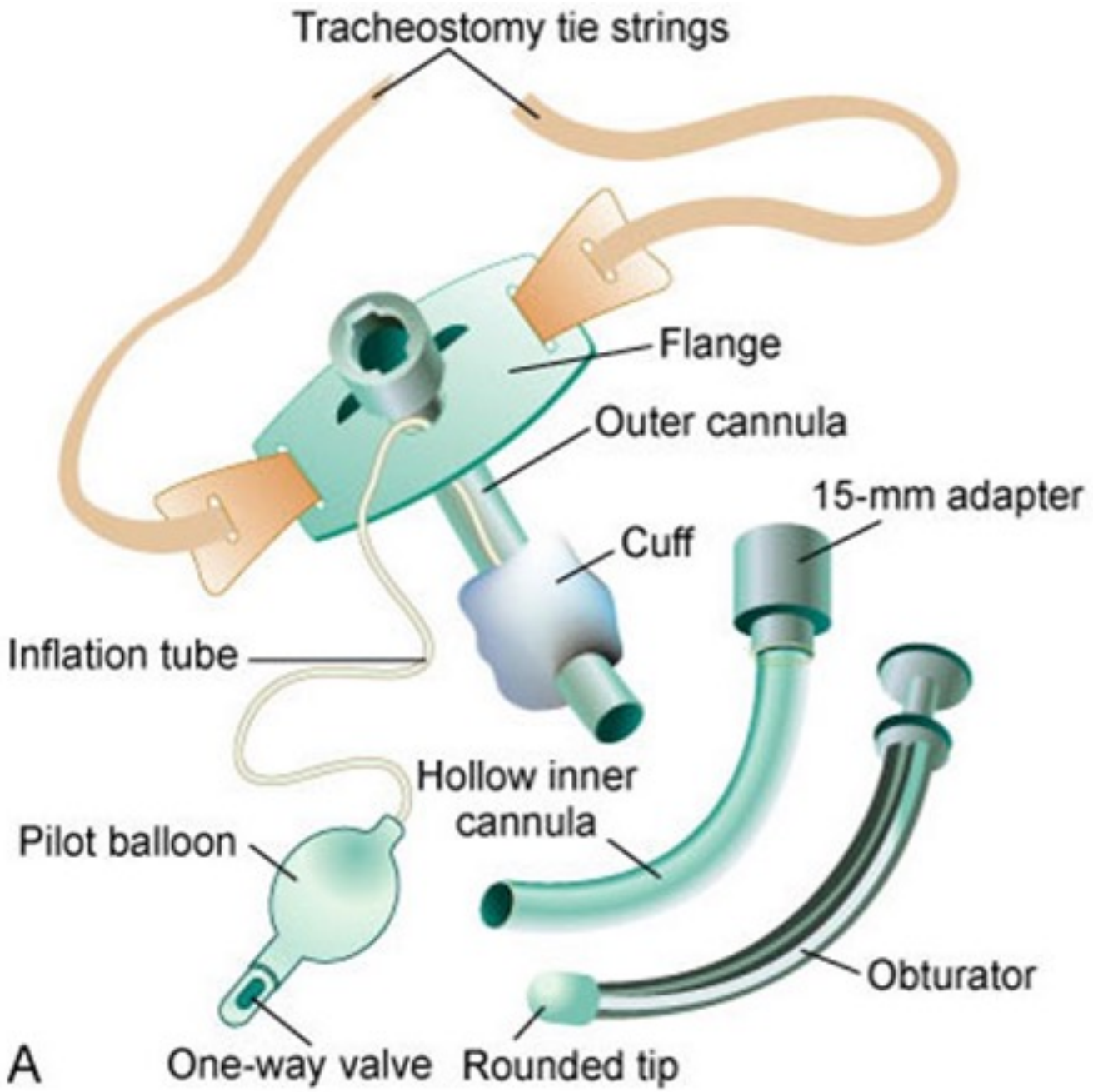
Outer Cannula

Common Tracheostomy Parts





Main Trach Components



Tracheostomy Types

Cuffed

Uncuffed

Foam Cuff

Extended Length

Metal

Fenestrated

Most Common Versions/**Brands**

🫁Shiley™
-PVC

🫁Portex

🫁Bivona™
-Silicone

🫁Jackson
-Metal

Special Trach Types

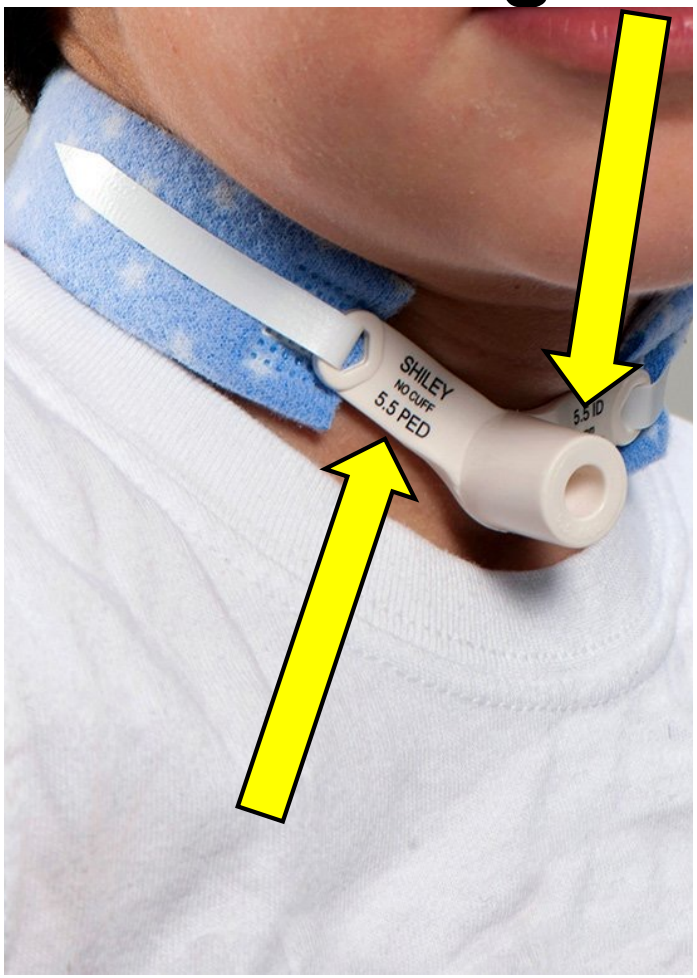
Wire-Reinforced

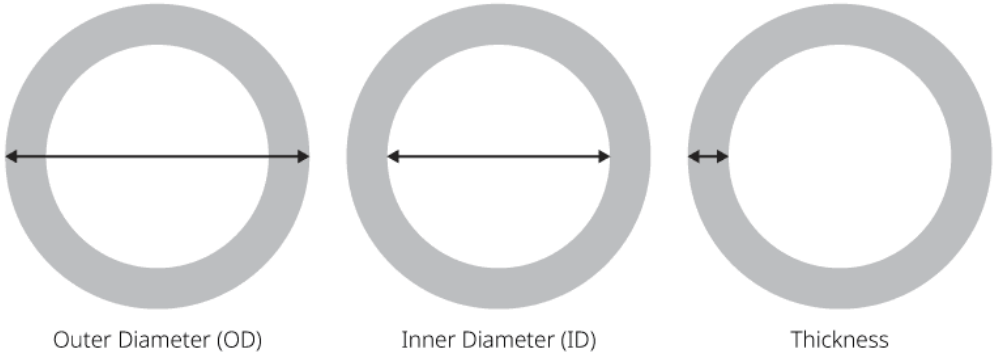
Extended-Length

Fenestrated

Foam Cuff

Tracheostomy Measurements and Markings





Sizing

ID – **I**nternal **D**iameter

OD – **O**uter **D**iameter

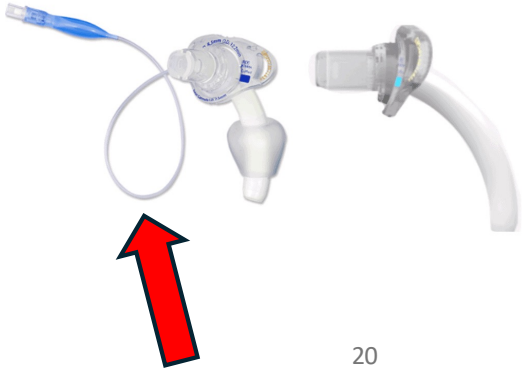
General Types:

Cuffed vs. Uncuffed

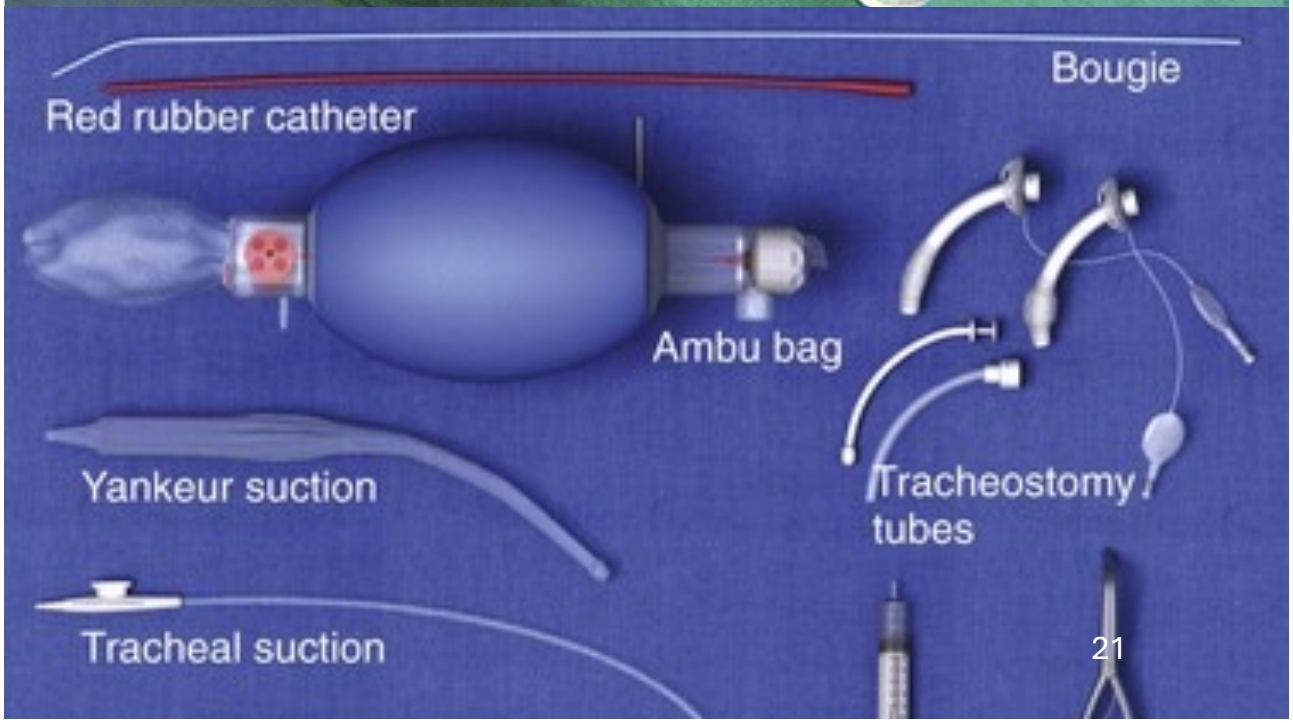
A lot to process…

Trach Terminology & Labeling

- **OD** – outer diameter
- **ID** – inner diameter
- **mm** – millimeter = 1/1000th meter
- **DCFS** – disposable cuffless tracheoston.,
- **DCT** – disposable cuffed tracheostomy
- **DIC** – disposable inner cannula
- **TTS** – tight to shaft
- **XLT** – extended length tracheostomy
- **FEN** – fenestrated



Equipment


Bougie
Red rubber catheter
Ambu bag
Yankeur suction
Tracheostomy tubes
Tracheal suction

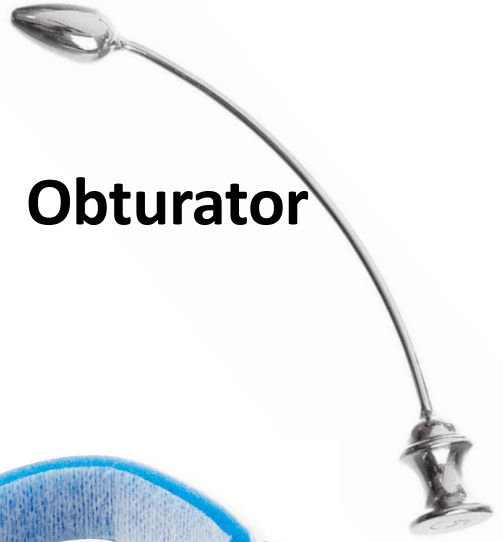
Equipment

HME

Dry Syringe

Saline Bullets

Suction Catheter



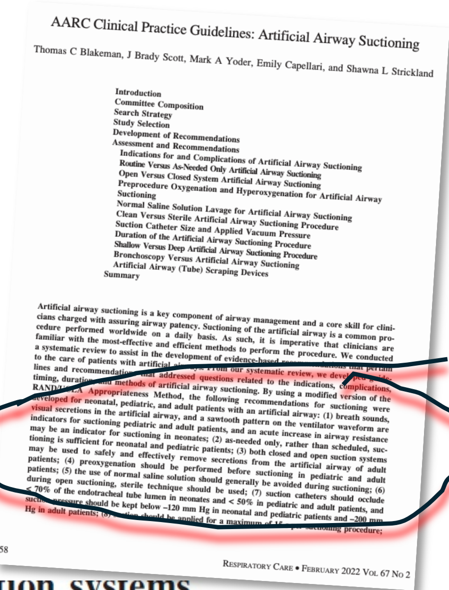
Obturator

Trach Tie

Whether using a **closed system** (i.e., Ballard) **or open technique** with sterile gloves, suctioning can be both therapeutic/beneficial and detrimental...

AARC Clinical Practice Guidelines: Artificial Airway Suctioning

Thomas C Blakeman, J Brady Scott, Mark A Yoder, Emily Capellari, and Shawna L Strickland



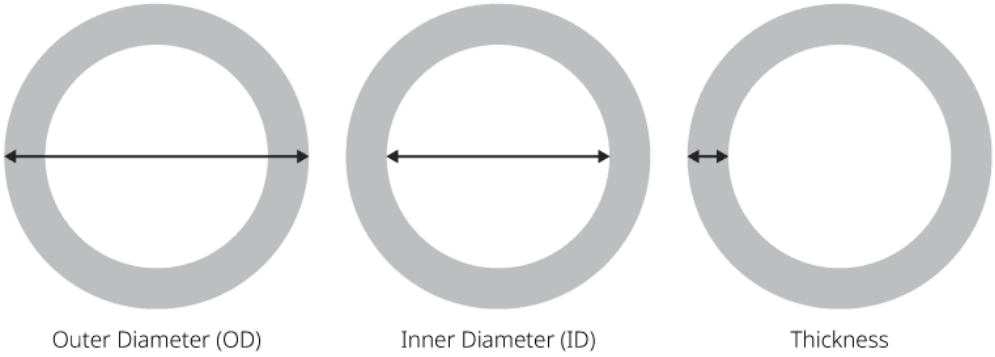
AARC Clinical Practice Guidelines: Artificial Airway Suctioning

Thomas C Blakeman, J Brady Scott, Mark A Yoder, Emily Capellari, and Shawna L Strickland

Artificial airway suctioning is a key component of airway management and a core skill for clinicians charged with assuring airway patency. Suctioning of the artificial airway is a common procedure performed worldwide on a daily basis. As such, it is imperative that clinicians are familiar with the most-effective and efficient methods to perform the procedure. We conducted a systematic review to assist in the development of evidence-based [illegible] to the care of patients with artificial [illegible] From our systematic review, we devel[illegible] lines and recommendation[illegible] addressed questions related to the indications, complications, timing, duratio[illegible] methods of artificial airway suctioning. By using a modified version of the RAND/[illegible] Appropriateness Method, the following recommendations for suctioning were [illegible]veloped for neonatal, pediatric, and adult patients with an artificial airway: (1) breath sounds, visual secretions in the artificial airway, and a sawtooth pattern on the ventilator waveform are indicators for suctioning pediatric and adult patients, and an acute increase in airway resistance may be an indicator for suctioning in neonates; (2) as-needed only, rather than scheduled, suctioning is sufficient for neonatal and pediatric patients; (3) both closed and open suction systems may be used to safely and effectively remove secretions from the artificial airway of adult patients; (4) preoxygenation should be performed before suctioning in pediatric and adult patients; (5) the use of normal saline solution should generally be avoided during suctioning; (6) during open suctioning, sterile technique should be used; (7) suction catheters should occlude < 70% of the endotracheal tube lumen in neonates and < 50% in pediatric and adult patients, and suc[illegible] pressure should be kept below –120 mm Hg in neonatal and pediatric patients and –200 mm Hg in adult patients; [illegible] should be applied for a maximum of [illegible] suctioning procedure;

tioning is sufficient for neonatal and pediatric patients; (3) both closed and open suction systems may be used to safely and effectively remove secretions from the artificial airway of adult patients; (4) preoxygenation should be performed before suctioning in pediatric and adult patients; (5) the use of normal saline solution should generally be avoided during suctioning; (6) during open suctioning, sterile technique should be used; (7) suction catheters should occlude < 70% of the endotracheal tube lumen in neonates and < 50% in pediatric and adult patients, and suction pressure should be kept below –120 mm Hg in neonatal and pediatric patients and –200 mm Hg in adult patients; (8) suction should be applied for a maximum of 15 s per suctioning procedure;

1 French = 0.33 mm



ET size ID (mm)	SC size (Fr)
5.0	8
6.0	8
7.0	10
8.0	12
9.0	14

Suction Catheter Sizing

Clinical Consideration

Gently dripping normal saline directly into the inner cannula of the tracheostomy can be indicated but not always recommended…

Clinical Consideration

Jetting/shooting normal saline directly into the inner cannula of the tracheostomy can be detrimental…

Review Paper

Normal saline instillation before suctioning: A meta-analysis of randomized controlled trials

Chia-Hui Wang RN, PhD [a,b]
Jui-Chen Tsai RN, MSN [a,b]
Shu-Fen Chen RN, MSN [a,b]
Chien-Ling Su RT, MSc [c,d]
Lawrence Chen MS [e]
Chao-Chun Lin RN [e]
Ka-Wai Tam MD, PhD [e,f,g,h,*]

[a] Department of Nursing, Shuang Ho Hospital, Taipei Medical University, New Taipei City, Taiwan
[b] School of Nursing, College of Nursing, Taipei Medical University, Taipei, Taiwan
[c] School of Respiratory Therapy, College of Medicine, Taipei Medical University, Taipei, Taiwan
[d] Department of Thoracic Internal Medicine, Shuang Ho Hospital, Taipei Medical University, New Taipei City, Taiwan
[e] Center for Evidence-Based Health Care, Shuang Ho Hospital, Taipei Medical University, New Taipei City, Taiwan
[f] Division of General Surgery, Department of Surgery, Shuang Ho Hospital, Taipei Medical University, New Taipei City, Taiwan
[g] Department of Surgery, School of Medicine, College of Medicine, Taipei Medical University, Taiwan
[h] Cochrane Taiwan, Taipei Medical University, Taipei, Taiwan

Conclusion: NS instillation before suctioning does not benefit patients undergoing endotracheal intubation or tracheostomy. Moreover, it reduces oxygen saturation 5 min after suction. However, our reviewed studies had a low methodological quality. Thus, additional studies involving large-scale RCTs are warranted.

Wang, et al., 2017. *Australian Critical Care*, *30*(5), 260-265.

Thorarinsdottir et al. Critical Care (2020) 24:382
https://doi.org/10.1186/s13054-020-03092-1

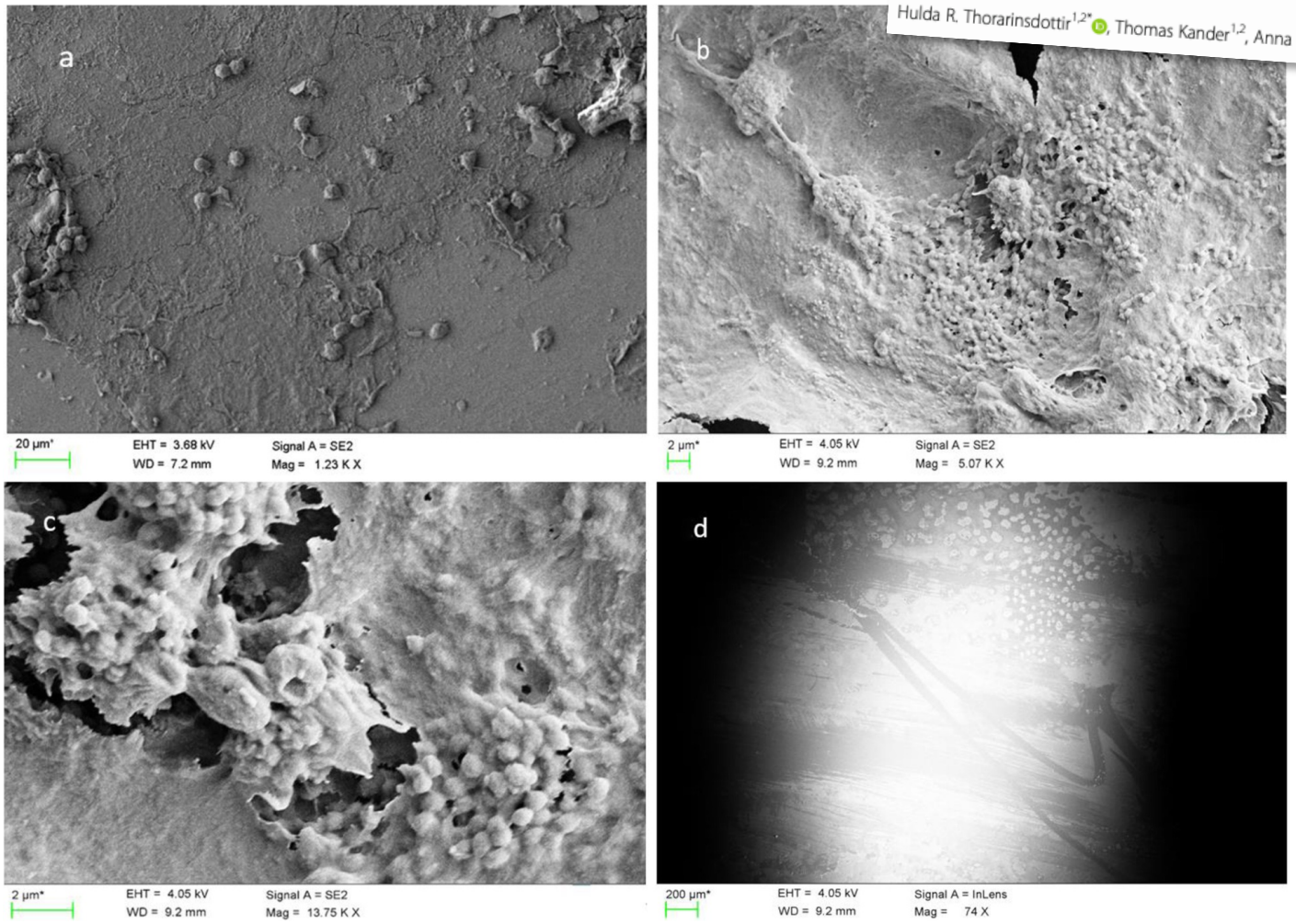
Critical Care

RESEARCH

Open Access

Biofilm formation on three different endotracheal tubes: a prospective clinical trial

Hulda R. Thorarinsdottir[1,2*], Thomas Kander[1,2], Anna Holmberg[3], Sarunas Petronis[4] and Bengt Klarin[1,2]



Scanning electron microscopy of biofilm formation on the surface of endotracheal tubes.

Checking Cuff Pressure

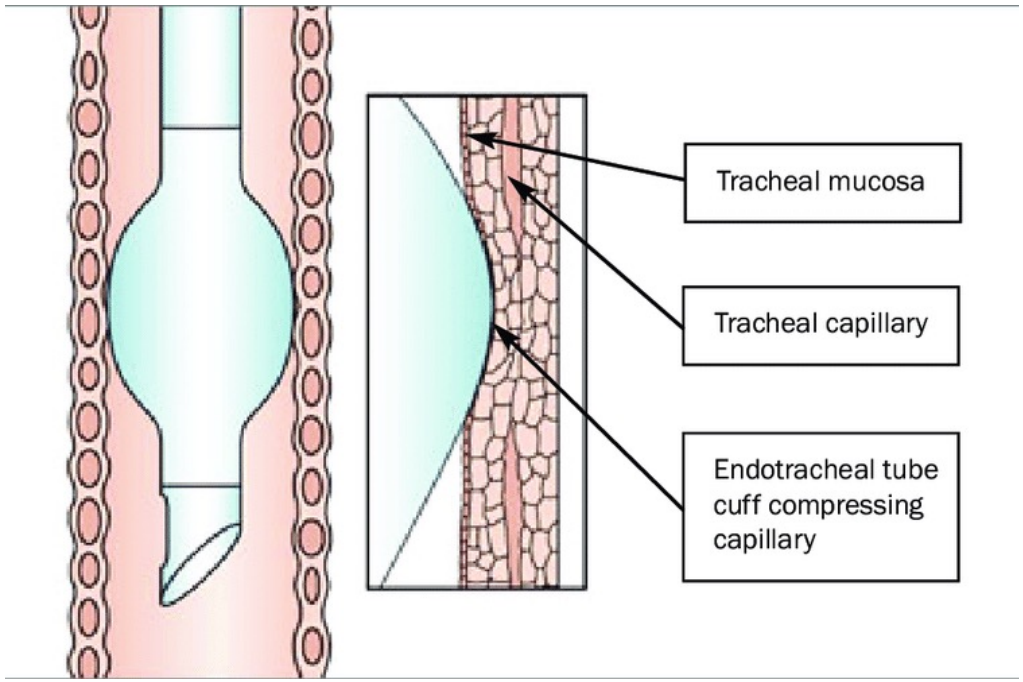
Cufflator

Tru-Cuff

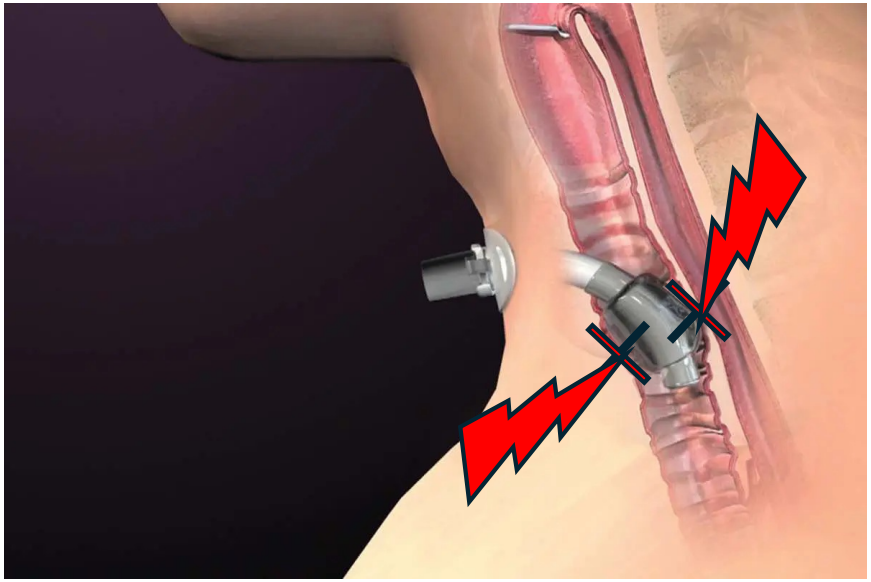
Cuffill

What is tracheal perfusion pressure?

-Capillary blood pressure within the tracheal vessels necessary to maintain **adequate blood flow** to the tracheal mucosa.

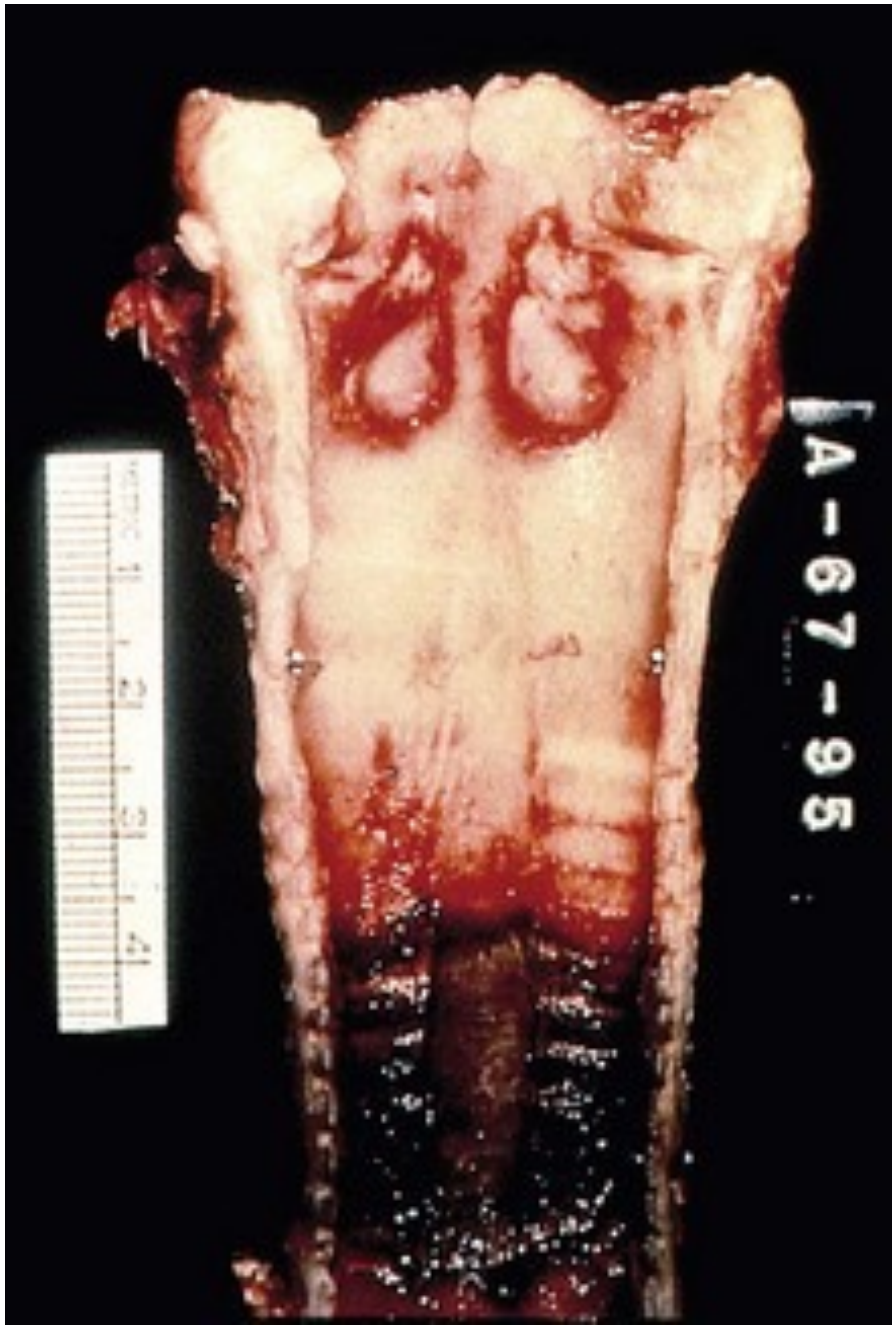


Normal tracheal perfusion pressure = 22-32 mmHg

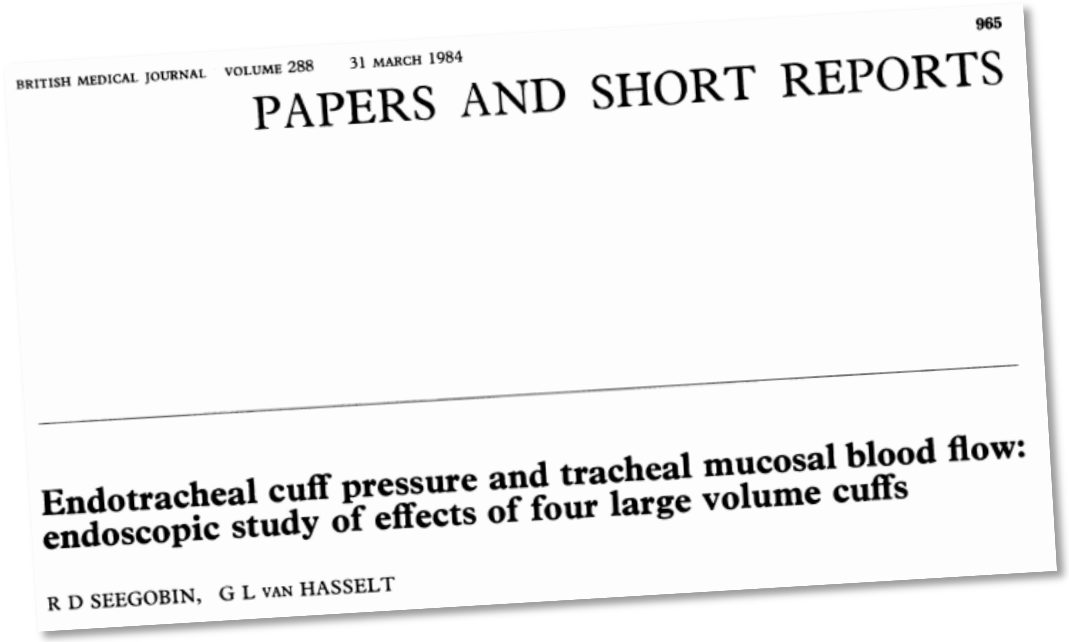


If cuff pressure exceeds tracheal perfusion pressure, adequate **blood flow** to the mucosa **stops**

1. **Check**
2. **Correct**
3. **Re-check**



Trachea with mucosal damage



965

BRITISH MEDICAL JOURNAL VOLUME 288 31 MARCH 1984

PAPERS AND SHORT REPORTS

Endotracheal cuff pressure and tracheal mucosal blood flow: endoscopic study of effects of four large volume cuffs

R D SEEGOBIN, G L VAN HASSELT

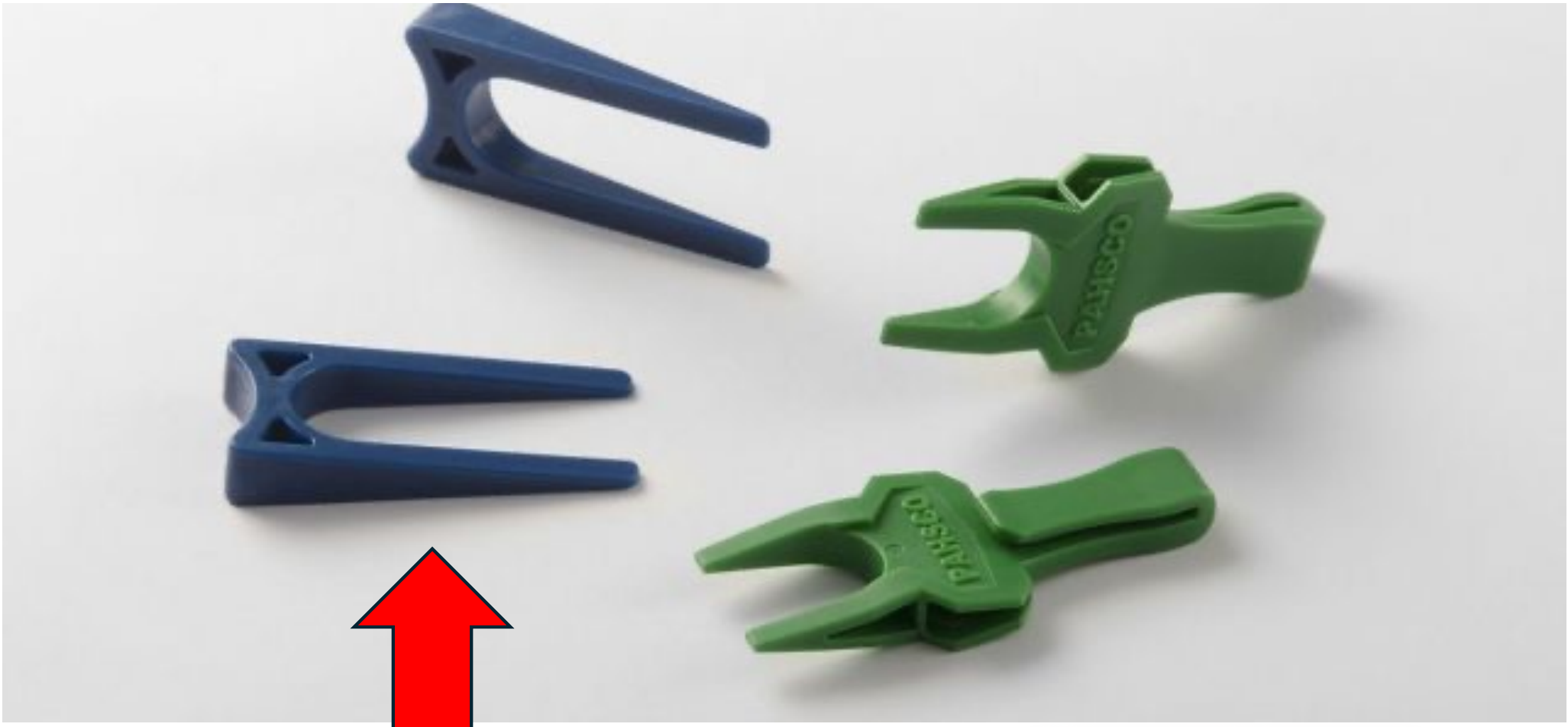
Modern day consensus:

Normal tracheal perfusion pressure is between 22-32 mmHg, therefore, **cuff pressures should be maintained below 30 cmH2O**

Common Issues with Tracheostomy

- Dislodged in false track
- Infection at the stoma
- Bleeding at the stoma or within the airway
- Coughed out
- No inner cannula
- Cuff blown

- Tracheal stenosis
- Mucosal granuloma/s
- Tracheoesophageal fistula
- Aspiration
- Pneumothorax; Sub-Q emphysema



What's this 'special' piece?

Friendly Reminder:

Air must be able to pass through the vocal cords for ‘normal’ phonation to occur…

Special Considerations

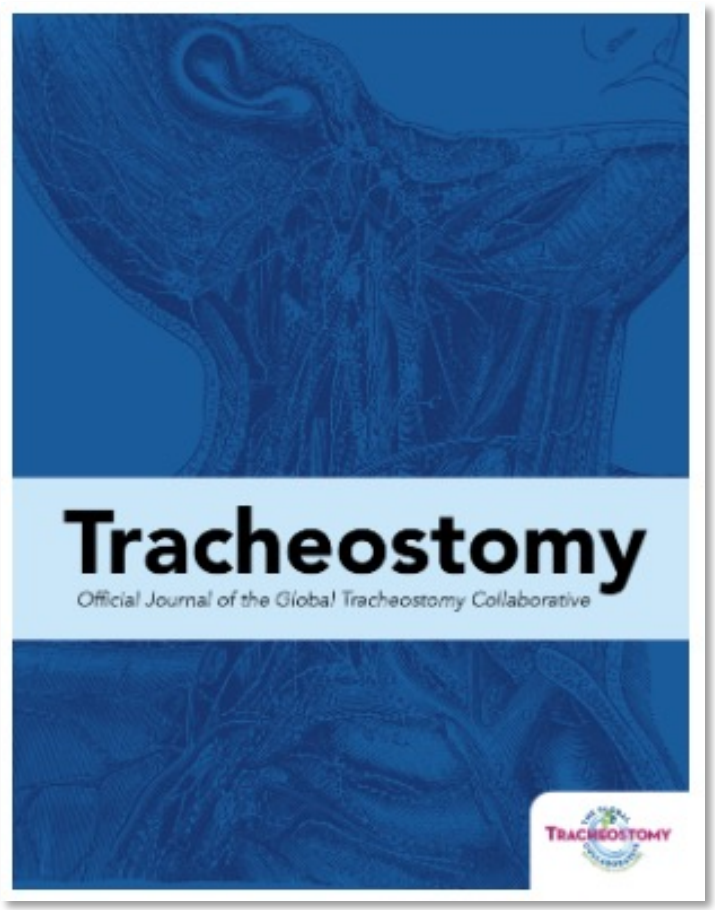
re: Trachestomy Patient's Ability to Speak

- Phonation can occur if air is 'forced' past the endotracheal tube cuff
  - Crude form of manually (with finger) plugging off tracheostomy during exhalation only
  - Accumulation of mucus and/or partial obstruction within the main cannula
- Phonation can occur through a fenestration within the main (outer) cannula
- Phonation can be allowed temporarily/intermittently with use of 'talk valve'

Managing **Tracheostomy** Patients

Passy Muir – one way, inspiratory-only valve, aka. speaking valve

Managing **Tracheostomy** Patients



Published in final edited form as:
Tracheostomy. 2024 ; 1(2): 1–6.

Elevating Tracheostomy Care Through Data-Driven Innovation: What Can Education, Evidence-Based Practice, and Quality Improvement Learn from One Another?

Michael J. Brenner, MD, FACS[1,a], **Vinciya Pandian, PhD, MBA, MSN, ACNP-BC**[2,b]

[1]Department of Otolaryngology Head and Neck Surgery, University of Michigan,

[2]School of Nursing, Johns Hopkins University

Evidence-Based Practice

Dynamic interaction of:

Education + Research + Quality Improvement

Grounded in **Patient-Centered Care**

**Fostering Excellence & Innovation*

Brenner, M. J., & Pandian, V. (2024). Elevating Tracheostomy Care Through Data-Driven Innovation: What Can Education, Evidence-Based Practice, and Quality Improvement Learn from One Another?. Tracheostomy (Warrenville, Ill.), 1(2), 1–6.

Evidence-Based Practice

Otolaryngology–Head and Neck Surgery
Volume 163, Issue 2, August 2020, Pages 232-243

https://doi.org/10.1177/0194599820917427

SAGE journals

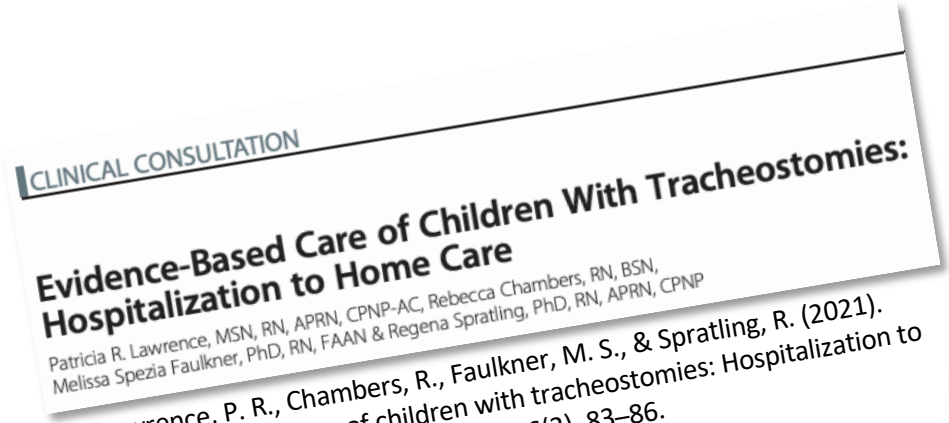
Special Focus Section: Patient Safety/Quality Improvement

The Trach Trail: A Systems-Based Pathway to Improve Quality of Tracheostomy Care and Interdisciplinary Collaboration

Rebecca L. Cherney[1,2], Vinciya Pandian, PhD, MBA, MSN[3], Ashly Ninan[1,3], Debra Eastman, MSN[1], Brian Barnes[1], Elizabeth King[1], Brianne Miller[1], Samantha Judkins[1], Alfred E. Smith, IV[4], Nan M. Smith[4], Julie Hanley, MSN[1], Eileen Creutz[1], Megan Carlson, MS, CCC-SLP[1], Kevin J. Schneider, MA[5], Leah L. Shever, PhD[1,2], Keith A. Casper, MD[5], Patricia M. Davidson, PhD[3], and Michael J. Brenner, MD[4,5]

Cherney RL, Pandian V, Ninan A, et al. The Trach Trail: A Systems-Based Pathway to Improve Quality of Tracheostomy Care and Interdisciplinary Collaboration. *Otolaryngology–Head and Neck Surgery*. 2020;163(2):232-243.

Evidence-Based Practice

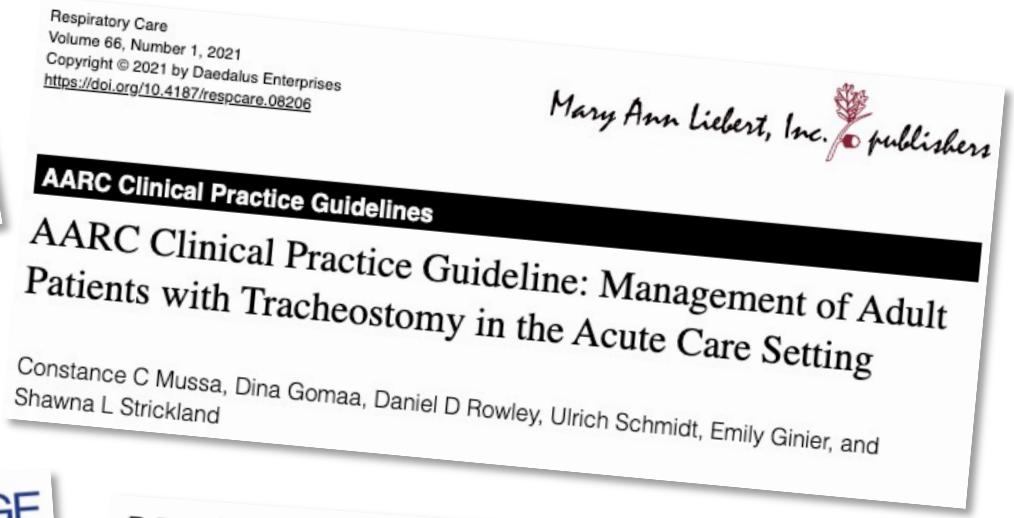


CLINICAL CONSULTATION

Evidence-Based Care of Children With Tracheostomies: Hospitalization to Home Care

Patricia R. Lawrence, MSN, RN, APRN, CPNP-AC, Rebecca Chambers, RN, BSN, Melissa Spezia Faulkner, PhD, RN, FAAN & Regena Spratling, PhD, RN, APRN, CPNP

Lawrence, P. R., Chambers, R., Faulkner, M. S., & Spratling, R. (2021). Evidence-based care of children with tracheostomies: Hospitalization to home care. Rehabilitation Nursing, 46(2), 83–86.



Respiratory Care
Volume 66, Number 1, 2021

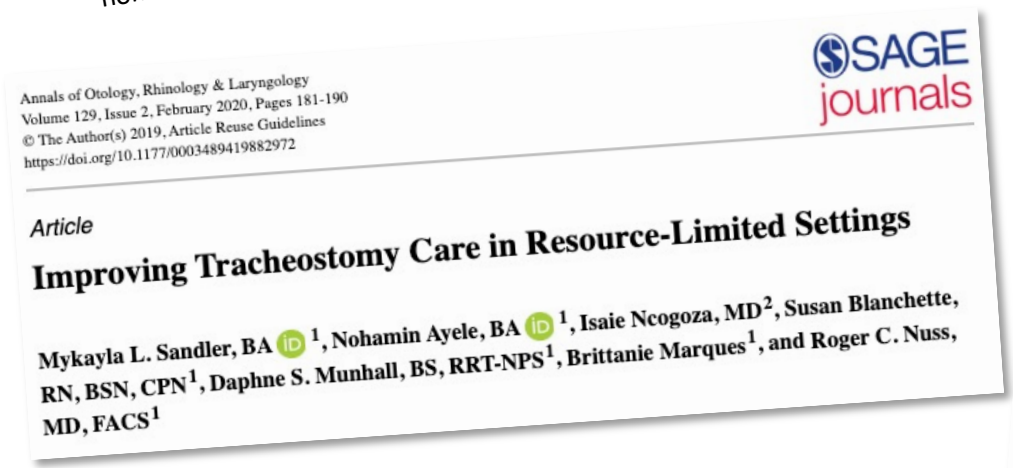
https://doi.org/10.4187/respcare.08206

Mary Ann Liebert, Inc. publishers

AARC Clinical Practice Guidelines

AARC Clinical Practice Guideline: Management of Adult Patients with Tracheostomy in the Acute Care Setting

Constance C Mussa, Dina Gomaa, Daniel D Rowley, Ulrich Schmidt, Emily Ginier, and Shawna L Strickland



Annals of Otology, Rhinology & Laryngology
Volume 129, Issue 2, February 2020, Pages 181-190

https://doi.org/10.1177/0003489419882972

SAGE journals

Article

Improving Tracheostomy Care in Resource-Limited Settings

Mykayla L. Sandler, BA [1], Nohamin Ayele, BA [1], Isaie Ncogoza, MD[2], Susan Blanchette, RN, BSN, CPN[1], Daphne S. Munhall, BS, RRT-NPS[1], Brittanie Marques[1], and Roger C. Nuss, MD, FACS[1]

Multidisciplinary Tracheostomy Care

How Collaboratives Drive Quality Improvement

Joshua R. Bedwell, MD, MS[a],
Vinciya Pandian, PhD, MBA, MSN, RN, ACNP-BC[b],
David W. Roberson, MD, MBA, FRCS[c],
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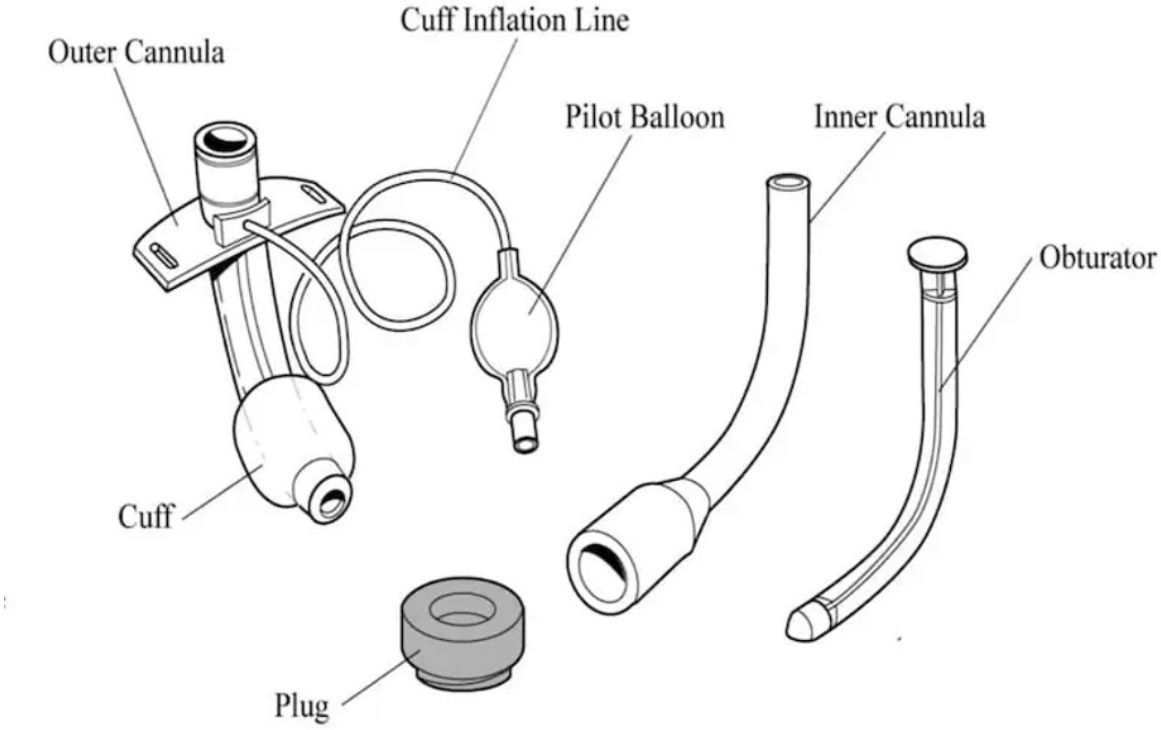
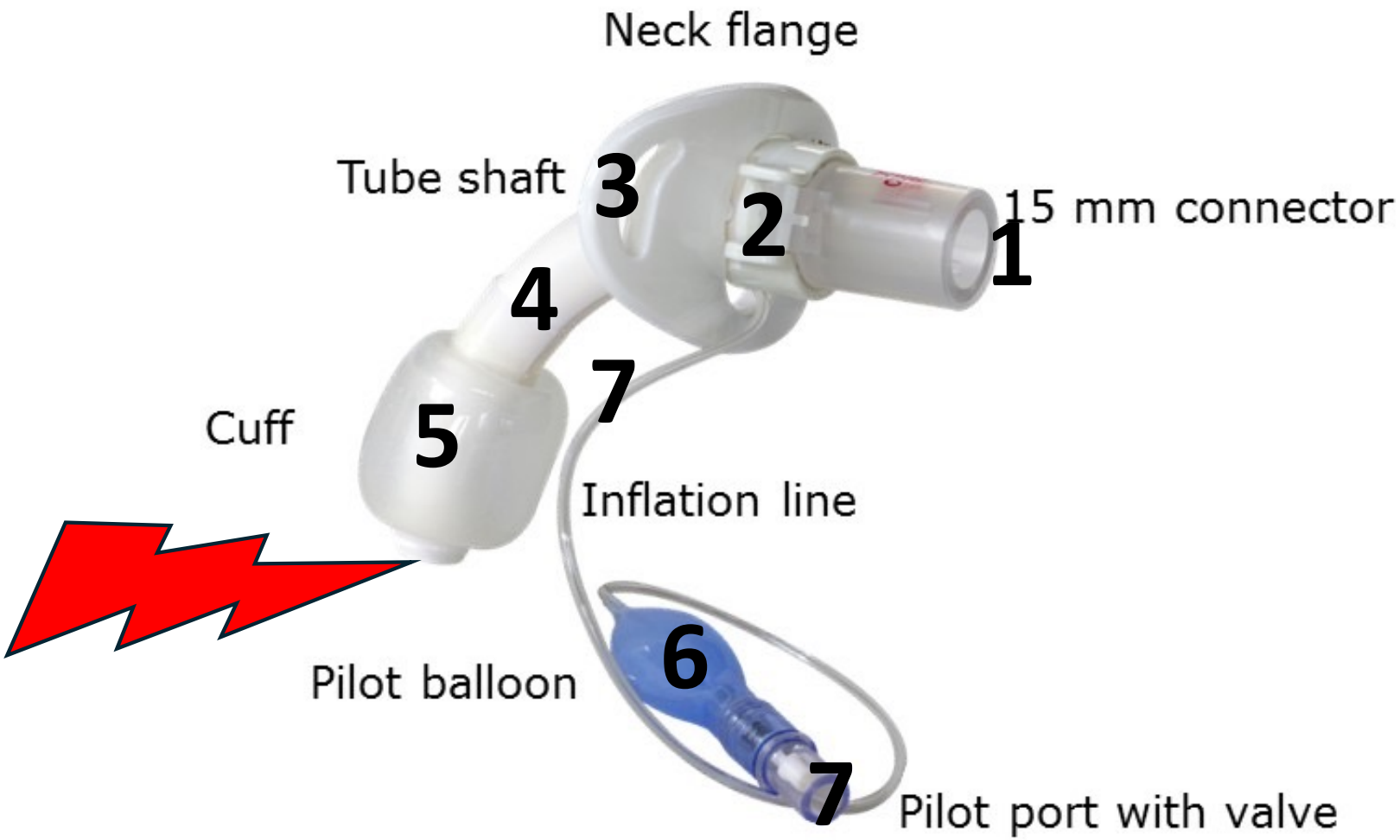
Otolaryngol Clin N Am 52 (2019) 135–147

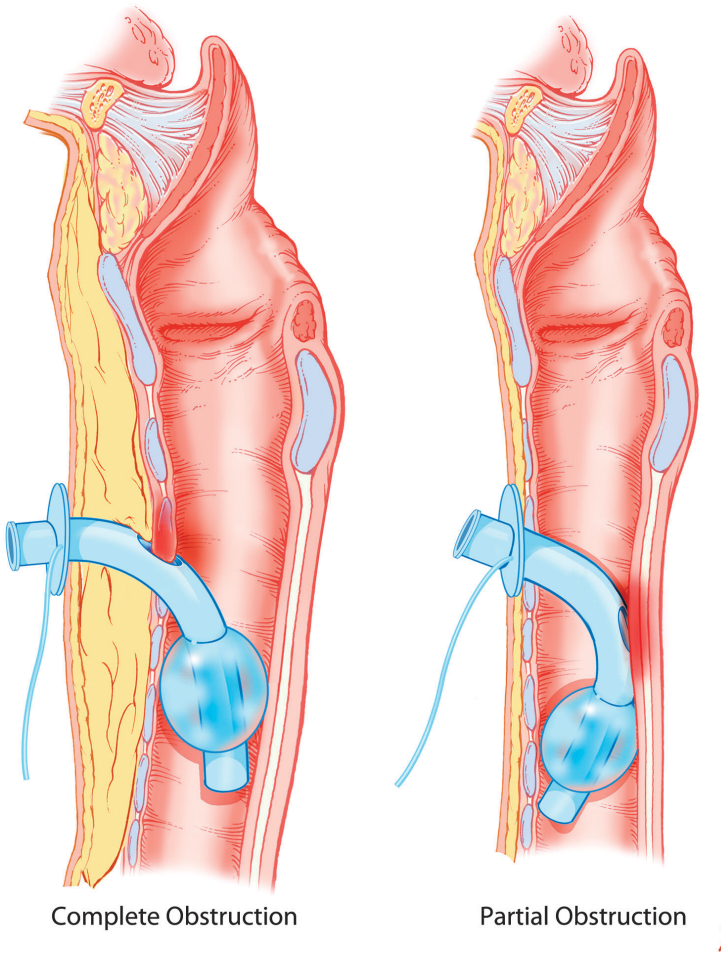
Trach-Related Issues

- Bleeding
  - External?
  - Internal?
- Obstruction
  - Partial?
  - Full?



Trach-Related Issues





A lot can go wrong during tracheostomy placement...

Patient (2018) 11:175–191
https://doi.org/10.1007/s40271-017-0277-1

SYSTEMATIC REVIEW

A Systematic Review of Patient and Caregiver Experiences with a Tracheostomy

Ivana Nakarada-Kordic[1] · Niamh Patterson[1] · Jill Wrapson[1] · Stephen D. Reay[1]

... Patients and their caregivers reported a range of mostly negative experiences related to the care, support, and management of a tracheostomy, speech and communication, wellbeing and QoL, disfigurement and body image, and stigma and social withdrawal."

Key Points for Decision Makers

People who have first-hand experiences of a tracheostomy and their caregivers report feeling scared, overwhelmed, unsupported, self-conscious, powerless, judged, and isolated.

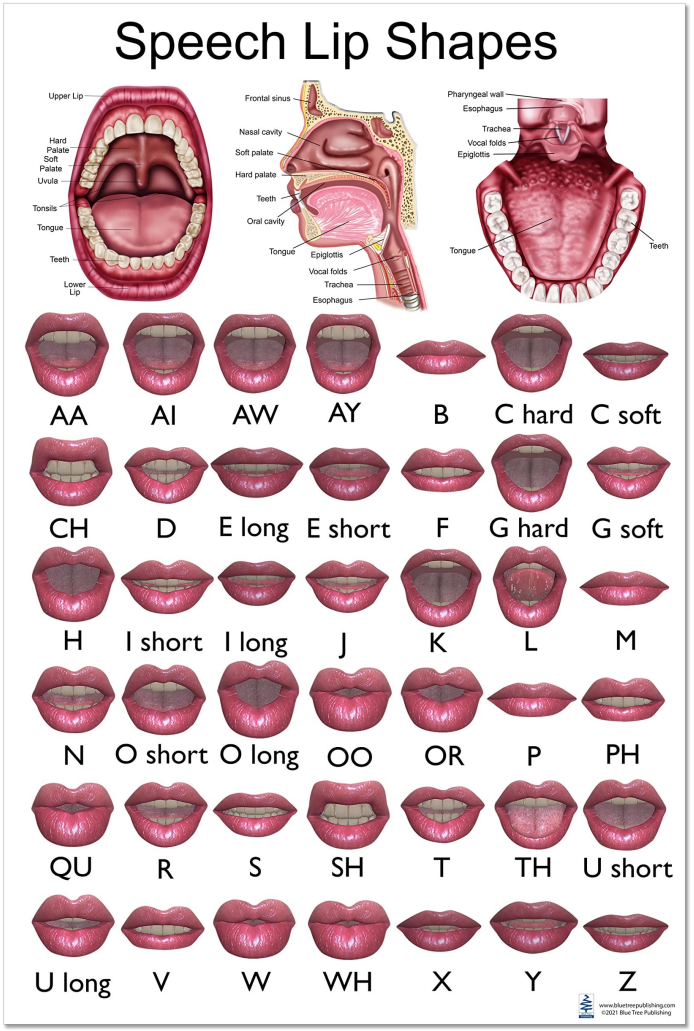
More research is needed to gain a deeper understanding of the first-hand experiences of individuals with long-term tracheostomies living in the community so as to develop new tools and strategies to enable a better quality of life for them and their families.

Practical steps could be taken to improve the experiences of persons with a tracheostomy and their caregivers, namely, providing more information and counselling prior to and immediately after receiving a tracheostomy; formulating a patient-specific communication plan early on; providing help through social support groups to overcome social isolation and withdrawal and to reduce stigma; and revisiting the design of tracheostomy-related products to improve comfort, aesthetics, and usability.

Special Considerations

YES	0	1	2	3	4	5	6	7	8	9	NO
New word	A	B	C	D	E	F	G	H	I	J	Start over
It starts with....	K	L	M	N	O	P	Q	R	S		I don't know
STOP	T	U	V	W	X	Y		Z			Thank you
HELP	Hungry		Hot	Hello / Goodbye		Cold		Thirsty			PAIN
Suction	Bathroom		Bed Up	Bed down		Doctor		Nurse			Family
Thank You	Toothbrush		Comb	Can't Breathe		Glasses		TV			Please

"...I'm sorry, I can't understand what you're trying to say..." ☹



AI Overview

+8

Voice cloning for text-to-speech involves **using artificial intelligence to create a digital version of a person's voice, which can then be used to generate speech from text**. This technology allows you to convert written text into spoken words using the cloned voice.

Here's how it generally works:

1. Voice Recording:

A voice sample, usually a short recording of the person's voice, is required as input.

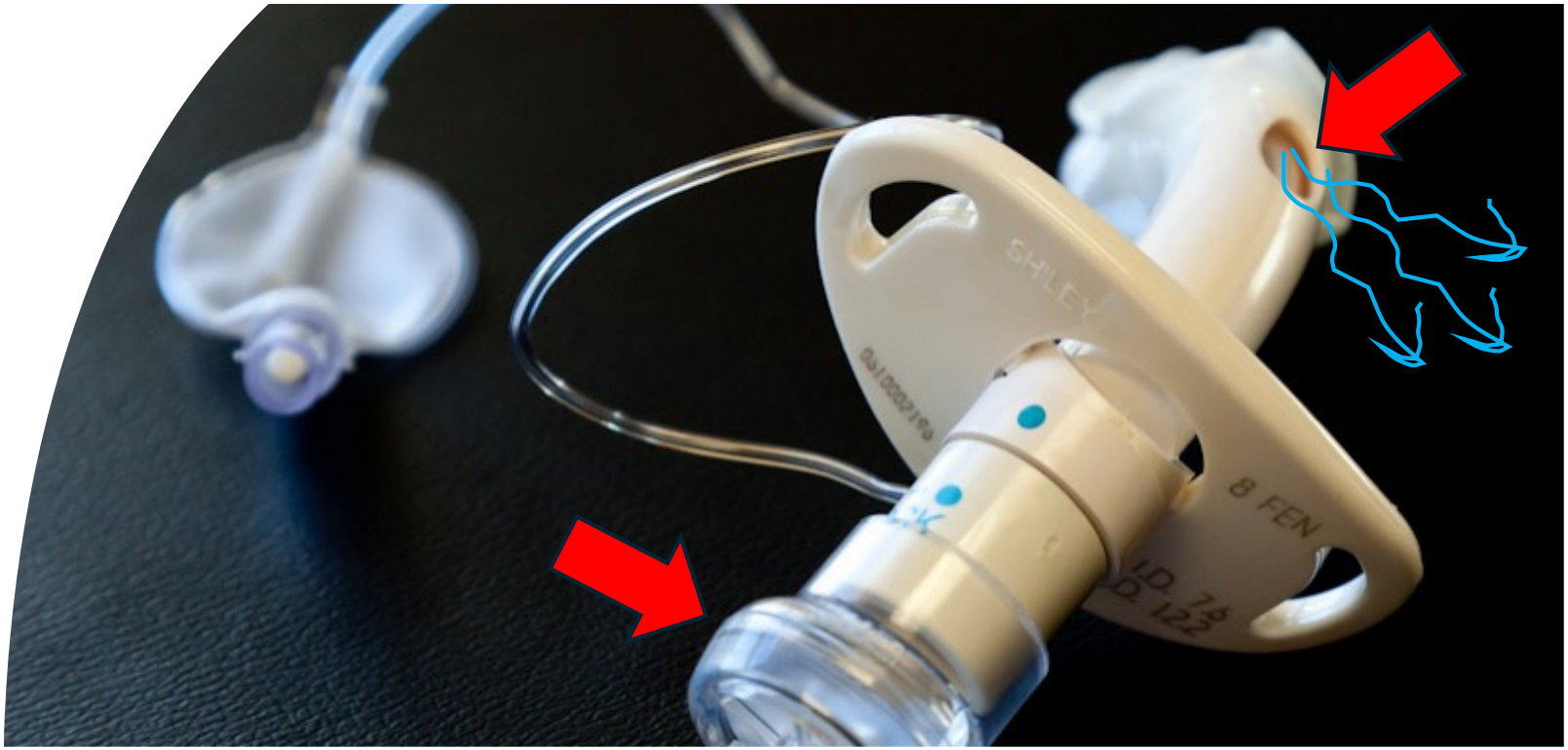
2. AI Training:

The AI algorithm analyzes the voice sample to learn its unique characteristics, such as tone, pitch, and speaking style.

3. Text-to-Speech Conversion:

Once the voice is cloned, you can input any text, and the AI will convert it into speech using the learned voice model.

Uses person's 'real' voice to allow text to speech

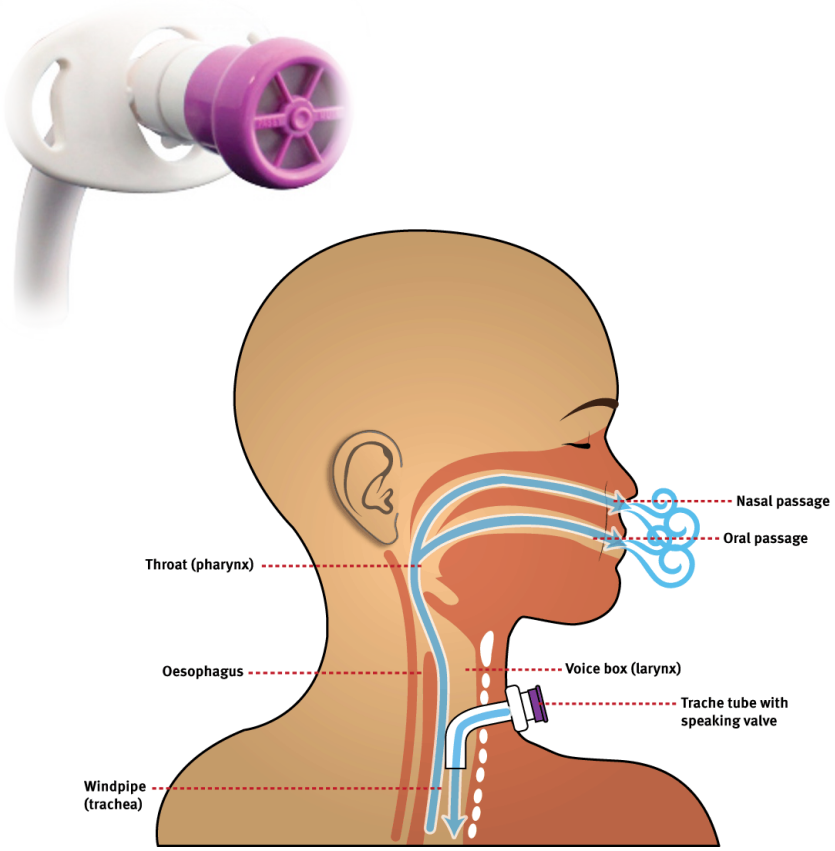


The Human Voice
is the most perfect
instrument of all

—

ARVO PÄRT

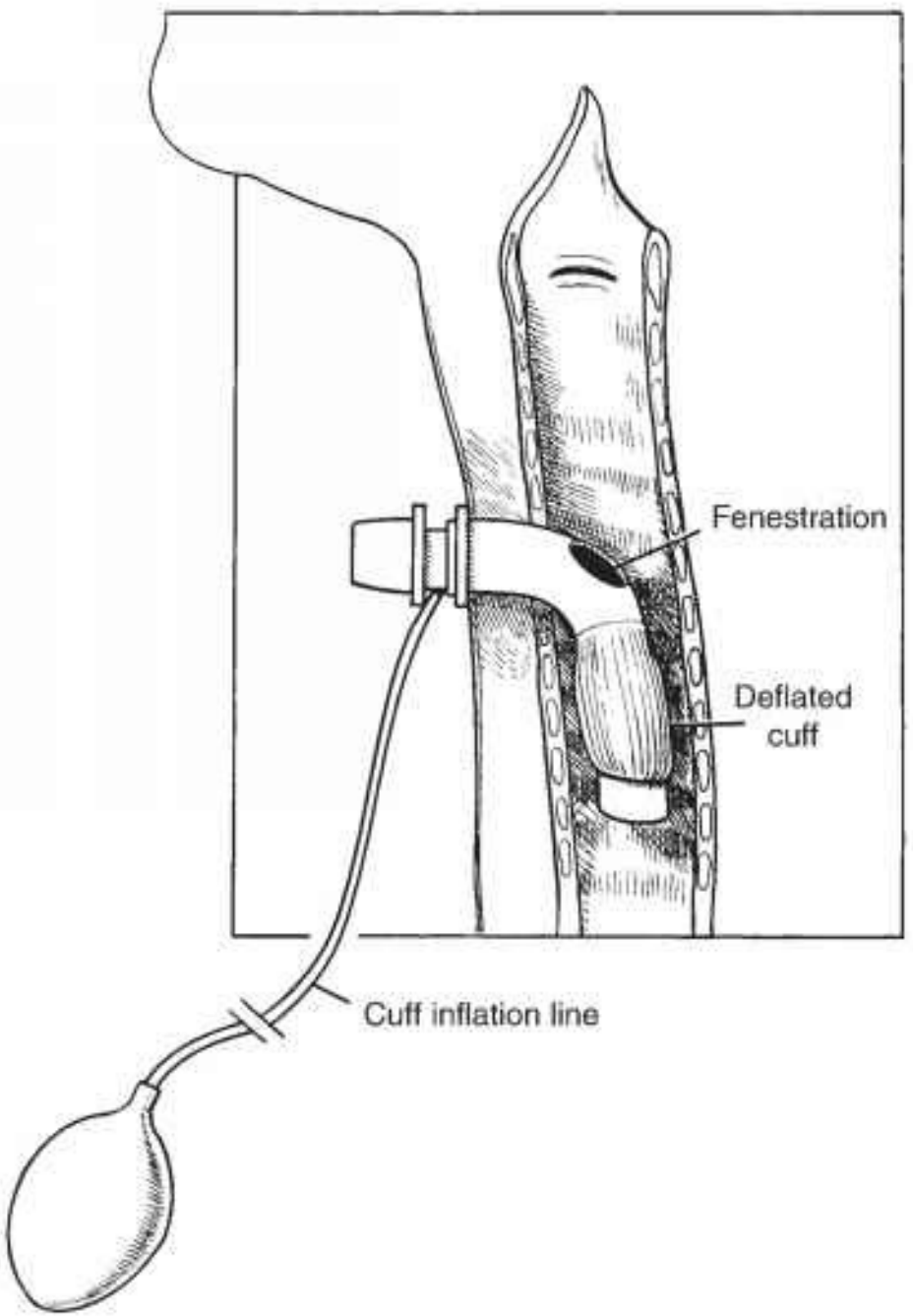
Talk Valves



- Commonly known as a **Passy-Muir** valve
- Requires some degree of UAW control
- Not recommended with aspiration precautions
- If cuffed trach, you MUST deflate the cuff prior to implementation
- Easily occluded

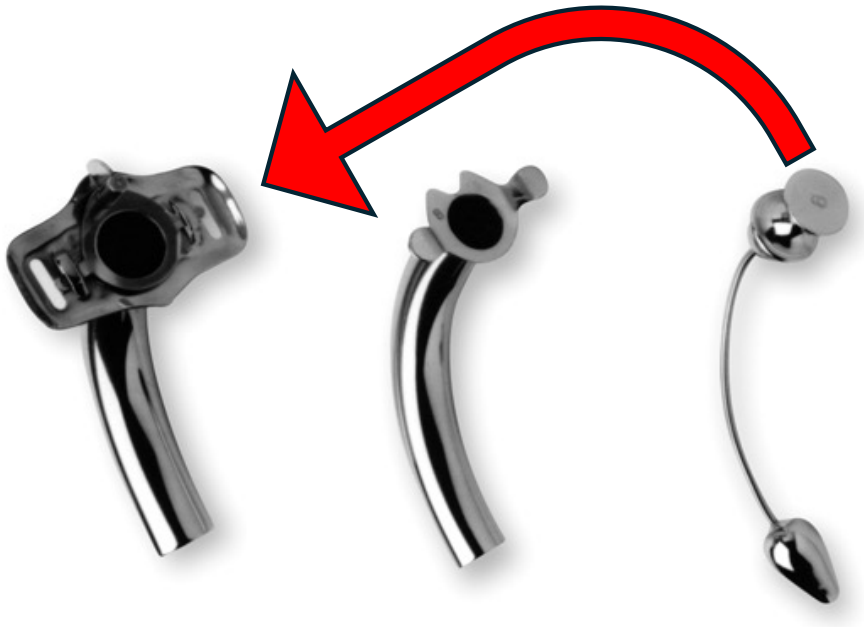
Patients LOVE these!

Deflated cuff with fenestrated outer cannula

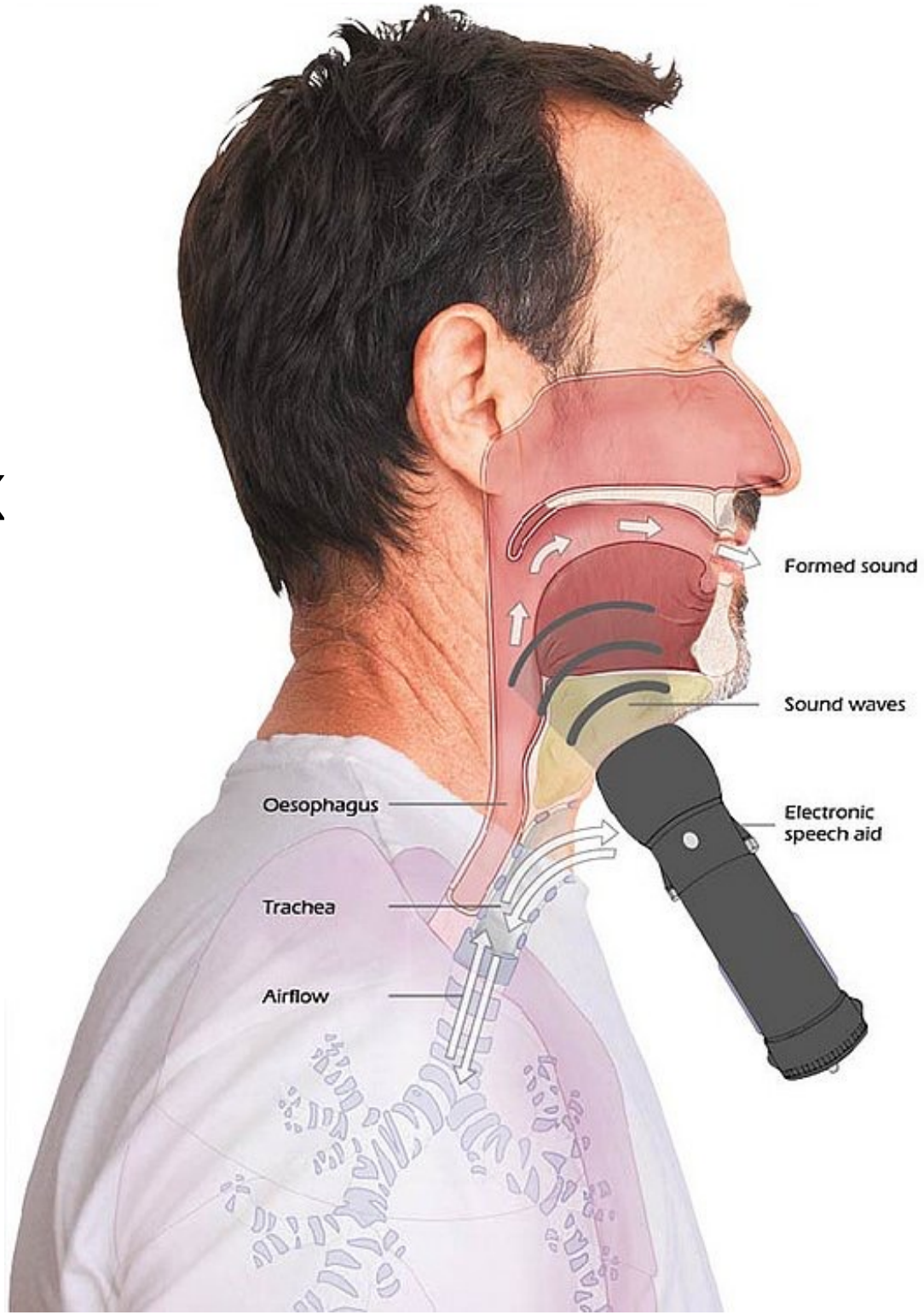


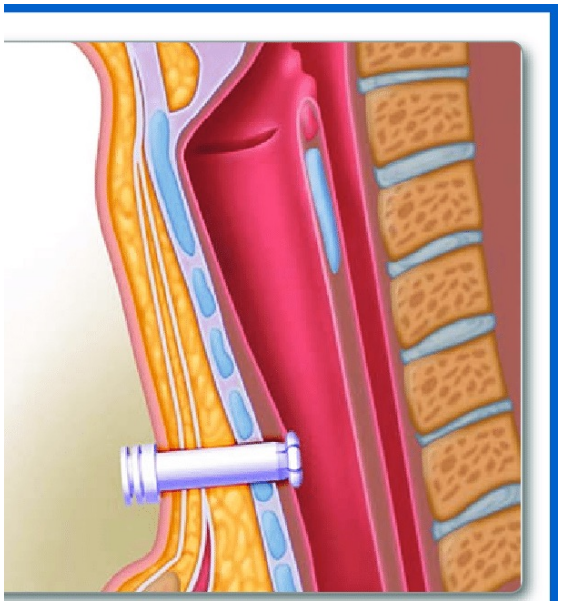
Friendly Reminder:

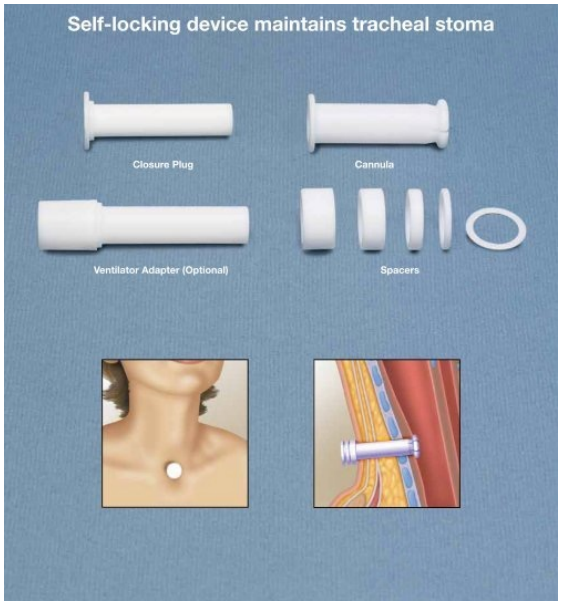
The **obturator** is a very important piece of equipment



The Electrolarynx is **not** intended for tracheostomy patients...

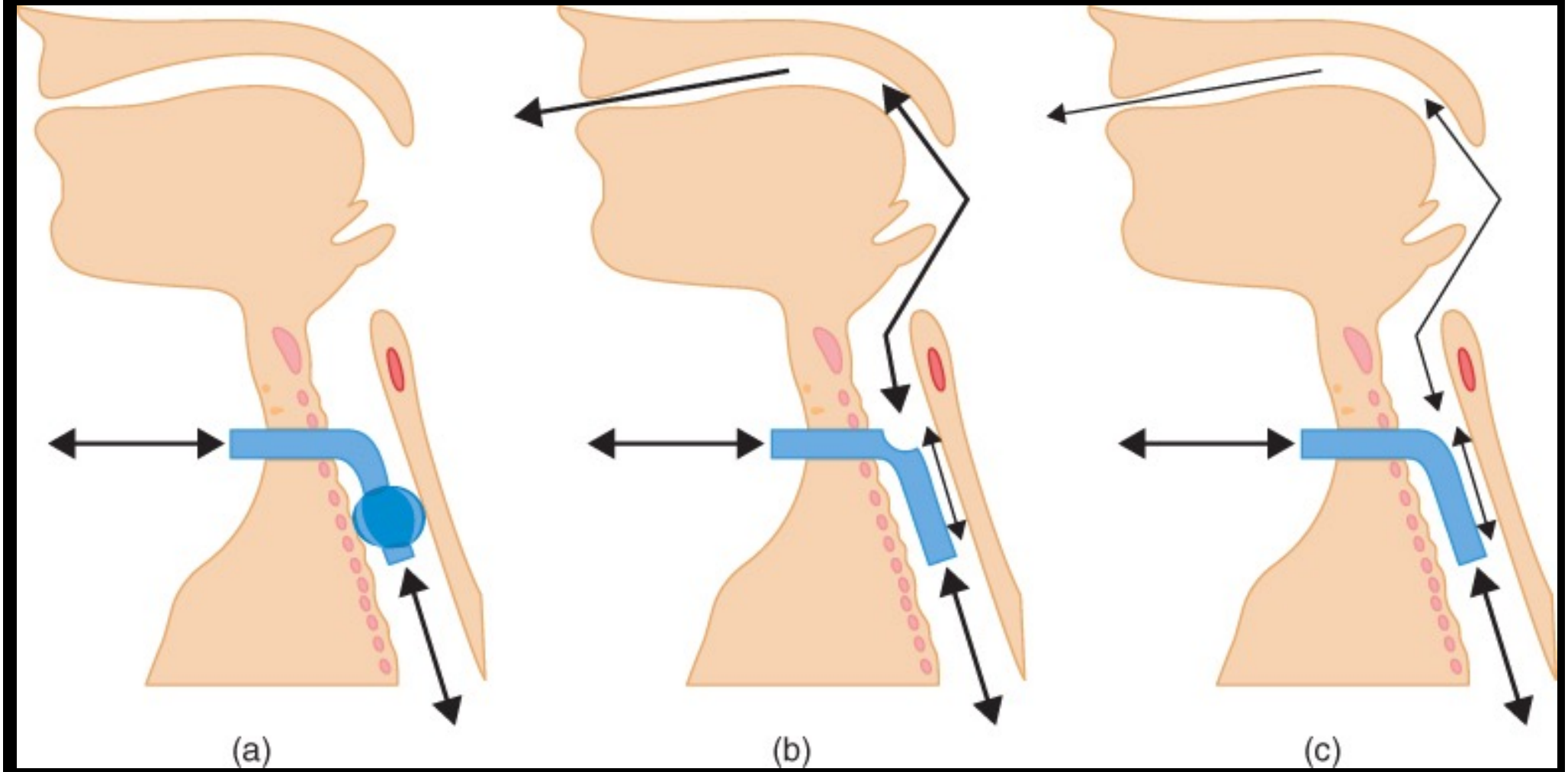






Tracheal Buttons
(Closure Devices)

Key Concepts



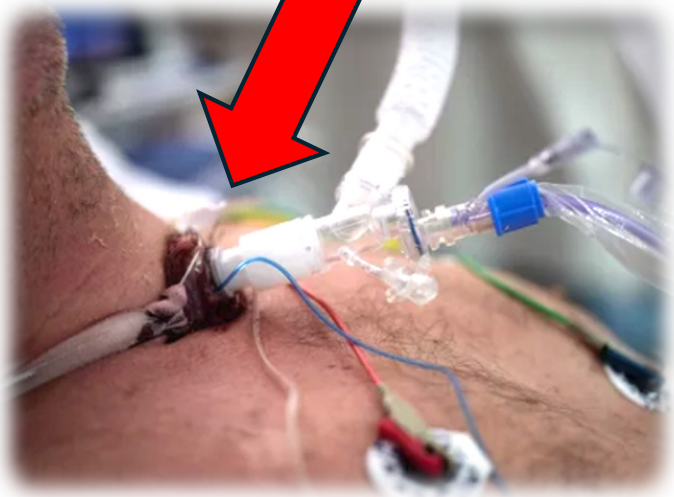
Cuffed Tracheostomy

Uncuffed, Fenestrated Tracheostomy

Uncuffed Tracheostomy

1

2



3

Thoughts in conclusion

- Patients with tracheostomy require specialized care and attention, often needing **additional & ongoing education** about their current condition
  - They may not know what they don't know
- For **homecare patients**, it falls the responsibility of the patient and family members to care for this complex airway, and few are formerly healthcare trained or have experience
- Be reminded to **always be kind** to all patients, but especially patients with tracheostomy – they been through a lot & care of tracheostomy requires constant, ongoing attention to their new 'lifeline'.

References

Bedwell, J. R., Pandian, V., Roberson, D. W., McGrath, B. A., Cameron, T. S., & Brenner, M. J. (2019). Multidisciplinary Tracheostomy Care: How Collaboratives Drive Quality Improvement. *Otolaryngologic clinics of North America*, *52*(1), 135–147. https://doi.org/10.1016/j.otc.2018.08.006

Blakeman, T. C., Scott, J. B., Yoder, M. A., Capellari, E., & Strickland, S. L. (2022). AARC Clinical Practice Guidelines: Artificial Airway Suctioning. *Respiratory care*, *67*(2), 258–271. https://doi.org/10.4187/respcare.09548

Brenner, M. J., & Pandian, V. (2024). Elevating Tracheostomy Care Through Data-Driven Innovation: What Can Education, Evidence-Based Practice, and Quality Improvement Learn from One Another?. *Tracheostomy (Warrenville, Ill.)*, *1*(2), 1–6.

Cherney, R. L., Pandian, V., Ninan, A., Eastman, D., Barnes, B., King, E., Miller, B., Judkins, S., Smith, A. E., 4th, Smith, N. M., Hanley, J., Creutz, E., Carlson, M., Schneider, K. J., Shever, L. L., Casper, K. A., Davidson, P. M., & Brenner, M. J. (2020). The Trach Trail: A Systems-Based Pathway to Improve Quality of Tracheostomy Care and Interdisciplinary Collaboration. *Otolaryngology--head and neck surgery : official journal of American Academy of Otolaryngology-Head and Neck Surgery*, *163*(2), 232–243. https://doi.org/10.1177/0194599820917427

Lawrence, P. R., Chambers, R., Faulkner, M. S., & Spratling, R. (2021). Evidence-based care of children with tracheostomies: Hospitalization to home care. Rehabilitation Nursing, 46(2), 83–86.

Miles, A., & Wallace, S. (2025). Management of adults with a tracheostomy: An international survey of speech-language pathologists' practice. *International Journal of Speech-Language Pathology*, 1–14. https://doi.org/10.1080/17549507.2025.2482865

Nakarada-Kordic, I., Patterson, N., Wrapson, J., & Reay, S. D. (2018). A Systematic Review of Patient and Caregiver Experiences with a Tracheostomy. *The patient*, *11*(2), 175–191. https://doi.org/10.1007/s40271-017-0277-1

Sandler, M. L., Ayele, N., Ncogoza, I., Blanchette, S., Munhall, D. S., Marques, B., & Nuss, R. C. (2020). Improving Tracheostomy Care in Resource-Limited Settings. *The Annals of otology, rhinology, and laryngology*, *129*(2), 181–190. https://doi.org/10.1177/0003489419882972

SEEGOBIN, R. D.; VAN HASSELT, G. L.. Endotracheal Cuff Pressure and Tracheal Mucosal Blood Flow: Endoscopic Study of Effects of Four Large Volume Cuffs. Survey of Anesthesiology 29(1):p 27, February 1985.

Thorarinsdottir, H. R., Kander, T., Holmberg, A., Petronis, S., & Klarin, B. (2020). Biofilm formation on three different endotracheal tubes: a prospective clinical trial. *Critical care (London, England)*, *24*(1), 382. https://doi.org/10.1186/s13054-020-03092-1

Wang, C. H., Tsai, J. C., Chen, S. F., Su, C. L., Chen, L., Lin, C. C., & Tam, K. W. (2017). Normal saline instillation before suctioning: A meta-analysis of randomized controlled trials. *Australian critical care : official journal of the Confederation of Australian Critical Care Nurses*, *30*(5), 260–265. https://doi.org/10.1016/j.aucc.2016.11.001

Questions?

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