Percutaneous Tracheotomy: When, How and Why

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Disclosure

- I am a consultant with Cook Inc
Objectives

1. Review the evolution and ‘types’ of PT
2. Understand WHEN to perform PT
3. Learn HOW to perform PT
4. Appreciate WHY you should perform PDT
Courtesy of Dr J Johnson
Who is doing Trachs? (n=666)

- Trauma 50%
- OTO-HNS 38%
- Thoracic 6%
- Transplant 2%
- Others

University of Pittsburgh 2009

Courtesy of Dr J Johnson
Tracheotomy options

- Open Tracheotomy in OR
- Bedside Open Tracheotomy
- Endoscopic Percutaneous Tracheotomy (PT)
Tracheotomy in the OR

Chevalier Jackson-1909
• Established safe guidelines:
  • Long incision
  • Avoid cricoid
  • Divide the isthmus
  • Slow, careful surgery
  • Meticulous post-op care
Incentives for developing safe bedside tracheotomy

1. Freedom from operating room scheduling and staffing constraints
2. Avoid transporting critically ill patients to the OR
3. Cost containment
Percutaneous Tracheotomy

- 1957 - Sheldon et al. first described Percutaneous Tracheotomy (PT)
- Special trocar blindly inserted into trachea
- No guide-wire used
Percutaneous Tracheotomy

- 1969 - Toye, Weinstein et al described “Seldinger technique” percutaneous tracheotomy
- 1985 Ciaglia: “Dilational Percutaneous Tracheotomy”
- 1989 Paul et al: Endoscopic percutaneous tracheotomy
- 1990 Griggs: Guidewire dilating forceps for percutaneous tracheotomy
PT Techniques

- Griggs Dilating Forceps (Smith/Portex): Europe and Asia
- Fantoni: Germany
- Percutwist: Europe
PT Techniques

- Ciaglia (Cook, Smith): USA
- The key step in all of these is needle puncture of the trachea and insertion of the Seldinger guidewire
- Safety conferred by attention to detail
Indications for PT

- Adult intubated ICU patients
Contraindications

**Absolute:**
- Emergency
- Unprotected airway
- Pediatric patient
- Midline neck mass
- Inability to palpate the cricoid
Relative Contraindications

Relative:
- PEEP > 15-20
- Coagulopathy
- C-spine immobilization
Personnel

- Surgeon
- Surgical assistant
- Respiratory technician
- Nurse
Technique – Single Dilator

- Simple layout
- No special lighting
Sedation

- Propofol
- Fentanyl
- Muscle relaxants
- 100% oxygen
- Vital sign monitoring
- Bronchoscopy
Technique

- Head extended on neck
- Standard prep and drape
- ETT securely held at all times
Technique

- Landmarks palpated
Technique

- Skin and subcutaneous tissues infiltrated with lidocaine and epinephrine
Technique

- 1.5 cm horizontal incision
- 2 fingerbreadths below cricoid
Technique

- Subcutaneous fat bluntly dissected horizontally
Technique

- Bronchoscope inserted to end of ETT
- ETT tube slowly withdrawn
- Incision transilluminated
Technique
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Technique
The Blue Dolphin: Background

- Involves radial dilatation by means of balloon in one step
The Blue Dolphin
The Blue Dolphin...
Procedure

- Intravenous sedation administered according to the needs of the patient
- The patient is positioned with the head extended on the neck
- Landmarks are palpated
- The incision site is infiltrated with 1-2% lidocaine with 1:100000 epinephrine
Procedure

- A 2cm horizontal incision is made
  - 1-2 finger breadths below inferior border of cricoid cartilage

- A curved hemostat is used to bluntly spread the subcutaneous tissues
Procedure

- Bronchoscope is positioned at the end of the ETT
Procedure

- ETT tube and bronchoscope are withdrawn to the point of maximal transillumination
- Depression of trachea can also be seen through the bronchoscope
Procedure

- A 14G introducer needle is inserted midline
  - Between 1st&2nd or 2nd&3rd tracheal rings.

- The needle is withdrawn and a J-tipped guidewire is advanced through the remaining catheter sheath
Procedure

- A 14F Introducer Dilator is advanced over the J-wire to facilitate passage of the ‘Blue Dolphin’
The Balloon Catheter loaded with the tracheostomy tube, is advanced over the J-wire preloaded with a Shiley Tracheostomy Tube.
The balloon is inflated to a max of 11 atm for a total of 10 seconds, and then deflated.
Procedure

- The unit is then advanced into the trachea with the tracheostomy tube
Procedure

- The balloon dilator/loading catheter unit is removed and the inner cannula inserted and attached to the ventilator.
Procedure

- The tracheostomy tube is secured in position using 4 corner sutures and neck ties.

- Chest radiographs are obtained in all patients immediately postop.
Suggestions...

- There is a learning curve
- Select your first patient with care
- Always use a bronchoscope
- Decannulation within 5 days means reintubation
Complications

- McGill PT Study (n=500): 9.2%
- Open Trachs in OR: 14%-66%
- Open Bedside Trachs: 4%-41%

Kost K, Laryngoscope 2005
Complications

EXPERIENCE

- MD group: 40% complications in the first 30 patients \( p < .0001 \)
- Not true for SD group

BODY MASS INDEX

- Complications higher with BMI > 30 \( p < .05 \)
- Even higher with BMI > 30 and ASA 4 \( p < .02 \)
- Risk of decannulation and obesity \( p < .003 \)
## Complications: Surgical vs Perc

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<th>SURGICAL</th>
<th>PERCUTANEOUS</th>
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<td>Mortality</td>
<td>0%–2%</td>
<td>.5%</td>
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<td>Accid Decann</td>
<td>0%–8%</td>
<td>.4%–1.4%</td>
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<td>Bleeding</td>
<td>0%–37%</td>
<td>1.3%–4%</td>
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<td>Infection</td>
<td>0%–19%</td>
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<td>Obesity</td>
<td>???</td>
<td>(15%)</td>
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<td>Stenosis</td>
<td>.6%–65%</td>
<td>2.5%</td>
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Kost K, Laryngoscope 2005
### Predicted Neck Thickness (CM) as a Function of Neck Circumference (CM) and Arm Circumference (CM)

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## Bronchoscopy & Complications

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<th>ENDOSCOPIC PT (N=851)</th>
<th>NON-ENDOSCOPIC PT (N=1385)</th>
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<td>TOTAL</td>
<td>71 (8.3%)</td>
<td>233 (16.8%)</td>
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p < .0001
Safety: Percutaneous vs Open Tracheotomy

Meta-analyses:
- 1999 – Dulguerov et al. *Crit Care Med*
- 2000 – Freeman et al. *Chest*
- 2005 – Kost *Laryngoscope*
- 2006 – Delaney et al. *Crit Care Med*
- 2007 – Higgins et al. *Laryngoscope*
- 2007 – Oliver et al. *Laryngoscope*

**Conclusion:** As safe as open tracheotomy
Education

- In the US only 29% of otolaryngology programs perform PT and teach it to their residents.

- In Canada, 42% of OTO-HNS programs perform PT and teach it to their residents – in another 30% of programs, OTO-HNS no longer participates in ICU trachs.

- In Europe PT is procedure of choice & almost all are performed by non-surgeons.

Percutaneous tracheotomy in otolaryngology-head and neck surgery residency training programs.
Goldenberg D, Park SS, Carr M.
Kost: unpublished data
Is resistance to PT by OTO-HNS real?

Mentioned in the OTO-HNS literature:

- Terris
- Kost
- Levin
- Sharp DB,
- Goldenberg,
- Jeannon JP,
- Donaldson and others
“Percutaneous tracheotomy should be relegated to the wastepile of other failed techniques.”

Wang et al Laryngoscope 1992
Literature – 137 publications on PT

- 74 (56%) were published by intensive care specialists or anesthesiologists
- 39 (29%) were published by surgeons
- 22 (16%) were published by Otolaryngologists

Kost K Endoscopic Percutaneous Dilatational Tracheotomy: A Prospective Evaluation of 500 Consecutive Cases Volume 115(10, Part 2) Laryngoscope SUPPLEMENT NO, 107, October 2005, pp 1-30
# Education

**Surgical Programs** (n=130 52%)

- 89% perform open Trach regularly
- 73% perform PT regularly
- 81% of programs: residents have an opportunity to learn PT

**OTO-HNS Programs** (n=81 80%)

- 92% perform open Trach regularly
- 29% perform PT regularly
- 71% of programs: residents do not have any opportunity to learn PT

Goldenberg D et al Laryngoscope 2009
Educational implications for our specialty

- Where PTs are performed by non-surgeons, only difficult cases will be referred to ENT
- Dilutes the expertise, reduces exposure
- May lead to an increase in complications when open trachs are performed
- We have a responsibility to train our residents in all techniques

Percutaneous (Portex) tracheostomy: an audit of the Newcastle experience.
Jeannon JP, Mathias D.
Educational implications for our specialty

- In ICUs where OTO-HNS is no longer involved, trach volumes drop 60%
- There is a clear inverse relationship between volume and complications
- Diluting our expertise allows for a new standard of mediocrity

Zeitouni & Kost
Training

- Expertise in open surgical tracheostomy does not confer safety and expertise in PT
- There is a learning curve - Training is essential
- OTO-HNS residents need training in both open and PT
- The ability to convert a percutaneous method to an open surgical procedure if needed is an advantage surgeons have over non-surgeons
Why should you care?

- Over half of tracheotomies are performed in adult, intubated ICU patients!
- **You** are the airway experts
- There is a clear inverse relationship between volume and complications
- Proficiency in more than one technique
- PT is in keeping with MIS techniques
Why Otolaryngologists should consider adopting PT

- PT is safe, simple and cost effective
- It is here to stay
- As we snooze, we lose
- We risk being marginalized as the airway experts
- We are denying our Residents the opportunity of learning a technique clearly within the realm of Otolaryngology
THANK YOU
THE LEARNING CURVE FOR SURGICAL TRACHEOTOMY

MORBIDITY
- TROUSSEAU 1834: 68%
- JACKSON 1909: 40%
- DULGUEROV: 1960-84 32.8%
- DULGUEROV: 1985-96 9.6%

MORTALITY
- RENAISSANCE: >90%
- PEMBERTON 1934-69 3.7%
- SALMON 1961-73 2.7%
- DULGUEROV 1960-84 1.2%
- DULGUEROV 1985-96 0.1%