

# Airway Management in the ICU

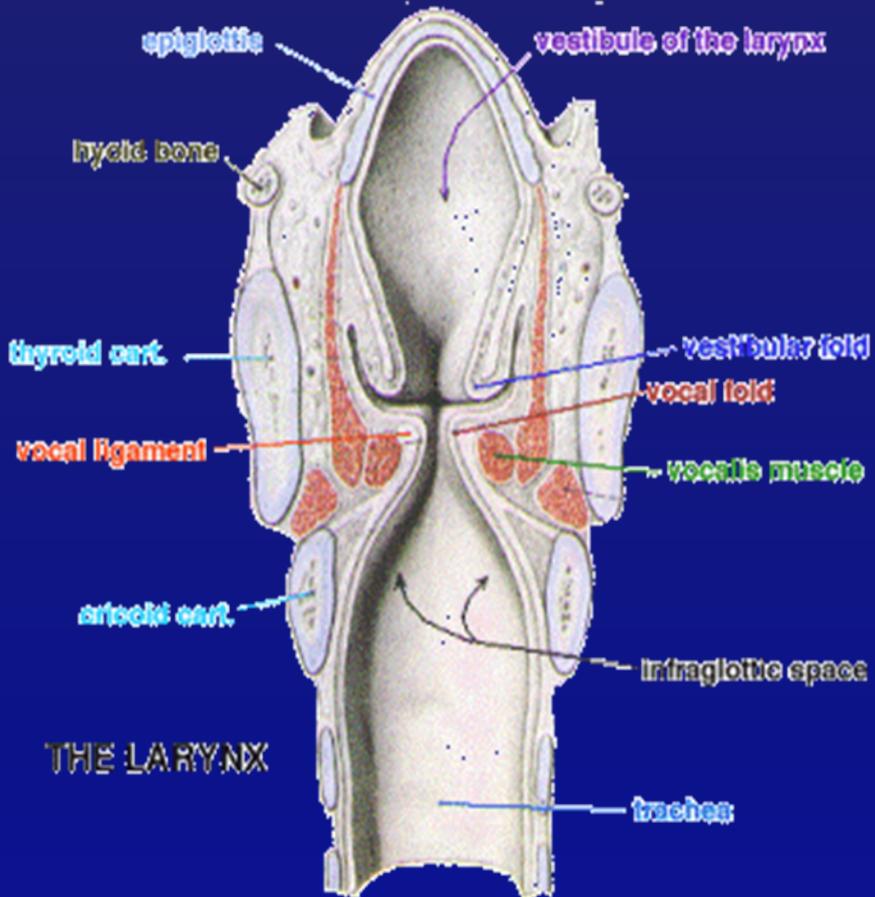
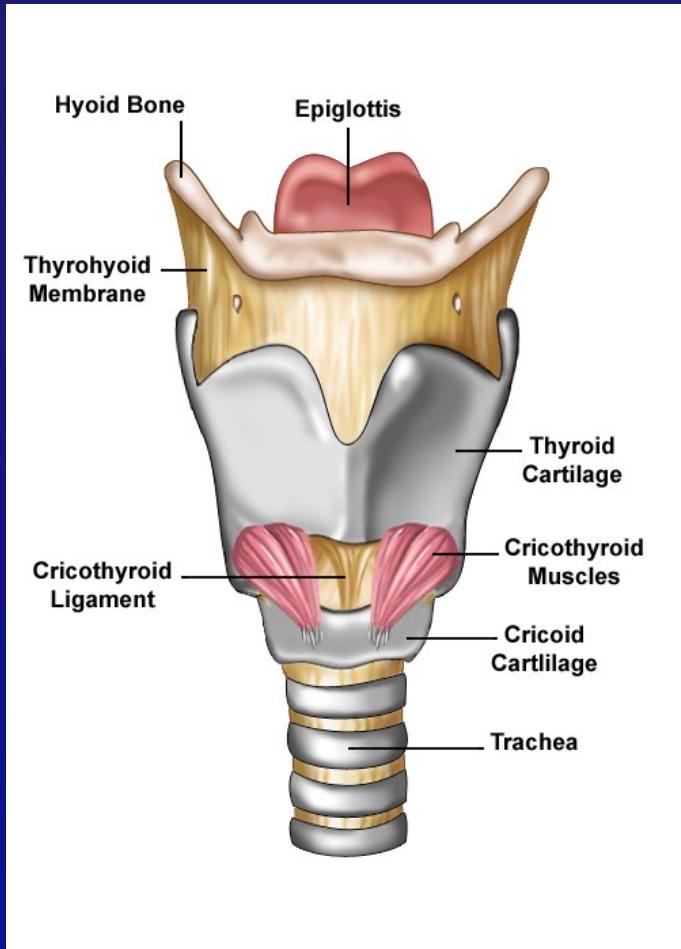
New developments in management of  
epistaxis.

April 28, 2008

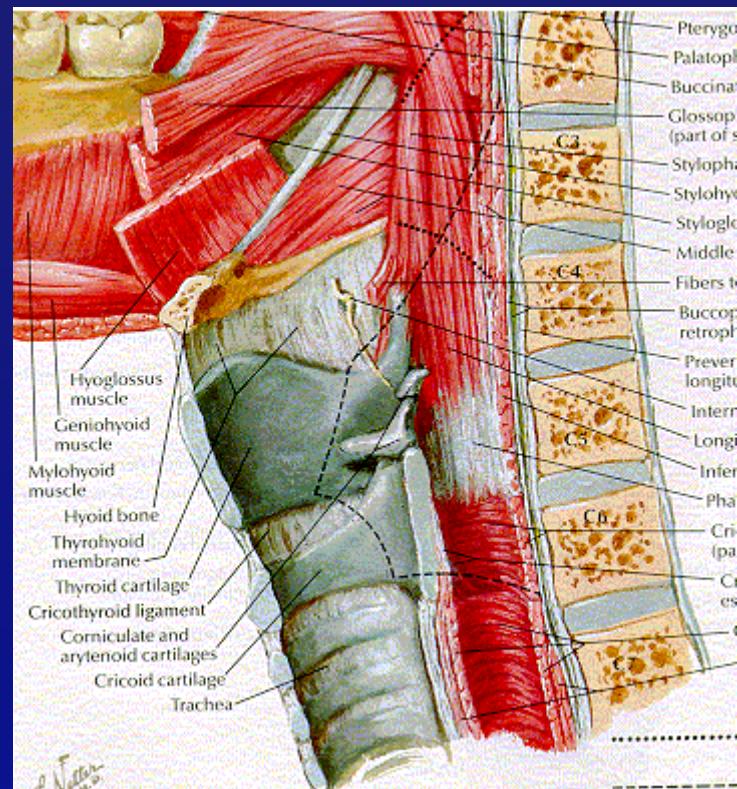
# Methods of airway control

- Non surgical
  - BIPAP
  - CPAP
  - Mask ventilation
  - Laryngeal Mask
  - Intubation
- Surgical
  - Cricothyrotomy
  - Tracheotomy

# Anatomy



# Anatomy



# Histology

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- Posterior and subglottis: respiratory epithelium
- Pseudostratified columnar ciliated epithelium
- Very poor resistance to trauma
- Anterior glottis: squamous epithelium

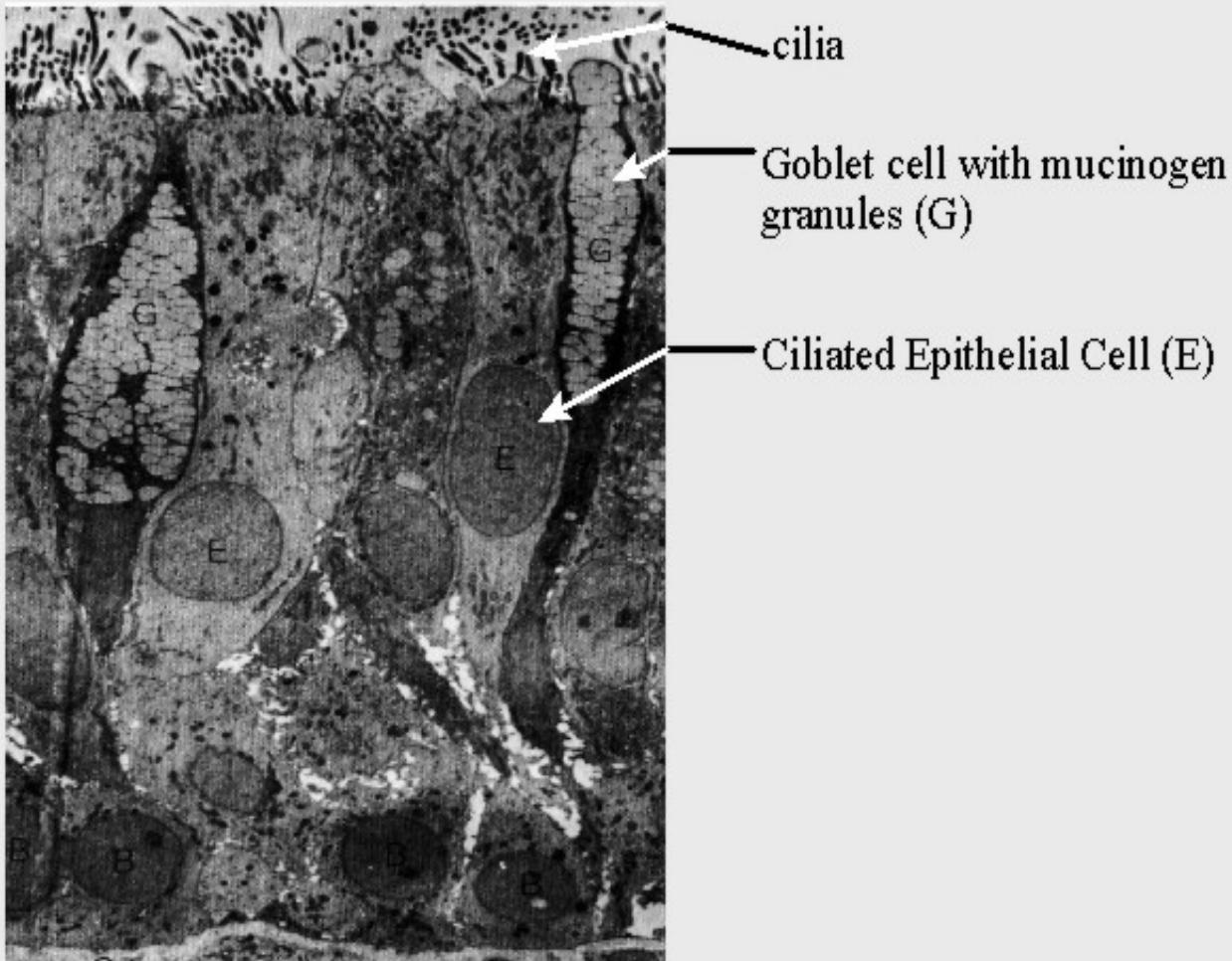


## Respiratory Epithelium

Pseudostratified ciliated columnar epithelium

# Tracheal Lining

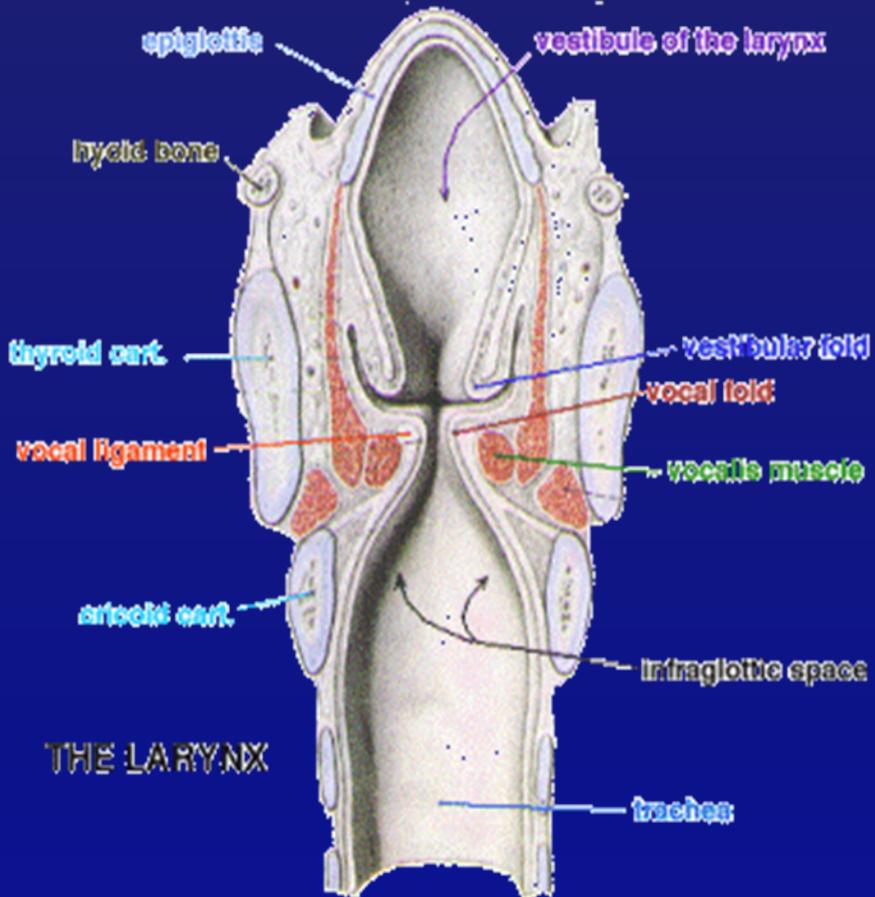
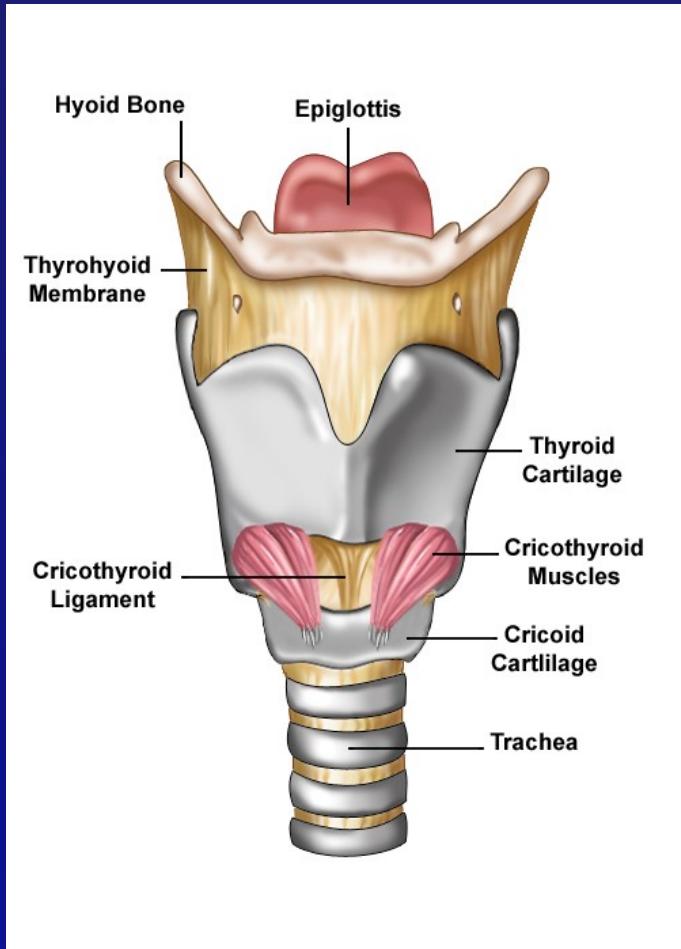
## Transmission Electron Micrograph (TEM)



# Surgical

- Cricothyrotomy
- Tracheotomy
  - Where
  - When
  - Why
  - How

# Anatomy



# Cricothyrotomy

- Percutaneous kits by Cook
- Portable kits
- # 11 blade
  - Snap
  - # 6 Schilley trach or Endotracheal tube



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# Cricothyrotomy

- E:\icu talk\C-T-  
UTCCSB304.pdf

# Indications for tracheotomy

Upper airway obstruction with any of the following:

Stridor

Air hunger

Retractions

Obstructive sleep apnea with documented arterial desaturation

Bilateral vocal fold paralysis

Previous neck surgery or throat trauma

Previous irradiation to the neck

Prolonged or expected prolonged intubation

Inability of patient to manage secretions, including the following:

Aspiration

Excessive bronchopulmonary secretions

Facilitation of ventilation support

Inability to intubate

Adjunct to manage head and neck surgery

Adjunct to manage significant head and neck trauma

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\*As defined by American Academy of Otolaryngology—Head and neck Surgery [7].

# Tracheotomy tubes

- Schilley
- Portex
- Bivuona
- Armored laryngectomy tubes

# Tracheotomy tube options

- [Shiley Quick Reference Guide June 2006.pdf](#)
- [Shiley XLT Sales Brochure.pdf](#)

# Tracheotomy care

- Sutured in for 7 days in open approach
- When to change tracheotomy tube?
- With disposable inner canula the trach can be left for 1 month before changing.
- How to change a trach?
- Suture removal?
- Accidental decannulation?
- Downsizing?

# Rationale for tracheotomy

- Initially indicated as a compromise between morbidity associated with laryngeal injury from endotrachial intubation and that associated with tracheotomy.
- 1989 consensus conference on artificial airways recommended continued use of ET if ventilation required for less than 10 days vs tracheotomy if anticipated to be required for more than 21 days.

# Why Tracheotomy in the ICU

- Reduce length of ICU stay
- Sedation
- Ventilator assisted pneumonia
- Mortality rate
- Complications of subglottic, tracheal stenosis
- Patient mobility
- Oral and pharyngeal complications
- Secure airway

# Studies

Study	Sample size	Timing (days)	Duration of mechanical ventilation (days)	LOS (days) ICU	LOS (days) Hospital	Morbidity (%) (pneumonia)	Mortality (%) ICU	Mortality (%) Hospital
	early/late	early/late	early/late	early/late	early/late	early/late	early/late	early/late
Flaatten [21**] retrospective	230/231	<6/>6	4.7/14.7 (median)* 6.7/16.0 (mean)	6.8/12.7 (median)* 9.0/20.6 (mean)			7/14.7*	22.2/32.5*
Barquist [22**] prospective, randomized	29/31	<8/>28	21.5/21.2 NS	25.0/24.7 NS		96.5/90.3 NS	6.9/16.1 NS	
Moller [23*] retrospective	81/104	<7/>7	12.2±0.9/21.9±1.3*	16.7±1.0/26.0±1.3*	23.8±1.2/33.4±1.7*	27.2/42.3*		
Rumbak [11] prospective, randomized	60/60	<2/14-16	7.6±2.0/17.4±5.3*	4.8±1.4/16.2±3.8*		5/25*		31.7/61.7*
Hsu [24*] retrospective	163 total	<21/>21	19.0/44.3*	10.8/14.2*		43.6/60.4 NS	14.5/28.3*	44.5/54.7 NS
Arabi [25] prospective, database	29/107	<7/>7	9.6±1.2/18.7±1.3*	10.9±1.2/21.0±1.3*	101±19/105±7 NS		3/1 NS	17/14 NS
Sugerman [26] prospective, randomized	127/28	3-5/10-14		20±2/24±2 NS		49/57 NS		24/18 NS

Most used different definitions for important variables (i.e., 'early' and 'late') including morbidities. LOS, length of stay; ICU, intensive care unit; NS, not significant.

\* Statistically significant.

# Where

- ICU vs OR suite
- Meta analysis of 17 RCT's involving 1212 patients looked at surgical vs percutaneous dilation technique (PDT) performing tracheotomy.
  - PDT found a lower incidence of wound infection and may reduce incidence of post operative bleeding and death compared with surgical tracheotomy in the operating room.
    - Delaney et al Critical Care 2006

# Timing of tracheotomy

- Ultimately it is the evaluation of the intensivist, combined with the consideration of the patient benefits which will determine this.

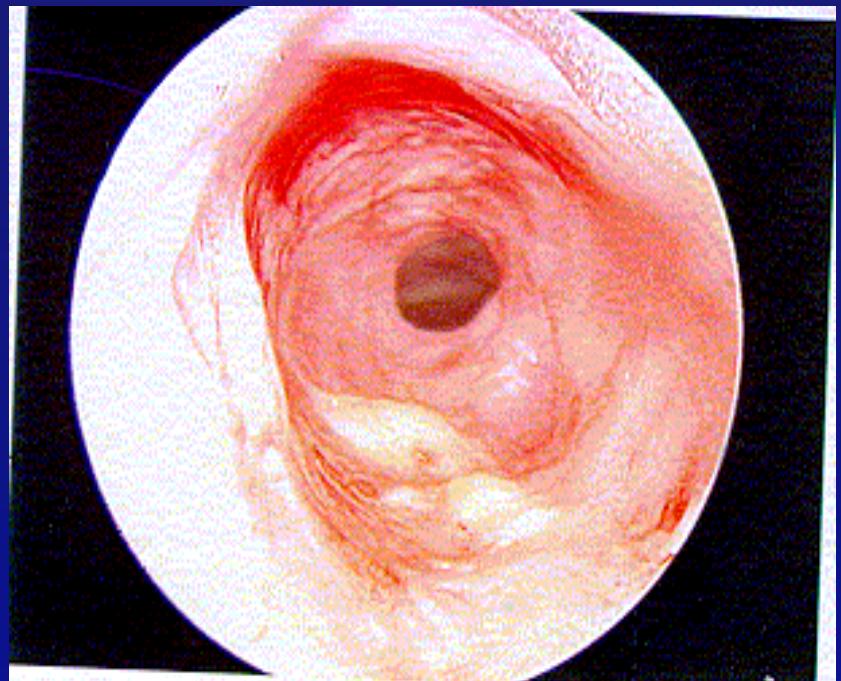
# Psychological impact

- 92% of critical care nurses indicated they would prefer tracheotomy if more than ten days of mechanical ventilation required
- Astrachan et al.



# When?

- Incidence: of subglottic stenosis following intubation
  - varies with length of intubation:
    - <5 days rare
    - 5-10 days 4%
    - >10 days 14%
- (Locicero et al, 1992)



# When

- Early tracheotomy can significantly decrease total days of sedative administration and may reduce ventilator assisted pneumonia.
- K Mitka et al Critical Care 2008
- Significant reduction in mechanical ventilation and VAP , lower ICU LOS when tracheotomy performed within 7 days of SICU admission
- M. Muller et al Am J of Surgery
- Lower mortality, accidental extubations, length of stay in the ICU, time on mechanical ventilation, reduced damage to oral mucosa and larynx
- Rumbak MJ et al Critical Care Medicine 2004

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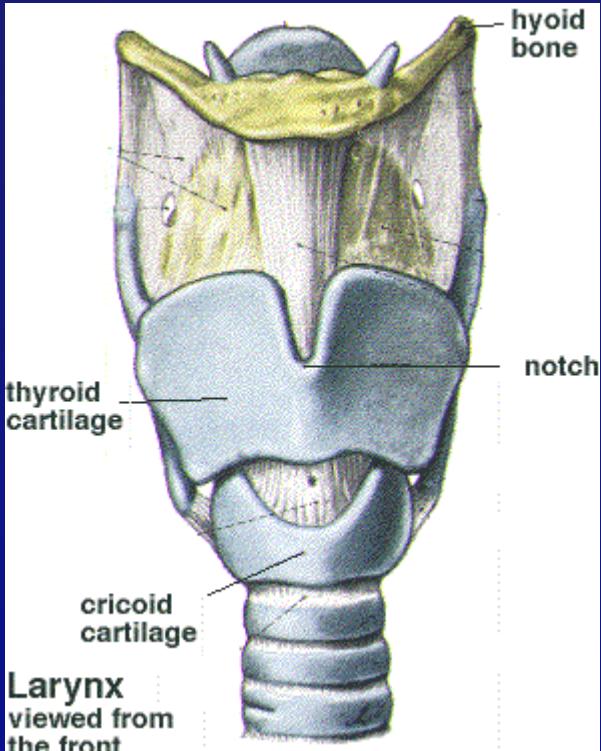
# Why

- Shorter length of stay in the ICU
- Lower incidence of pneumonia
- Lower mortality rates
- Reduction in oral and pharyngeal complications
- More secure airway
- Reduced sedation
- Increased mobility
- Reduction in subglottic and tracheal stenosis

# How

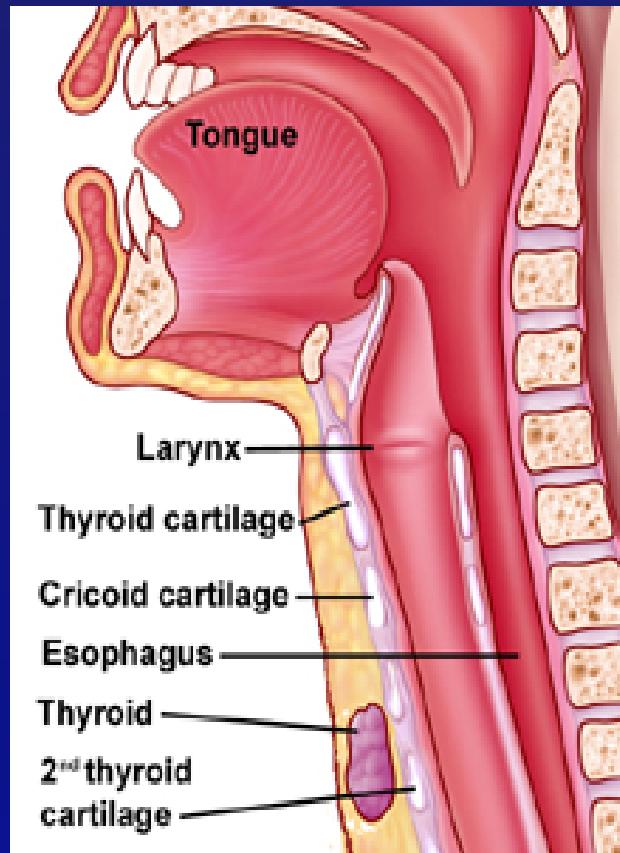
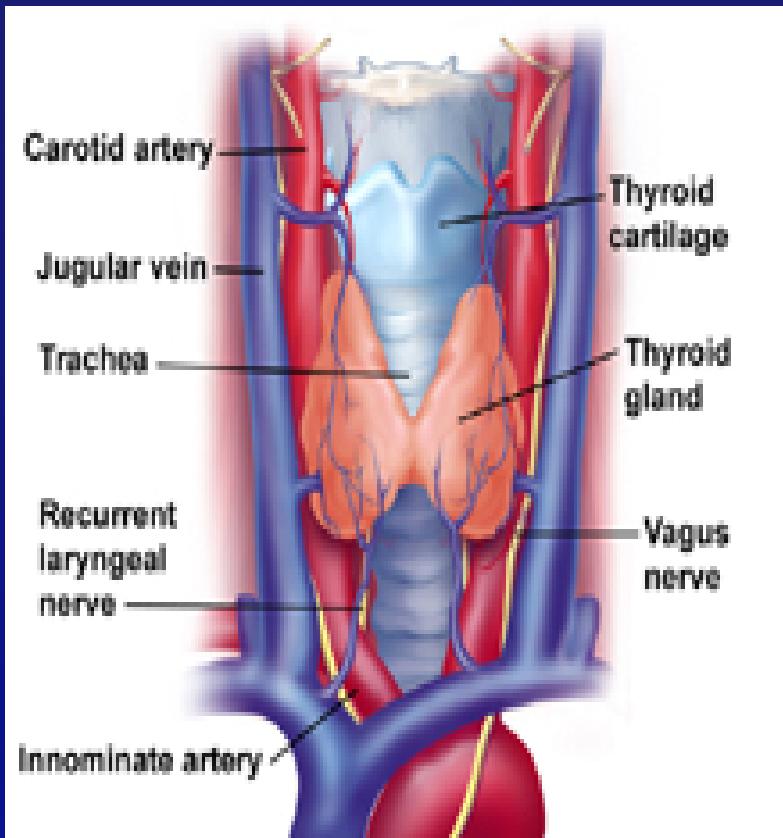
- Surgical
  - Bedside
  - In the Operating Room
- Percutaenous
  - There is no role for routine pre op imaging
- Translaryngeal tracheotomy

# Surgical



- Tracheotomy: defined as an incision of the trachea.
- Tracheostomy: surgical creation of an opening into the trachea through the neck with the tracheal mucosa being brought into continuity with the skin.

# Surgical



# Complications

- Bleeding (number one complication)
- Loss of Airway
- Recurrent nerve injury
- Tracheo innominate fistula
- Infection

# Five percutaneous techniques

- Ciaglia serial dilation
- Ciaglia tapered single dilator
- Griggs' forceps dilation technique
- Translaryngeal tracheotomy
- Screw-in dilational technique



Figura 1

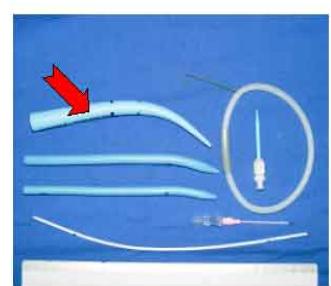


Figura 2

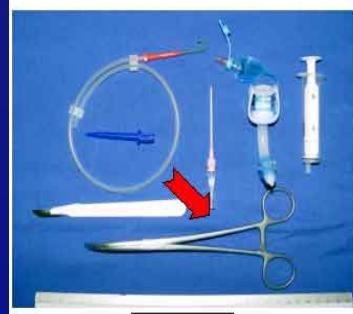


Figura 3

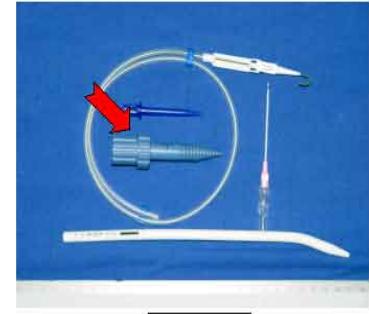


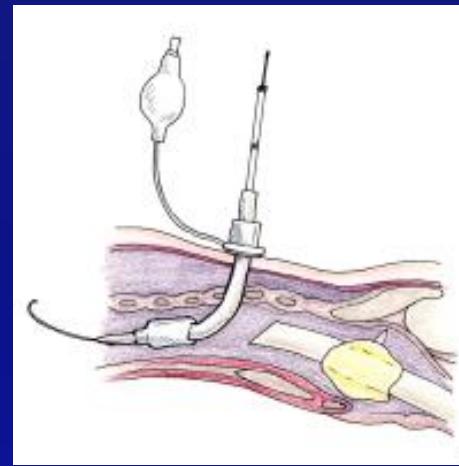
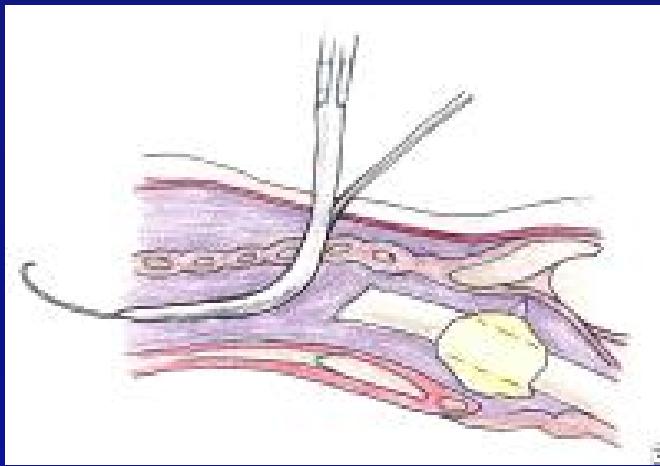
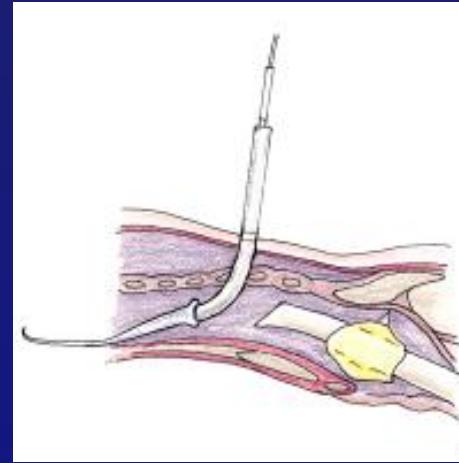
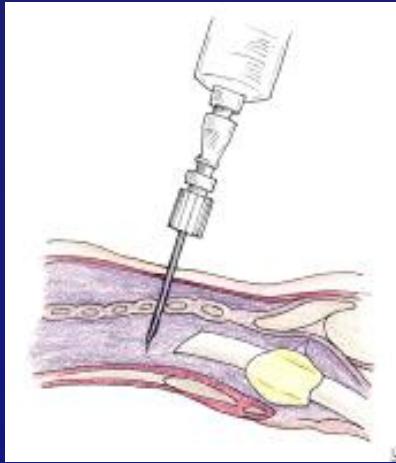
Figura 4

# Patient Selection

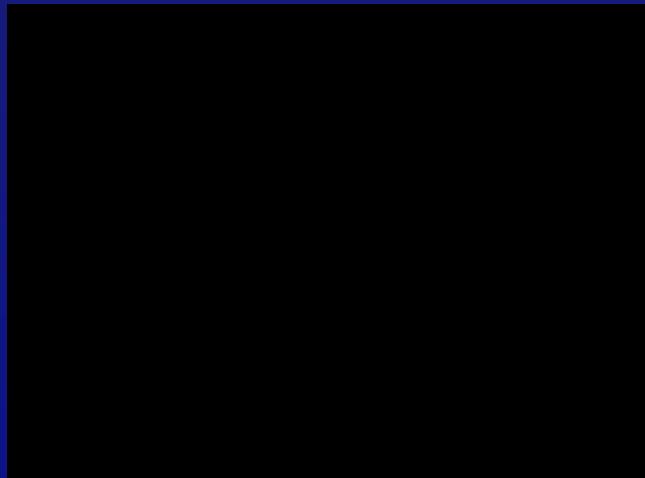
- Palpable cricoid cartilage ideally 3cm above sternal notch with appropriate neck extension
- Ideally patient should not be a difficult translaryngeal intubation
- Reasonable level of positive end-expiratory pressure needed ie. Less than 10cm H<sub>2</sub>O



# Ciaglia Percutaneous dilation



# Video



# Complications

- Death
- Hemorrhage
- False passage
- Stomal infection
- Granulation tissue
- Subcutaneous emphysema
- Accidental extubation
- Tracheal stenosis
- Tracheoesophageal fistula

# Bronchoscopic guidance

## Cons

- Concerns about hypercarbia
- Possible hypoxia
- Partial airway obstruction

– Reilly et al Intensive Care Medicine 1997

## Pros

- Improved visualization
- Reduced complication rates
- Improved needle localization
- Reduction of posterior tracheal wall injury
- Reduced tracheal stenosis

– Polderman et al Chest 2003

# Video monitoring

- Improved visualization and exposure during procedure.
- Ideally should be the standard in the ICU for percutaneous techniques



# Safety of technique

- Numerous studies show percutaneous techniques to be reproducible safe.
- Results comparable with open techniques in long term follow up.
- Shown to have lower cost, infection and morbidity in some studies vs open techniques.

# Percutaneous vs Open complication rate

## Pro

- Freeman et al Chest 2000: lower incidence of peristomal bleeding and post op infection with ease of performing procedure
- Cheng, Fee: Ann Otol Rhinol Laryngol 2000: similar findings to above

## Con

- Dulguerov et al Critical Care Medicine 1999: higher rate of perioperative complications with PDT including a higher rate of death and cardiorespiratory arrests.
- Massick and Schuller Laryngoscope 2001: lower complication rate for open vs percutaneous.

# Post op care

- Percutaneous tracheotomy requires a longer period for stomal maturation.
- 2 weeks are recommended before any tube change to prevent loss of airway.
  - Marx WH, Ciaglia P et al: Some important details in the technique of Percutaneous dilatational tracheotomy via the modified Seldinger technique Chest 1996

# Special Considerations

- Obese patients
- Short neck
- High innominate artery
- Large thyroid gland
- Midline neck mass
- Coagulopathic patients

# Conclusion

- Early vs Late tracheotomy seems to produce better results
- Tracheotomy in the ICU is a safe cost effective option
- Percutaneous techniques are safe when performed in experienced hands
- Videobronchoscopic techniques improve exposure and reduce complications.