



Airway & breathing

กลุ่มงานเวชศาสตร์ฉุกเฉิน

โรงพยาบาลขอนแก่น





Objectives

- Integrate the principles of ventilation and gas exchange with the pathophysiology of trauma to identify patients with inadequate perfusion.
- Relate the concepts of minute volume and oxygenation to the pathophysiology of trauma.
- Understand the difference between ventilation and respiration.
- Explain the mechanisms by which supplemental oxygen and ventilatory support are beneficial to the trauma patient.
- Given a scenario that involves a trauma patient, select the most effective means of providing a patent airway to suit the patient's needs.
- Presented with a scenario that involves a patient who requires ventilatory support, discuss the most effective means available to suit the trauma patient's needs.
- Given situations that involve various trauma patients, formulate a plan for airway management and ventilation.
- Presented with current research, understand the risks versus benefits when discussing new invasive procedures.
- Discuss the indications and limitations of end-tidal carbon monoxide (ETCO₂) monitoring in the trauma patient.





Respiratory system

- 2 primary functions
 1. Provide oxygen to the RBC, which carry the oxygen to all of the body's cells
 2. Remove CO₂ from the body





Anatomy

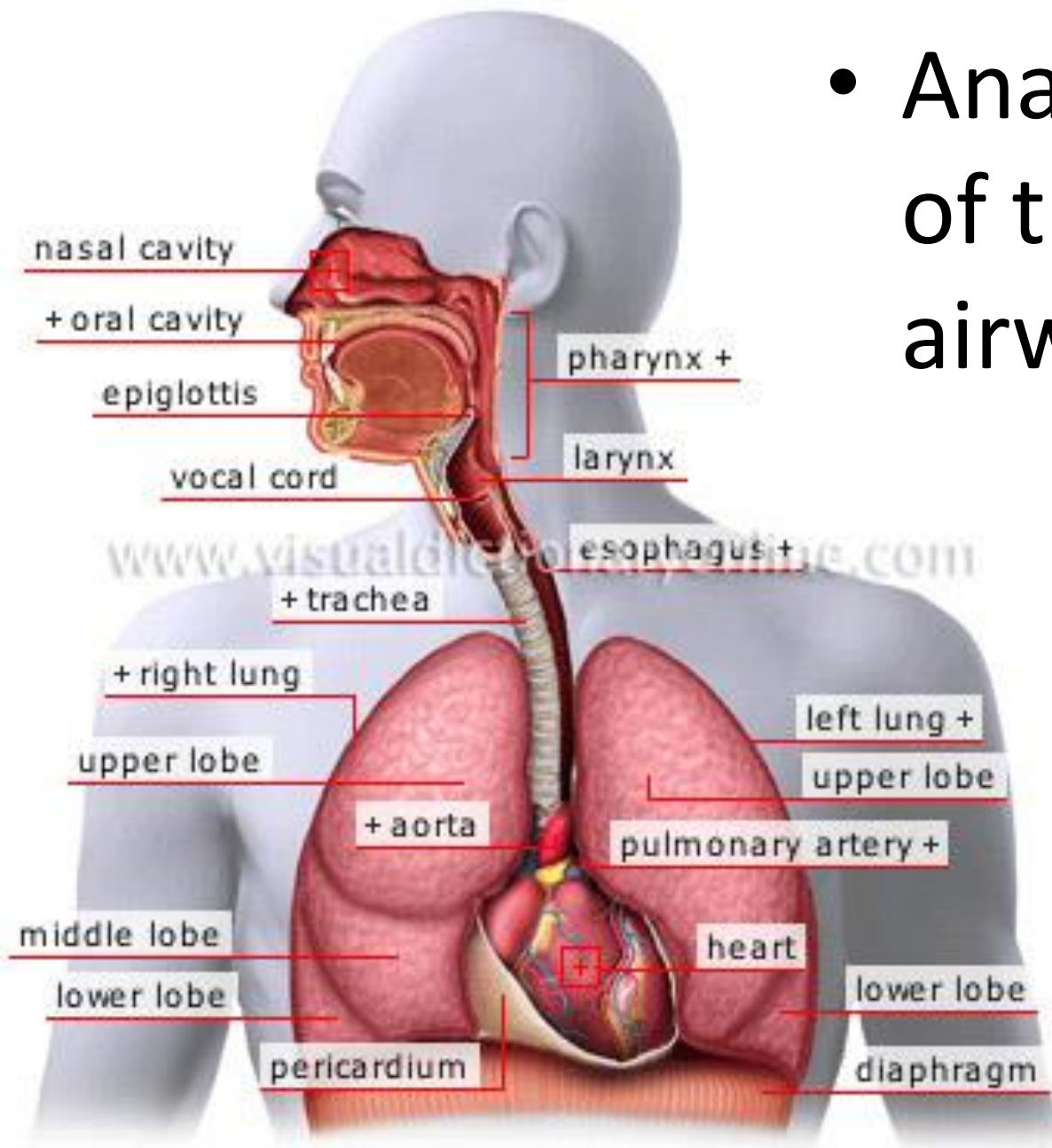
- Upper airway (nasal cavity, oral cavity)
 - >pharynx (nasopharynx, oropharynx, hypopharynx)
 - >larynx
 - >epiglottis
- Lower airway (trachea , lungs)



On-scene T



- Anatomy of the airways





On-scene Trauma care

Oxygenation and ventilation of the Trauma patient

- 3 phases
 - External respiration
 - Oxygen delivery
 - Internal respiration (cellular)





Pathophysiology

- 1.Hypoxemia
- 2.Hypoxia
 - The inability of the air to reach the capillaries
 - Decrease blood flow to the alveoli
 - Decrease blood flow to the tissue cells
- 3.Hypoventilation
 - Obstruction of airflow through the upper and lower airways
 - Decrease expansion of the lungs
 - Loss of ventilatory drives





Assessment of the Airway and ventilation

- Position of the airway and patient
- Any sounds emanating from the upper airway
- Airway obstruction
- Chest rise





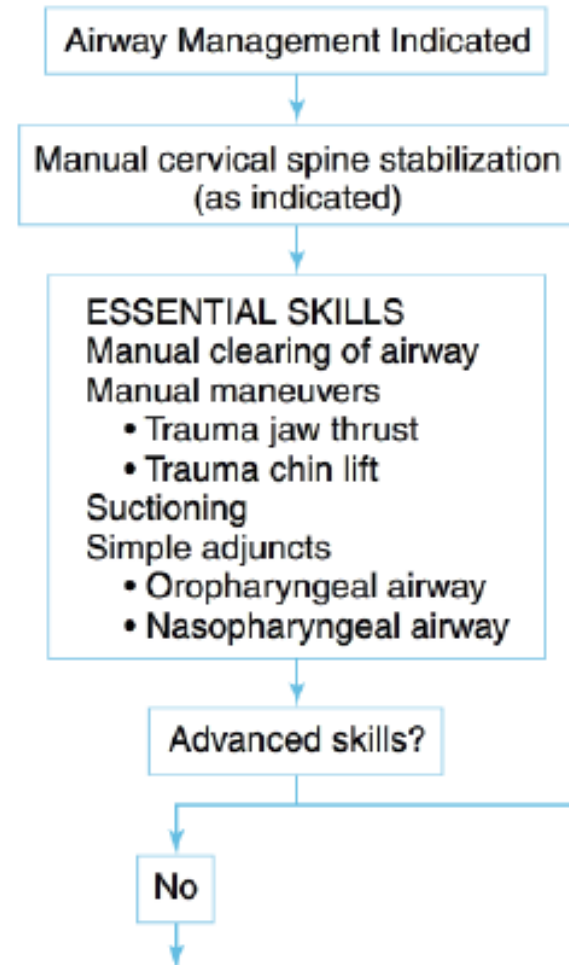
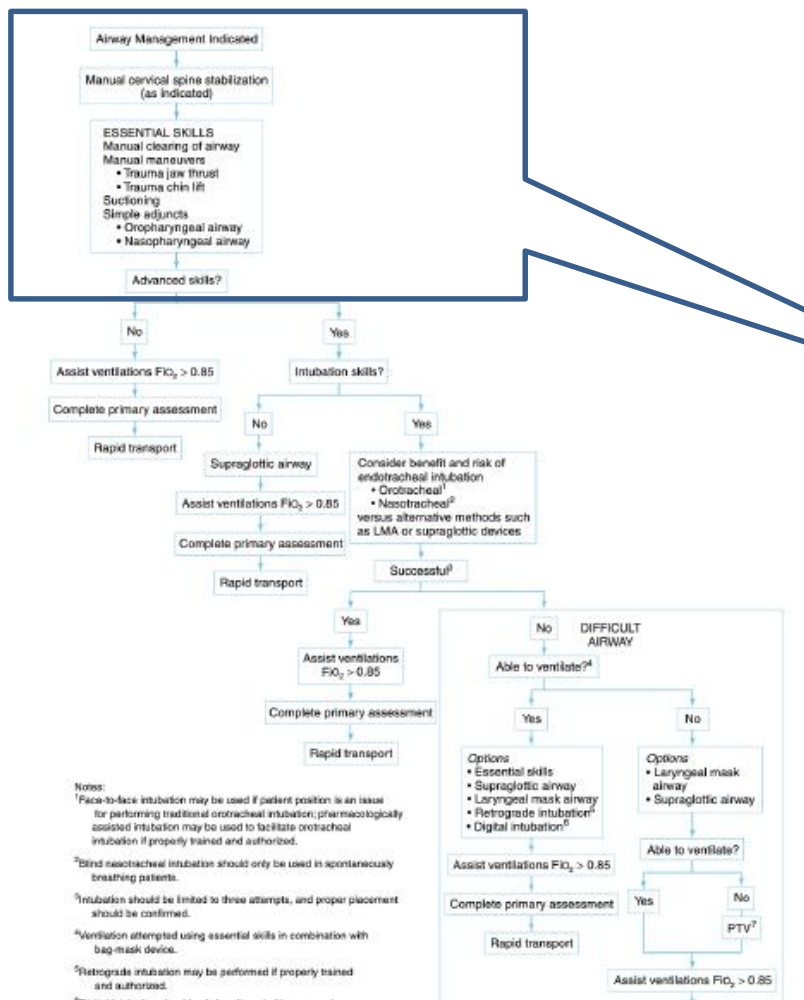
Management

1. Airway control
2. Essential skills



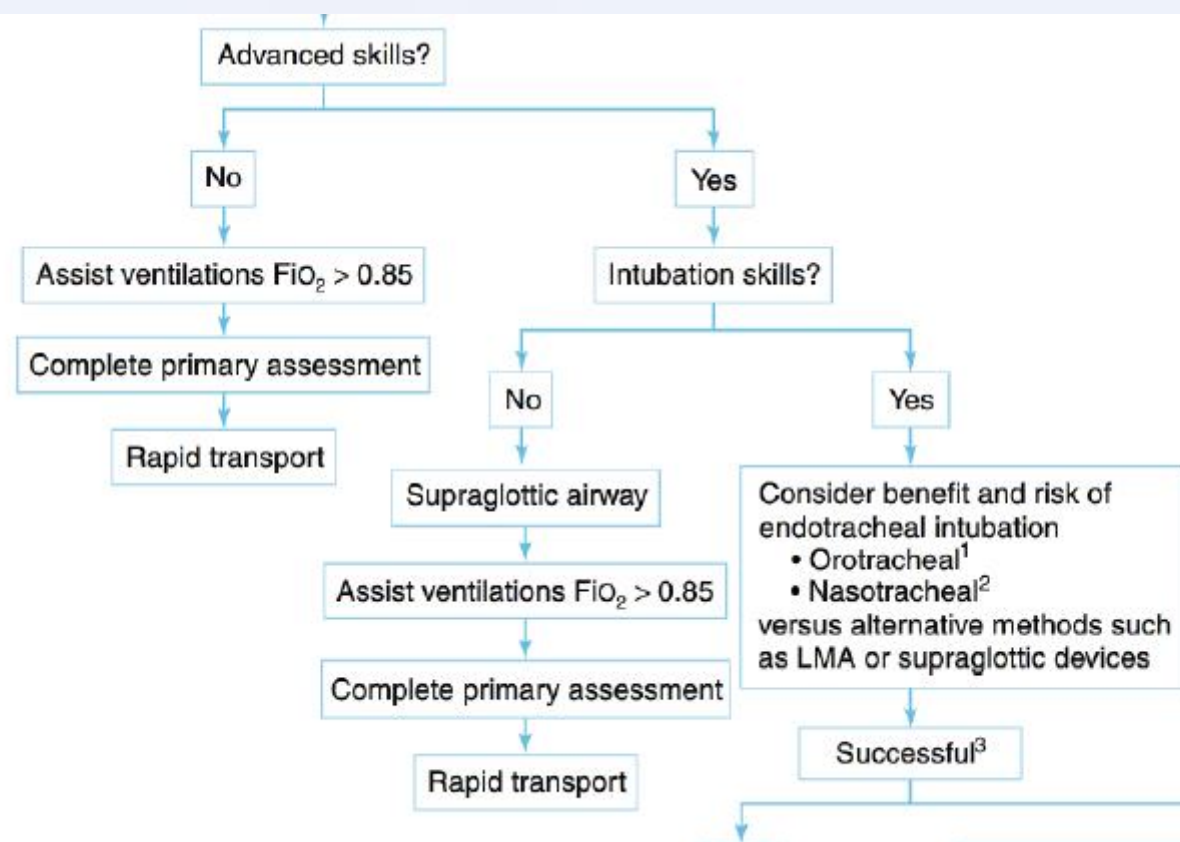
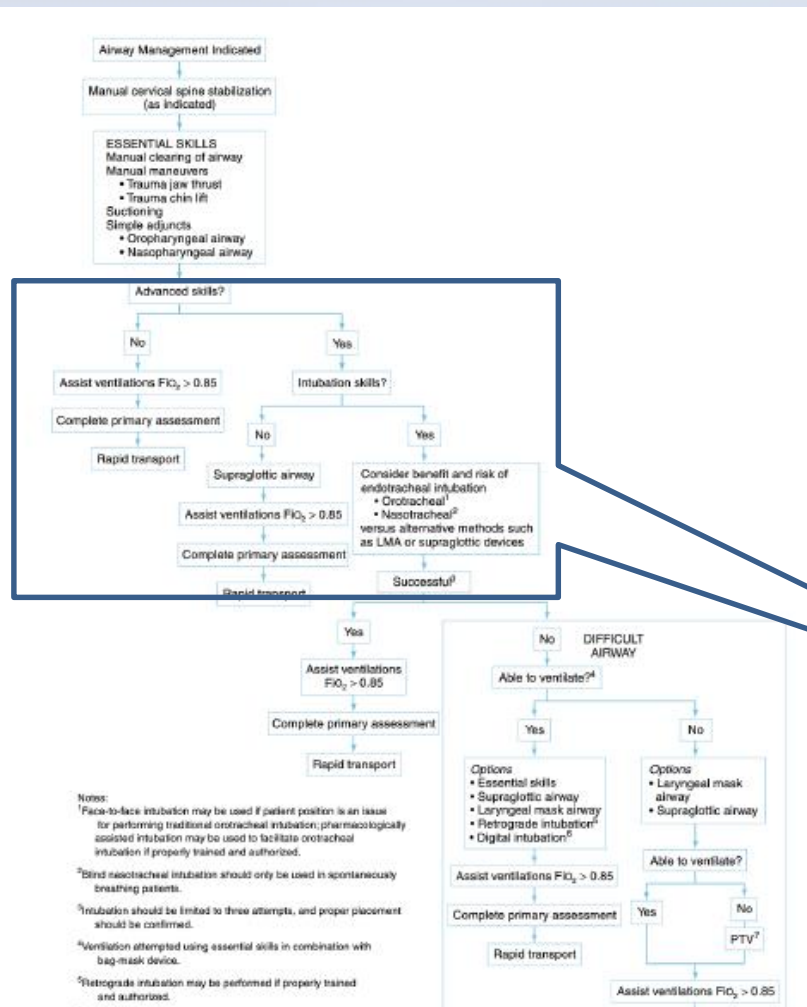


On-scene Trauma care



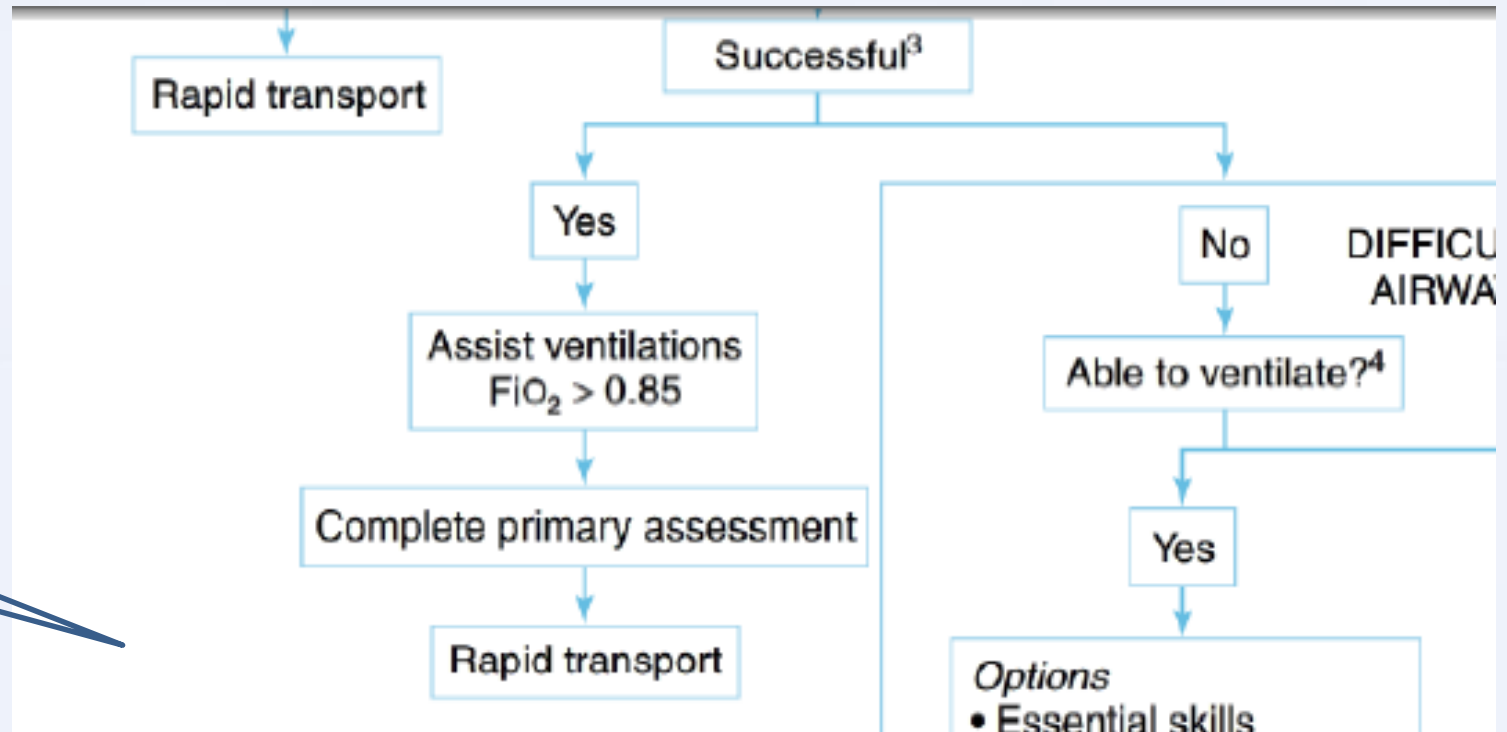
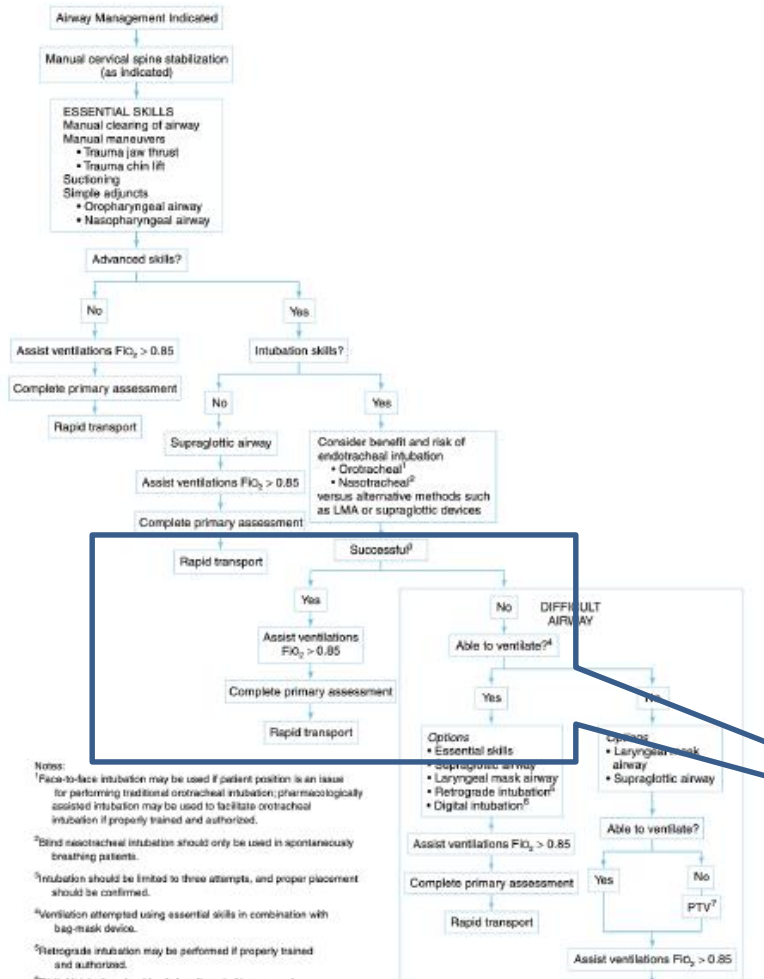


On-scene Trauma care



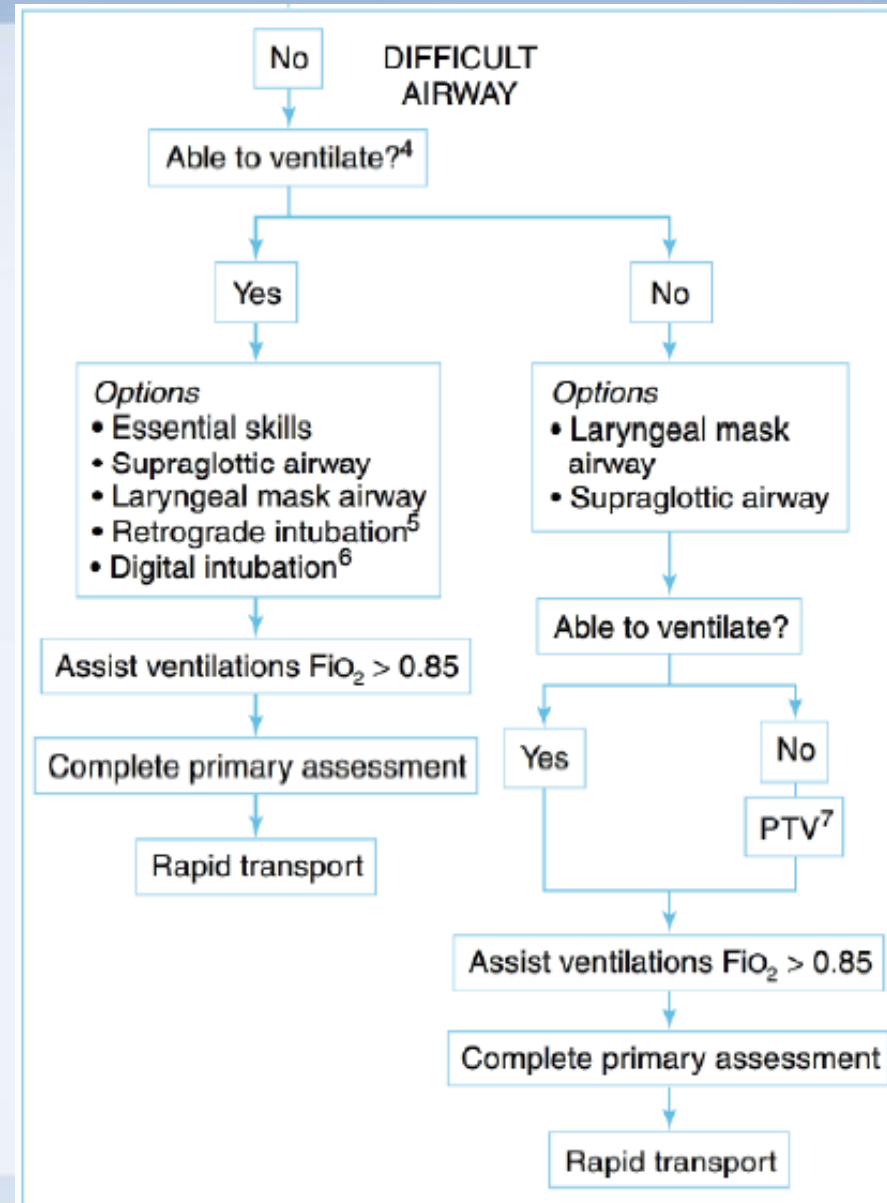
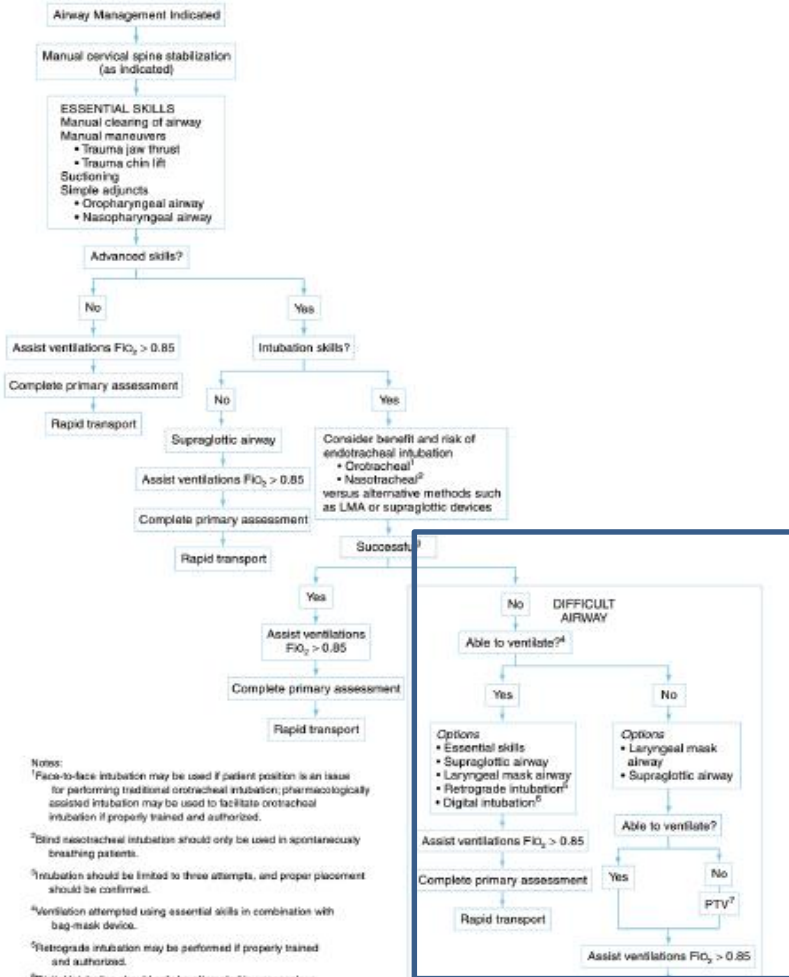


On-scene Trauma care





On-scene Trauma care





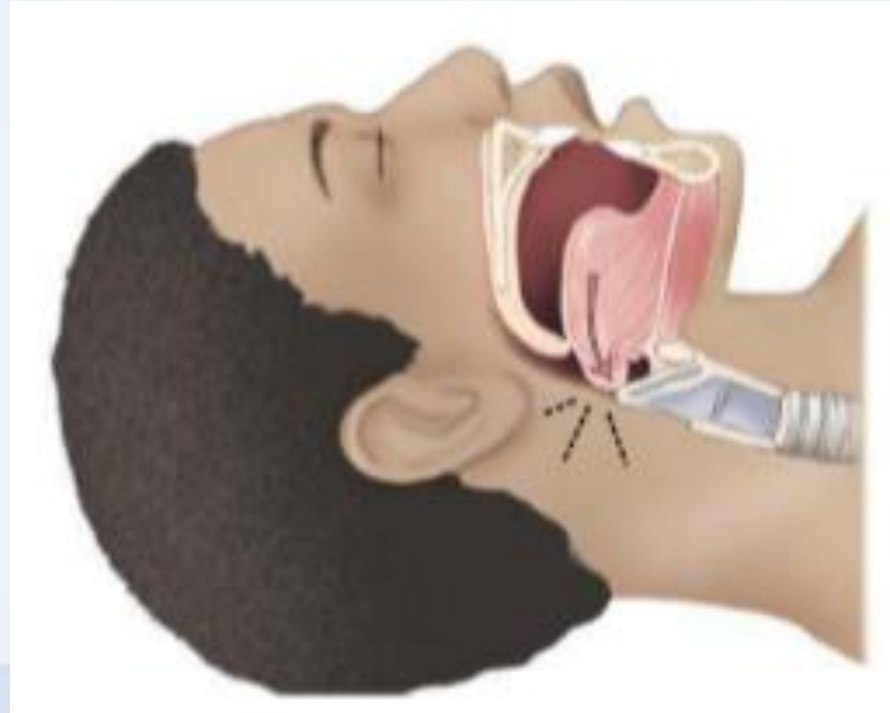
Methods of airway management

- Manual
 - Hands only
- Simple
 - Oropharyngeal airway
 - Nasopharyngeal airway
- Complex
 - ET tube
 - Supraglottic airways
 - Pharmacologically assisted/RSI
 - Percutaneous airway
 - Surgical airway

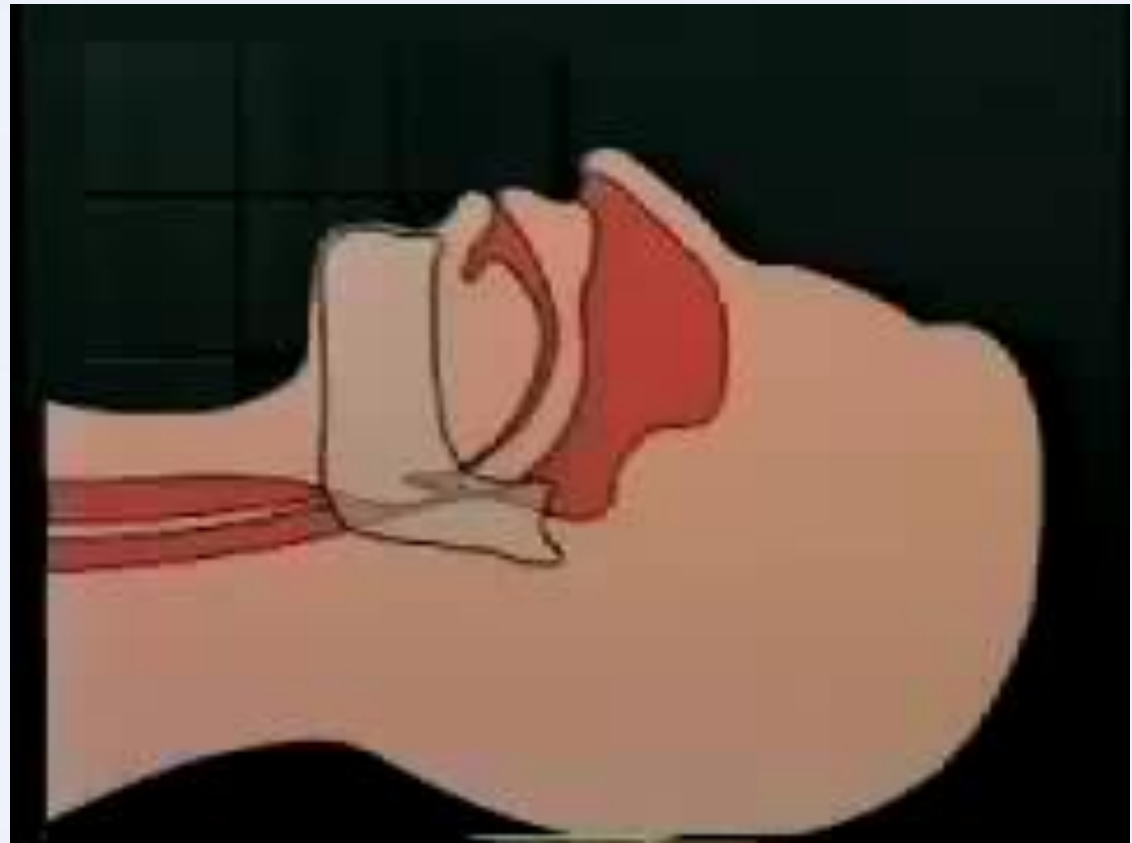


Manual maneuvers

- Tongue is the most common cause of airway obstruction
- Trauma jaw thrust
- Trauma chin lift



Trauma jaw thrust



Trauma chin lift





Simple adjuncts

- Oropharyngeal airway
 - The most frequently used artificial airway

Indications

- Unstable to maintain his/her airway
- Prevent an intubated patient from biting an ET tube

Contraindications

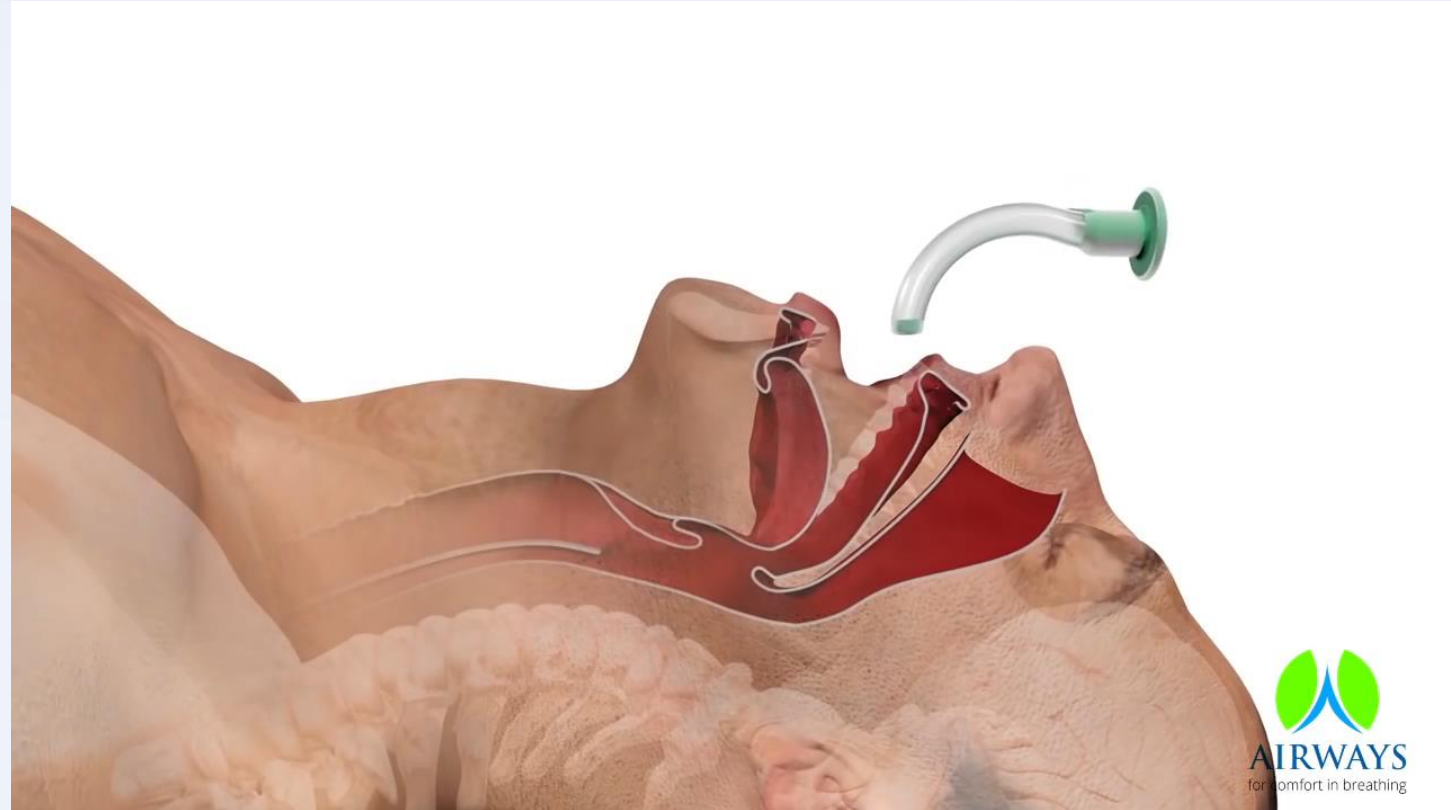
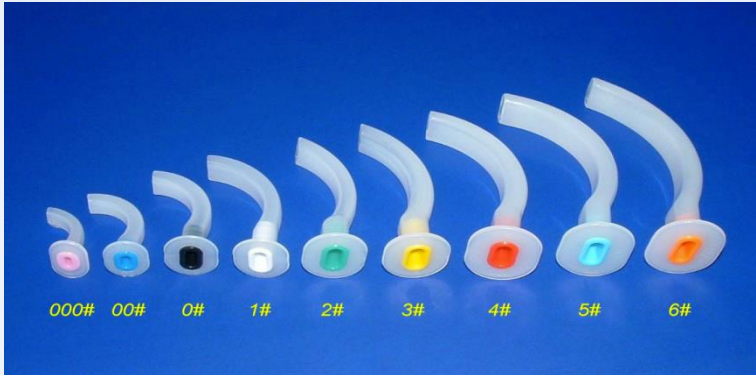
- Patient who is conscious or semiconscious

Complication

- Gagging, vomiting, laryngospasm



Oropharyngeal airway





Simple adjuncts

- Nasopharyngeal airway

Indications

- Unstable to maintain his/her airway

Contraindications

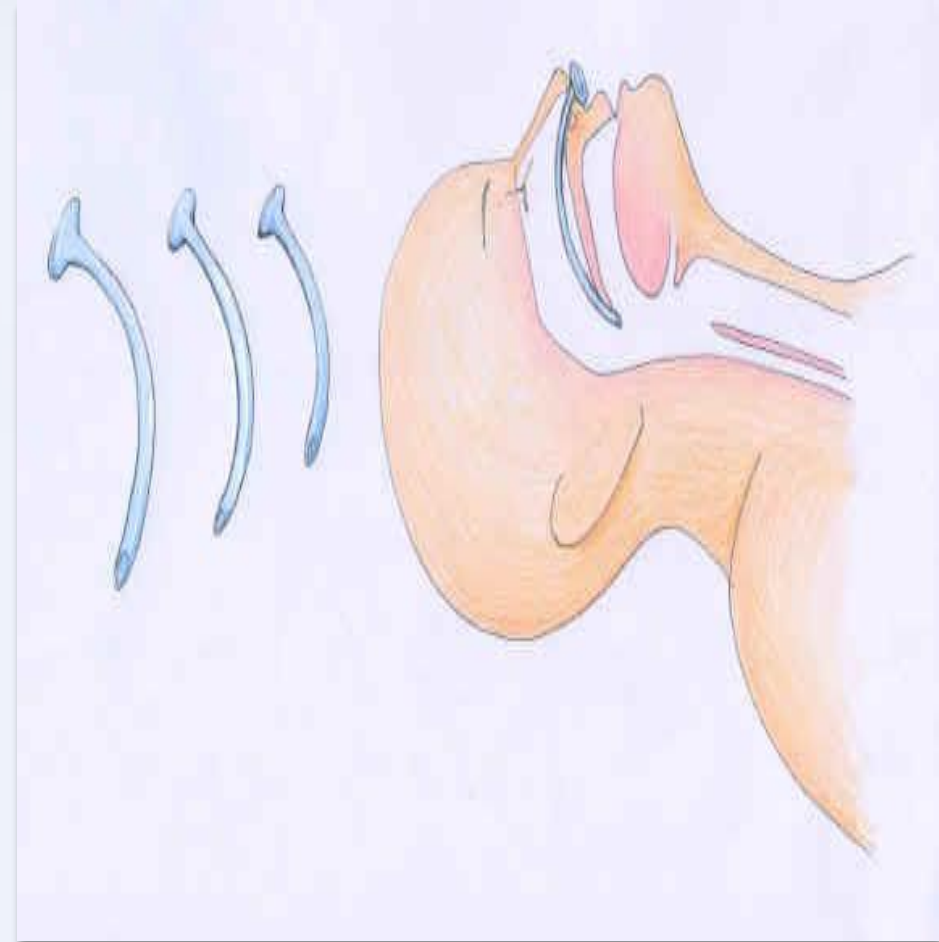
- No need for an airway adjunct
- Facial/basilar skull fracture

Complications

- Bleeding



Nasopharyngeal airway





Complex airways

- Supraglottic airways
 - King LT airway
 - Combitube
 - Laryngeal mask airway
 - Intubating LMA
- Indications
 - Basic providers
 - Advanced providers



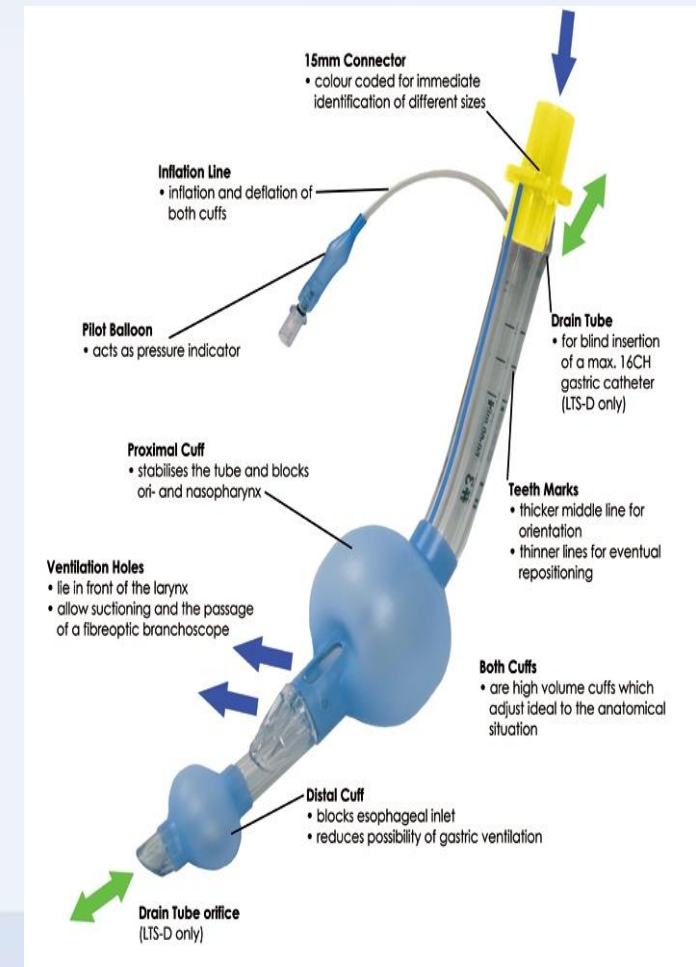
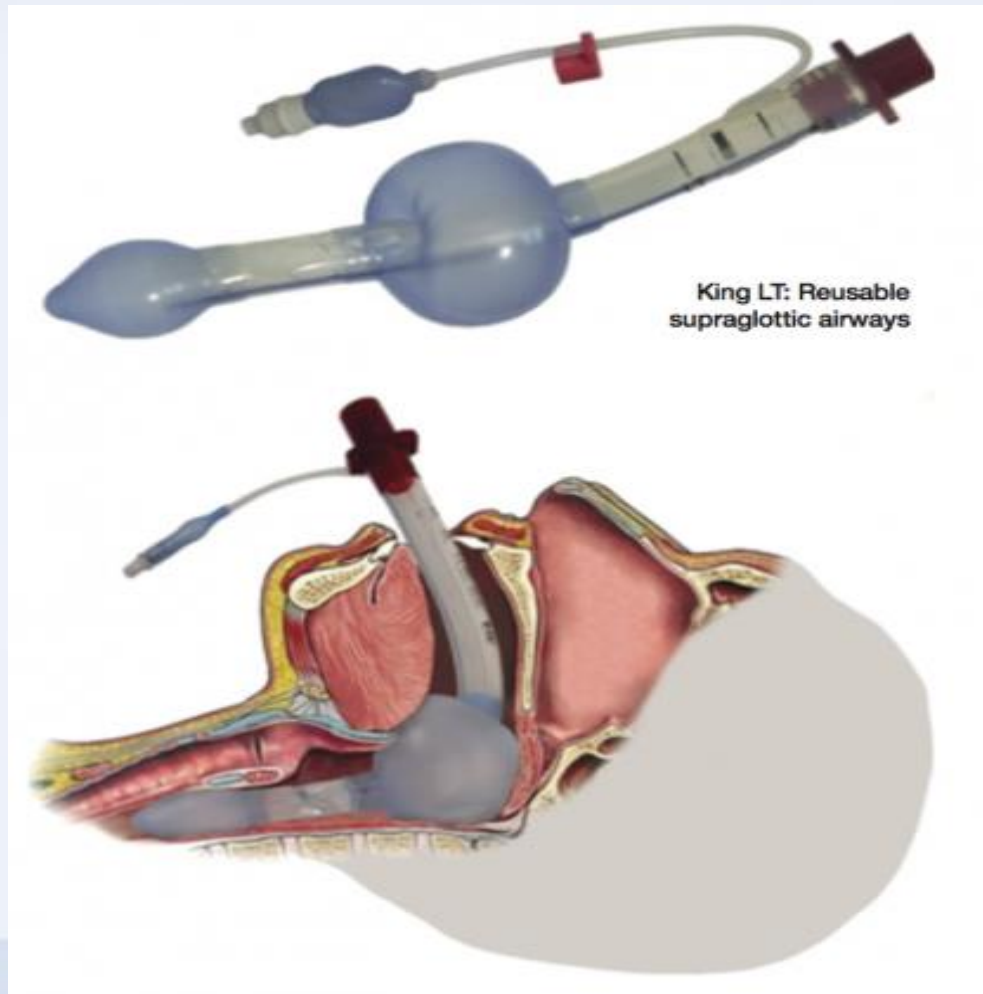


Supraglottic airways

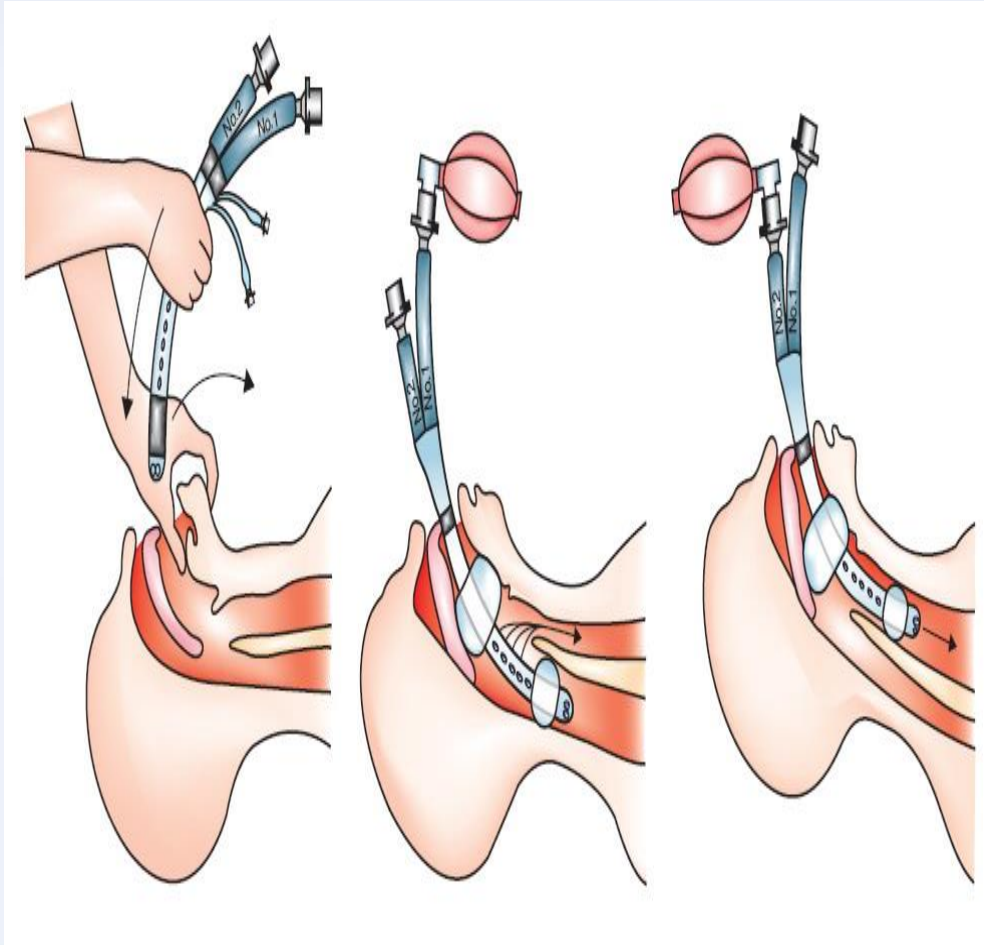
- Contraindications
 - Intact gag reflex
 - Nonfasting
 - Known esophageal disease
 - Recent ingestion of caustic substances
- Complications
 - Gagging and vomiting
 - Aspiration
 - Damage to the esophagus
 - Hypoxia if ventilated using the incorrect lumen



King laryngotracheal airway



Combitube





Laryngeal mask airways

Indications

- May be used as a primary airway device in some EMS systems
- When unable to perform endotracheal intubation and the patient cannot be ventilated using a bag-mask device

Contraindications

- When endotracheal intubation can be performed
- Insufficient training

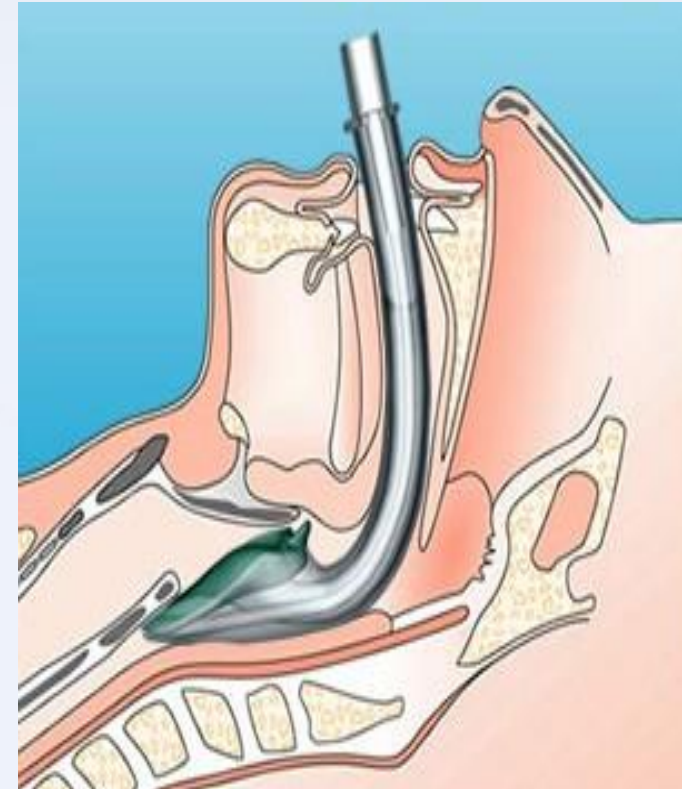


Laryngeal mask airways

Complications

- Aspiration, because LMA does not completely prevent regurgitation and protect the trachea
- Laryngospasm

Laryngeal mask airway (LMA)



On-scene Trauma care





On-scene Trauma care

Factors that contribute to difficult intubation

- Receding chin
- Short neck
- Large tongue
- Small mouth opening
- Cervical immobilization or stiff neck
- Facial trauma
- Bleeding into the airway
- Active vomiting
- Access to the patient
- obesity



LEMON Assessment for difficult intubation

LEMON trial

- **Look**
 - Facial trauma
 - Large incisors
 - Beard
 - Large tongue
- **Evaluate 3-3-2**
 - Interincisor distance (3 fingers)
 - Hyoidmental distance (3 fingers)
 - Thyroid to floor of mouth (2 fingers)
- **Mallampati**
- **Obstruction**
- **Neck movement – chin to chest**
(Airway management in trauma
Indian J Anaesth. 2011 Sep-Oct; 55(5): 46)3–469)



On-scene Trauma care

Evaluate 3-3-2



Mallampati classifications



Sniffing position



POSITIONING INFANTS FOR AIRWAY MANAGEMENT



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The head of an infant is large in relation to the trunk, and tends to naturally flex at the neck. Simply extending the neck can bring an infant into optimal sniffing position. More often than not, a combination of a shoulder roll and head rest is required as shown in the graphic above. Notice, how the nose - chin axis is near horizontal to the ceiling, and the anterior neck space is wide open. Neck overextension must be avoided as it can make laryngeal exposure difficult.



Verification of ET tube placement

- Direct visualization of the ET tube passing through the vocal cords
- Presence of bilateral breath sounds
- visualization of the chest rising and falling during ventilation
- Fogging in the ET tube on expiration
- ETCO₂ monitoring (capnography)
- Colorimetric carbon dioxide detector
- Pulse oximetry



On-scene Trauma care

Alternate Techniques

- Digital intubation
- LMA
- Needle cricothyroidotomy
- Surgical cricothyrotomy



On-scene Trauma care

การวัดขนาดของเฟือกตามคอ



การวัดขนาดของเฟือกตามคอ



การวัดขนาดของ Hard collar

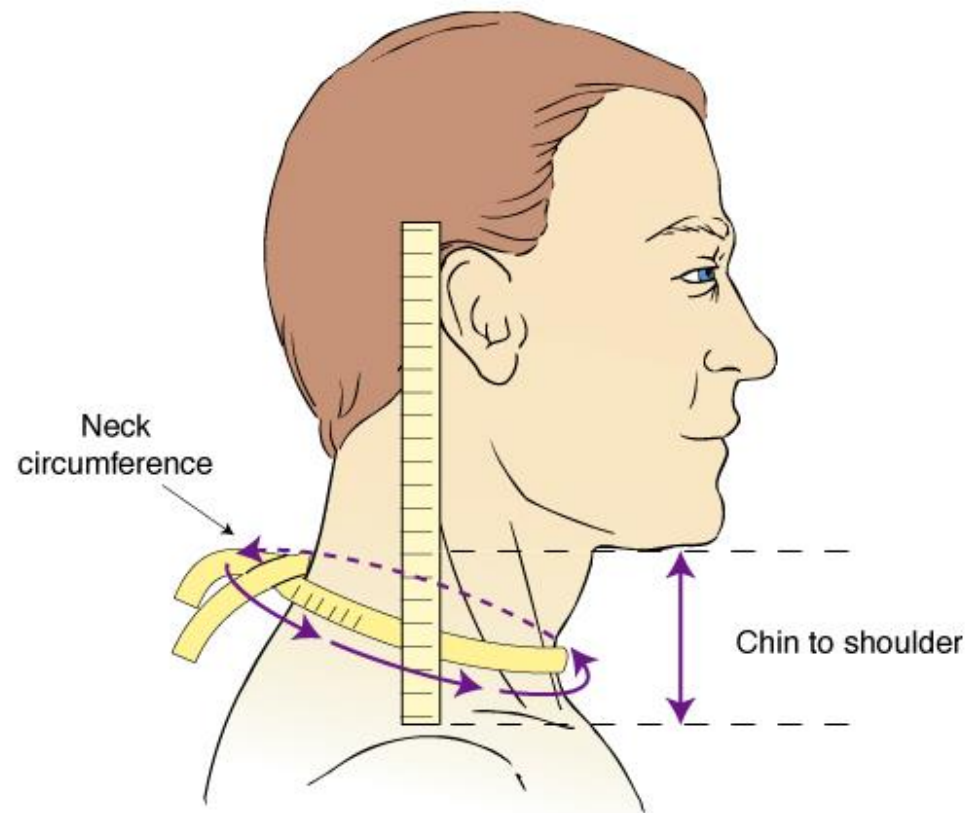


Figure 25-7 Vertical and circumferential measurements for cervical collar size.

Copyright © 2005 Lippincott Williams & Wilkins. Instructor's Resource CD-ROM to Accompany *Timby's Fundamental Nursing Skills and Concepts*, Eighth Edition, by Diana L. Rupert and GERALYN FRANDSEN.

Breathing-oxygenation and ventilation

- ดู
- คลำ
- เคาะ
- ฟัง
- วัด **oxygen pulse saturation**



Ventilatory Rate	Management
Abnormally fast > 30	<ul style="list-style-type: none"> • Assisted Ventilation • $FiO_2 \geq 0.85$
Fast 20–30	<ul style="list-style-type: none"> • Administration of $\geq 85\%$ Oxygen • $FiO_2 \geq 0.85$
Normal 10–20	<ul style="list-style-type: none"> • Observation • Consider Supplemental Oxygen
Slow < 10	<ul style="list-style-type: none"> • Assisted or Total Ventilation with $\geq 85\%$ Oxygen • $FiO_2 \geq 0.85$
Apneic	<ul style="list-style-type: none"> • Total Ventilation with $\geq 85\%$ Oxygen • $FiO_2 \geq 0.85$

Oxygenation keep pulse saturation $\geq 95\%$

- What is $FiO_2 \geq 0.85$ = Oxygen mask with reservoir bag > 11-15 LPM



Figure 8-34 Oxygen Tank Size and Duration

Flow Rate (L/min)	Tank Size and Duration (in Hours)				
	D	E	M	G	H/K
2	2.5	4.4	24.7	38.2	49.7
5	1	1.8	9.9	15.3	19.9
10	0.5	0.9	4.9	7.6	9.9
15	0.3	0.6	3.3	5.1	6.6

Note: This table shows the approximate duration in hours of various sizes of oxygen tanks and flow rates. The numbers are based on the assumption that the oxygen tank is completely full at 2,100 pounds per square inch.

Ventilatory Devices

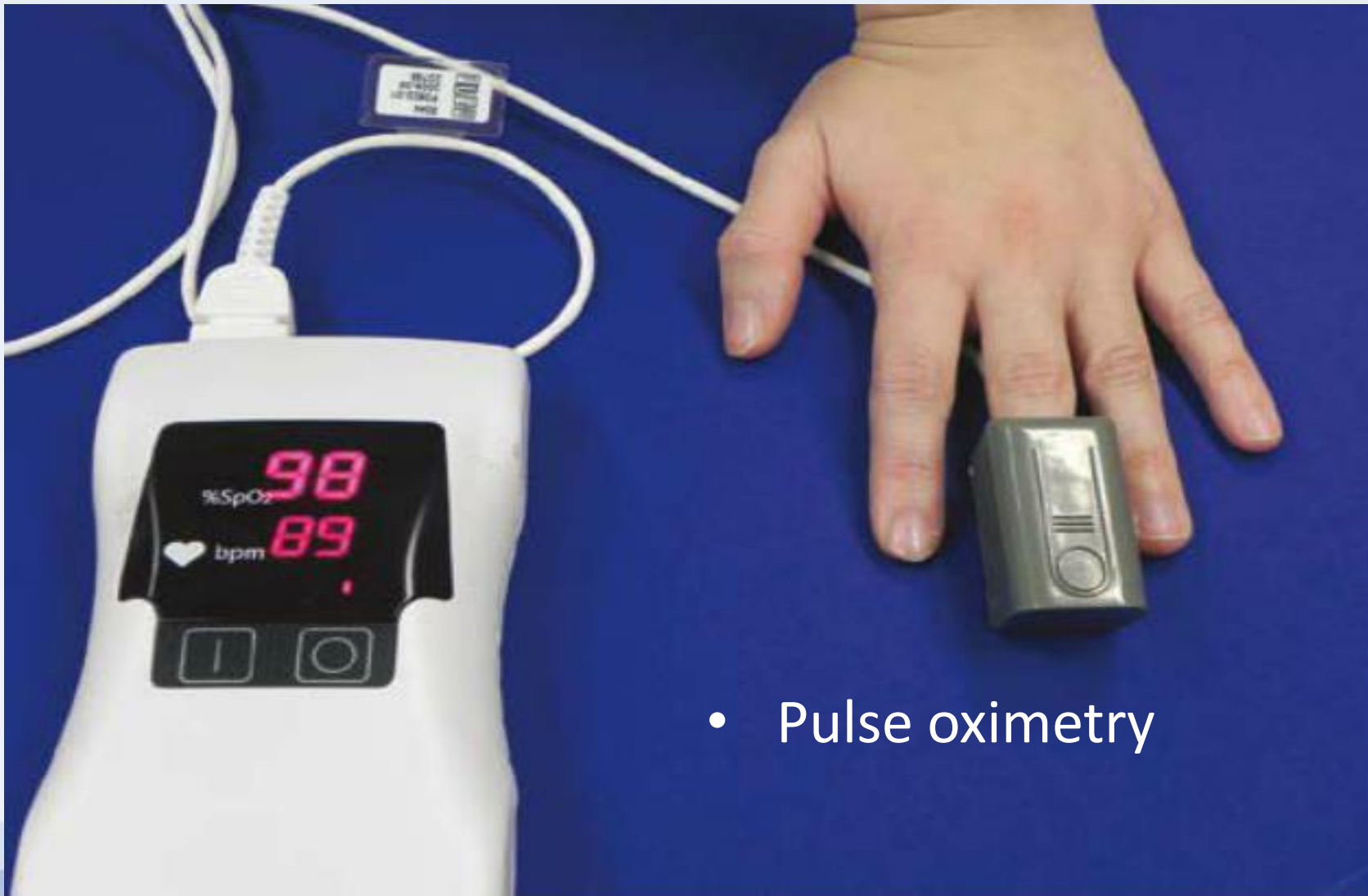
Figure 8-31 Ventilatory Devices and Oxygen Concentration

Device	Liter Flow (L/min)	Oxygen Concentration*
WITHOUT SUPPLEMENTAL OXYGEN		
Mouth-to-mouth	N/A	16%
Mouth-to-mask	N/A	16%
Bag-mask	N/A	21%
WITH SUPPLEMENTAL OXYGEN		
Nasal cannula	1–6	24–45%
Mouth-to-mask	10	50%
Simple face mask	8–10	40–60%
Bag-mask without reservoir	8–10	40–60%
Bag-mask with reservoir	10–15	90–100%
Nonrebreathing mask with reservoir	10–15	90–100%
Demand valve	N/A	90–100%
Ventilator	N/A	21–100%

*Percentages indicated are approximate.

N/A, Not applicable.

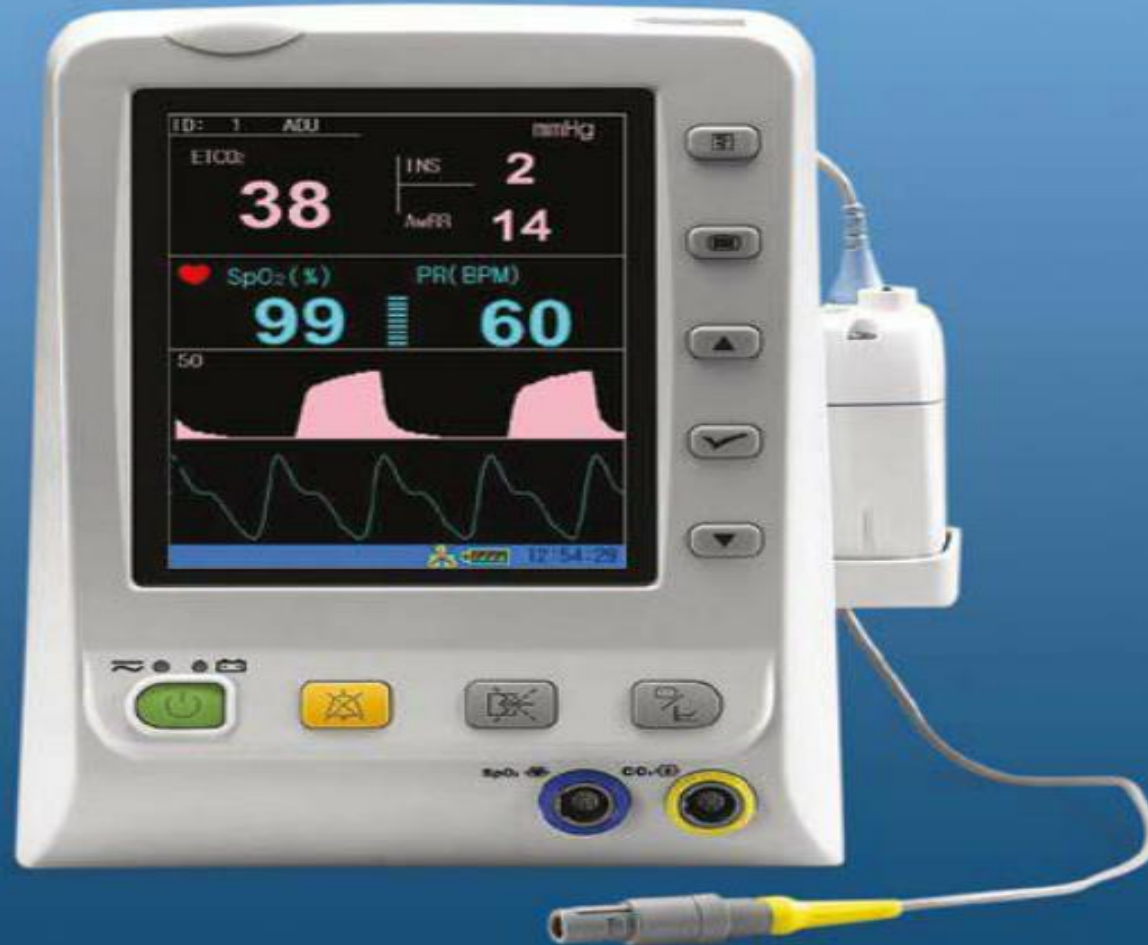
Evaluation



- Pulse oximetry

On-scene Trauma care

Capnography





On-scene Trauma care

Summary (1)

- The trauma patient is susceptible to various injuries that may impair ventilation and gas exchange.
- Trauma to the chest, airway obstruction, central nervous system injury, and hemorrhage can all result in inadequate tissue perfusion.
- To properly care for the trauma patient, the provider must understand and be able to do the following:
 1. Integrate the principles of ventilation and gas exchange with the pathophysiology of trauma to identify patients with inadequate perfusion





Summary (2)

2. Relate the concepts of minute volume and oxygenation to the pathophysiology of trauma
3. Explain the mechanisms by which supplemental oxygen and ventilatory support are beneficial to the trauma patient
4. Given situations that involve various trauma patients, formulate a plan for airway management and ventilation
5. Given current research, understand the risks versus benefits when discussing new, invasive procedures
6. Determine by examination of the patient the relative difficulty of endotracheal intubation
7. Given a scenario, develop a plan for airway management for a given patient in a given location





Summary (3)

- Managing the airway is not without risks. When applying certain skills and modalities, the risk has to be weighed against the potential benefit for that particular patient. What may be the best choice for one patient in a certain situation may not be for another with a similar presentation.
- Sound critical-thinking skills need to be in place to make the best judgments for the trauma patient.





Thank you

