AIRWAY MANAGEMENT

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Slide 1

Hi everyone, My name is Dr. Kristina Buszta and I am a certified registered nurse anesthetist. This lecture will cover the basic information for airway management you will see when caring for patients.

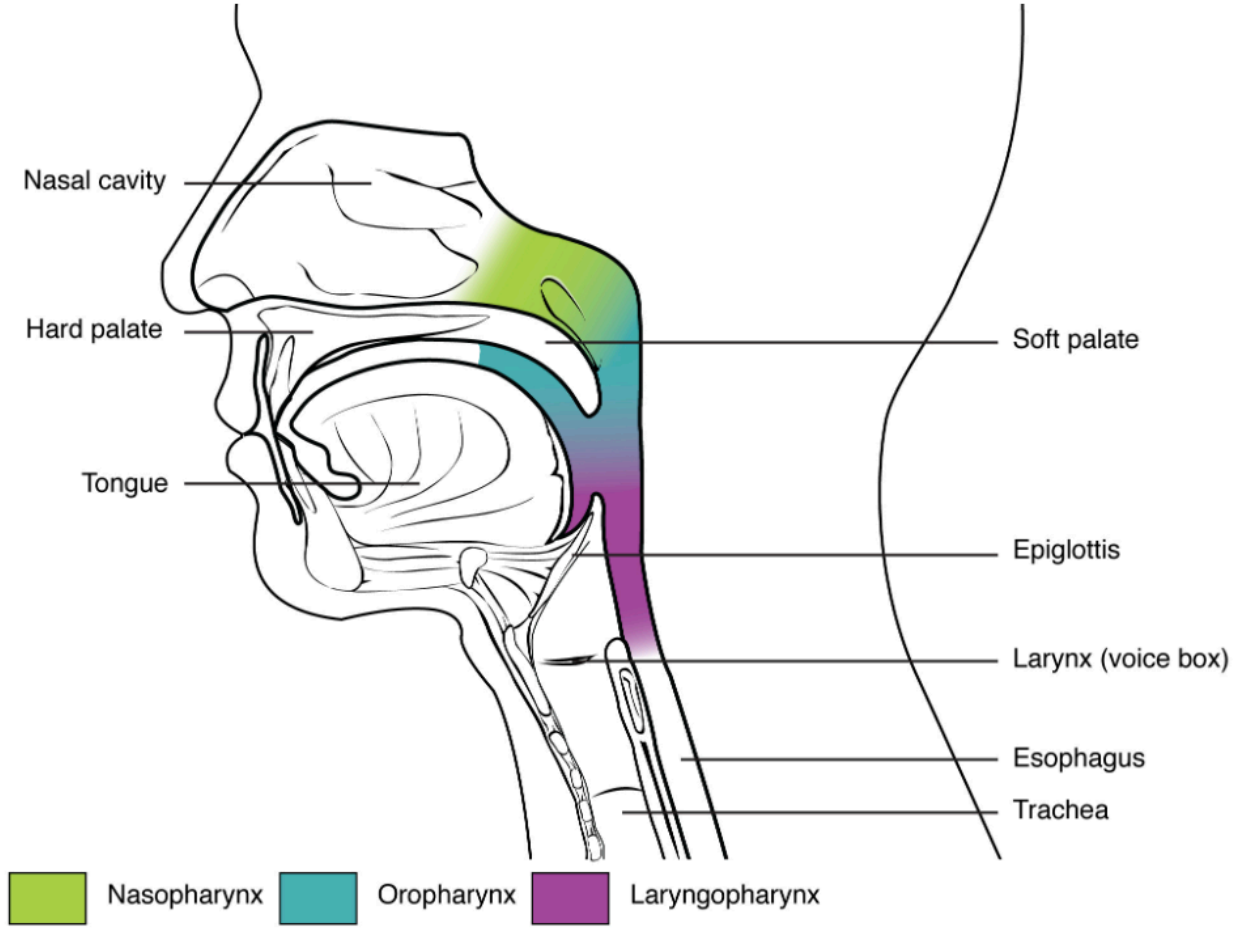
OVERVIEW

- Anatomy
- What is it
- Why
- How
- Various devices

Slide 2

I will cover airway anatomy, what airway management consists of, how to support oxygenation and ventilation and the various devices used.

ANATOMY

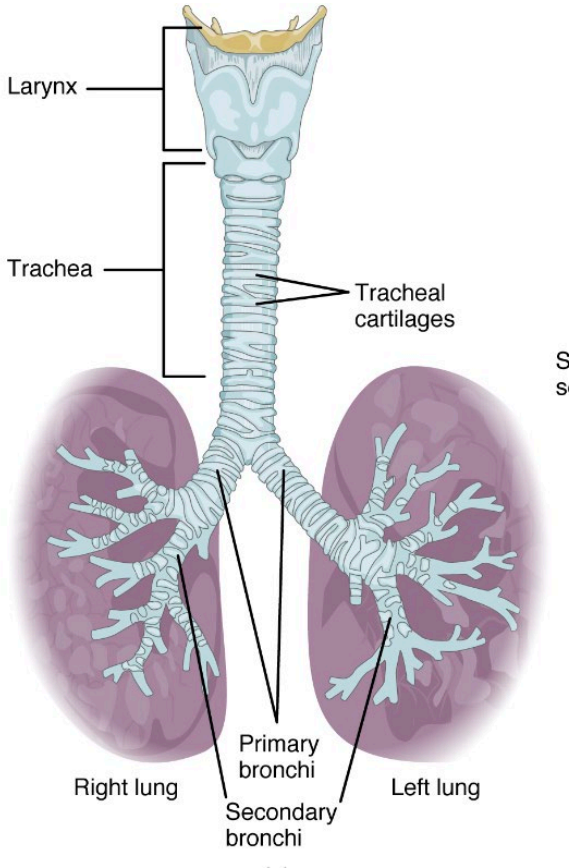

Nasal cavity
Hard palate
Tongue
Soft palate
Epiglottis
Larynx (voice box)
Esophagus
Trachea
Nasopharynx
Oropharynx
Laryngopharynx

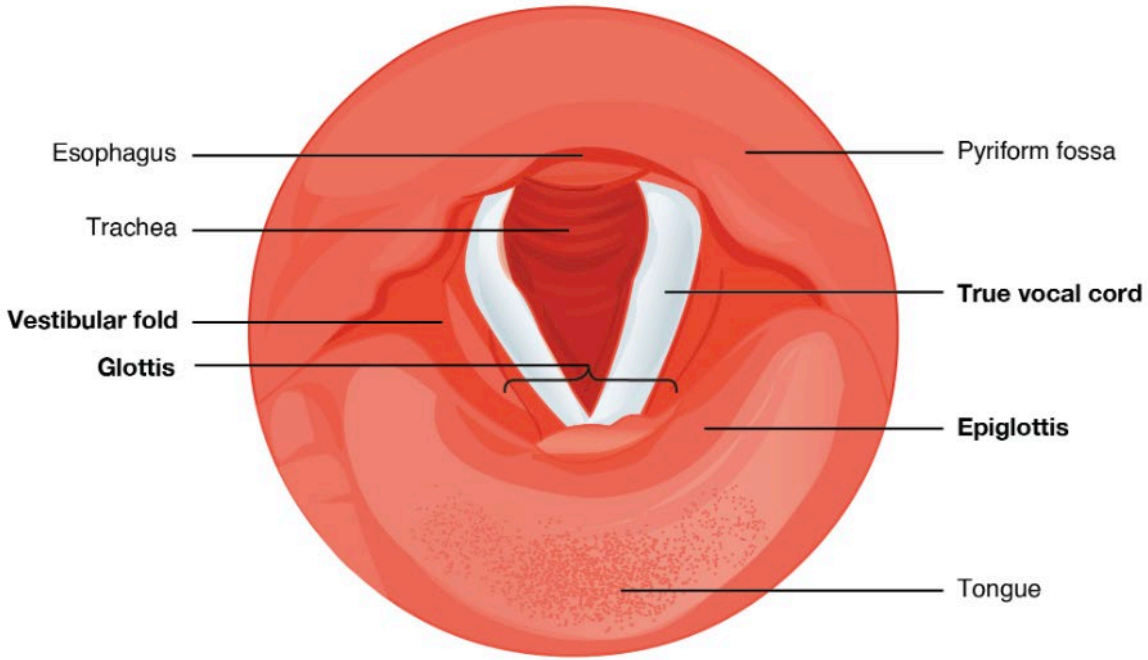
Slide 3

What I'd like to highlight in this photo is the various areas, the nasopharynx in green, the oropharynx in teal and the laryngopharynx in purple.
You can see the nasopharynx is the area behind the nasal cavity, the oropharynx is the area behind the tongue and mouth, and the laryngophyrnx is the portion of the airway behind the larynx, epiglottis and esophagus.

https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_2e_%28OpenStax%29/05%3A_Energy_Maintenance_and_Environmental_Exchange/22%3A_The_Respiratory_System/22.02%3A_Organs_and_Structures_of_the_Respiratory_System

ANATOMY


Larynx
Trachea
Tracheal cartilages
Primary bronchi
Right lung
Left lung
Secondary bronchi


Esophagus
Trachea
Vestibular fold
Glottis
Pyriform fossa
True vocal cord
Epiglottis
Tongue

Slide 4

In this photo what I'd like to highlight is the the Larynx and Trachea on the left. You will notice the trachea has rings called tracheal cartilages, these are important for invasive method of ventilation.
On the photo on the right I want to highlight the glottic opening also known as vocal cords. The vocal cords are at the level of the larynx and is anterior to the vertebral column at levels C 3 – C 7.
These photos will be referenced throughout the lecture.

AIRWAY MANAGEMENT: WHAT IS IT?

- A way to support ventilation and oxygenation in trauma, allergic reactions, head injuries, for surgery, or lung pathophysiology, or various pathologies such as acute respiratory distress syndrome (ARDS) – make a new lecture for some respiratory diseases
- Can be invasive or non-invasive
  - Non-invasive examples
    - Nasal cannula
    - Mask: non-rebreather
    - BiPap/CPAP
  - Invasive examples: supported by ambu-bag or ventilator
    - Laryngeal mask airway (LMA)
    - Endotracheal tube
    - tracheotomy

Slide 5

Airway management covers varying ways to support oxygenation and ventilation whether it be from decreased respiratory effort or ability or anatomical inability. Some examples when a patient would need airway management would be in trauma, overdoses with narcotics which results in high CO2 in the blood and a decreased respiratory drive, head injuries, allergic reactions, a way to support mechanical ventilation for surgery as well as in lung disease.
Airway support can be non-invasive like a nasal cannula, mask or BiPap or Cpap
Or invasive like ambu-bag ventilation or a ventilator via an LMA, and endotracheal tube, or tracheotomy.

HOW MUCH OXYGEN IS IN THAT FLOW?

% = (Liters per minute X 4) + 20

Example: 4 liters of oxygen per minute would be 36% oxygen delivery

Wall mounted oxygen regulator valve
https://commons.wikimedia.org/wiki/File:Wall-mounted_oxygen_regulator_valve.JPG
CC by SA

NON -INVASIVE

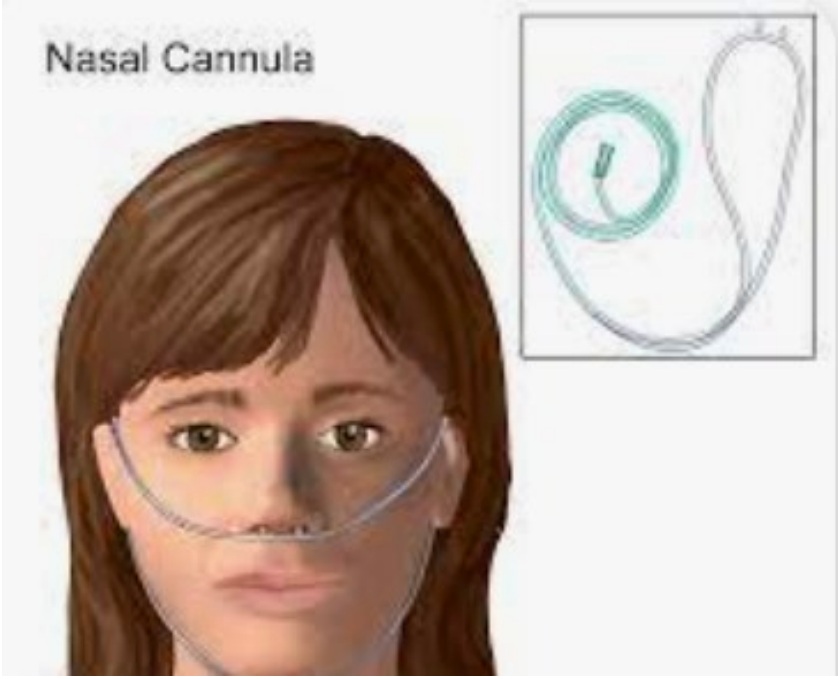
- Nasal Cannula
- Simple mask
- Non Rebreather Mask
- Bipap
- CPAP

Slide 7

Recall that room air provides 21% oxygen, 78% nitrogen and 1% mixed gases.
Each of these mechanisms of supporting oxygen and ventilation therefore, provide greater than 21% oxygen.

NON -INVASIVE

- Nasal cannula – 0.5 – 6 Liters of oxygen per minute = 22% - 44%



Slide 8

The delivery of oxygen using a nasal cannula can deliver 0.5 – 6 liters of oxygen per minute which will deliver 22% - 44% oxygen, the patient must be spontaneously ventilating, as this does not support ventilation only oxygen.
Side note: leaving a patient on 6 liters of oxygen is very drying to the nares, you can add humidified oxygen.

nasal cannula - https://commons.wikimedia.org/wiki/File:Nasal_Cannula_%28Child%29.png

NON – INVASIVE

- Simple mask can use flows 6 – 10 LPM to prevent rebreathing of patients exhaled CO_2
- Provides 44% - 60% oxygen

Slide 9

To increase oxygen delivery more than the nasal cannula can provide is the simple mask. You can see it is a mask with a malleable nose piece and two side vents that allow exhalation of carbon dioxide. Oxygen flow rates need to be greater than 6 in order to prevent rebreathing of the patients carbon dioxide. This mask can deliver 44 – 60% oxygen.

https://commons.wikimedia.org/wiki/File:Simple_face_mask.jpg

NON -INVASIVE

- Non – rebreather mask
- Delivers 60 - 91% oxygen
- Oxygen flow rates 10 – 15 L/minute

Slide 10

If a patient requires additional oxygen, a non-rebreather mask can be used. Non-rebreather means the patient is not rebreathing their CO2 due to the presence of a one way valve. Shown in the picture as the white circle on the left. The mask consists of a mask with moldable nasal aspect, straps, reservoir bag and one way valve on the side. The reservoir bag is for oxygen. The nice thing about the non-rebreather and the simple mask is the patient can breathe through heir mouth or nose. This is helpful in surgical cases of the nose or when the patient needs more oxygen than the nasal cannula can provide. The non-rebreather supplies 60 – 91%of oxygen. The patient must be spontaneously ventilating, as this does not support ventilation only oxygen.

Non rebreather - https://commons.wikimedia.org/wiki/File:NRBer.JPG

NON -INVASIVE

- BiPap
- CPAP

Slide 11

Bipap stands for bi level positive airway pressure meaning it has two pressure settings, one for inhalation and one for exhalation. This is typically used to support increased oxygen requirements in order to prevent endotracheal intubation. Can set the oxygenation, up to 100%

CPAP stands for Continuous positive airway pressure which provides a constant pressure during inhalation. The pressure during inhalation keeps soft tissues open in order to support inspiration in patients with sleep apnea. It is triggered by the patients spontaneous inhalational.
The similarity in these two mechanisms is they support ventilation with the option to support oxygenation. They both use a mask so a patient can breathe through their nose or mouth, in the photo example of the CPAP machine it is specific to the nose but the mask does come in a full face and mouth/nose option.
CPAP uses room air to generate pressure, additional oxygen can be added in various flow rates. The difference in the two is the pressure setting in BiPAP to support exhalation of carbon dioxide.

A fun fact is high levels of carbon dioxide cause drowsiness in patients which turns to a viscous negative cycle, high CO2, person is more drowsy, breathes less effectively and CO2 continuous to rise.

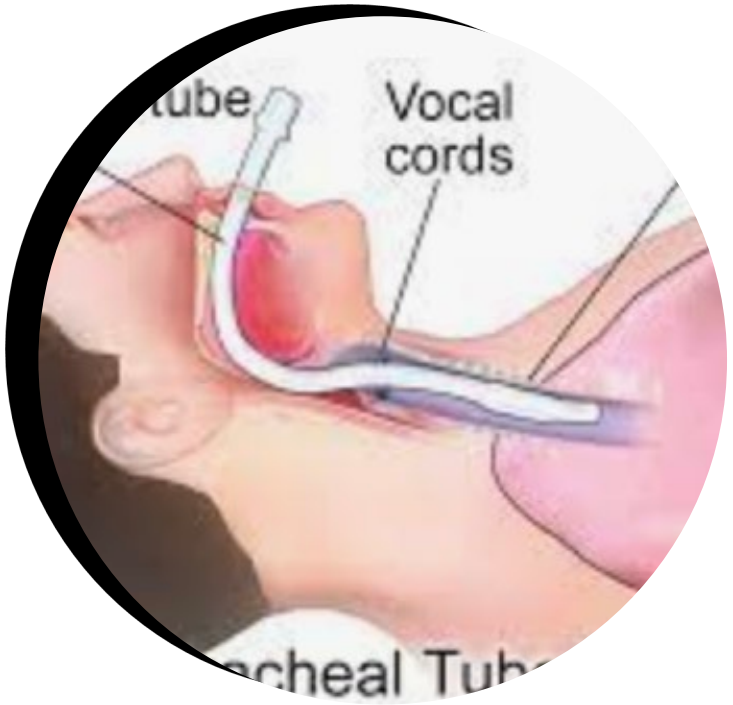
Bipap - https://commons.wikimedia.org/wiki/File:BIPAP.JPG
Cpap -
https://upload.wikimedia.org/wikipedia/commons/d/dc/Depiction_of_a_Sleep_Apnea_patient_using_a_CPAP_machine.png

INVASIVE

LARYNGEAL MASK AIRWAY

Slide 12

The invasive methods of supporting oxygen and ventilation include a laryngeal mask airway. Endotracheal tube and tracheotomy



INVASIVE

ENDOTRACHEAL TUBE

Slide 13

A laryngeal mask airway is typically seen during surgery or in the rare event a patient is difficult to intubate as a way to bridge to intubation by a different means. The LMA sits in the both the laryngopharynx and oropharynx, with the tip occluding the esophagus yet the ventilation is supported by what is called an aperture that is facing the trachea. This is not an ideal airway since it does not protect the airway from stomach contents.

LMA - https://gas.careteamapp.com/LMA

INVASIVE

- LMA – laryngeal mask airway
- Endotracheal tube
- Tracheotomy

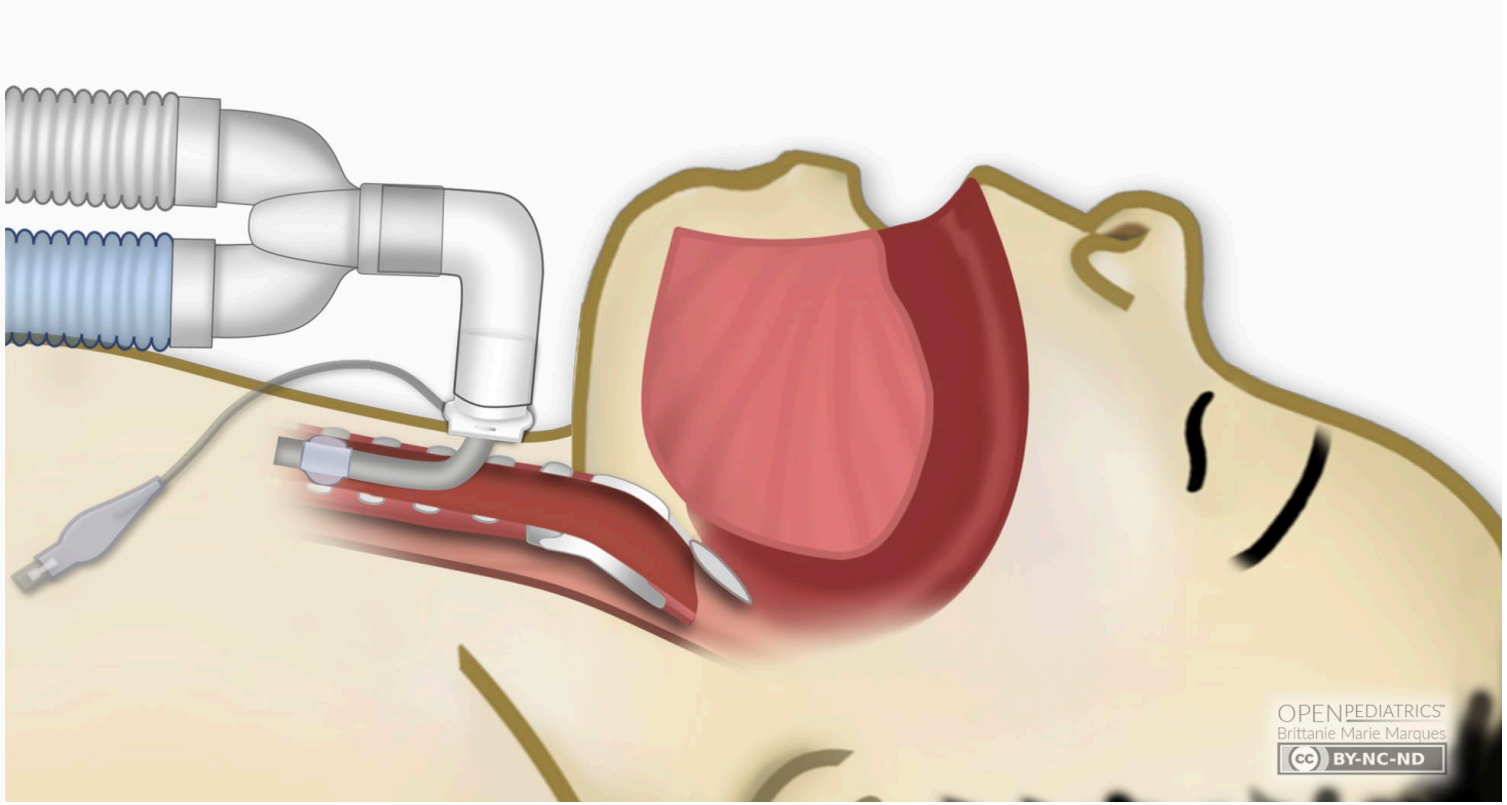
Slide 14

The endotracheal tube or ET tube as it is commonly called goes between the vocal cords, with the tip sitting above the carina, the bifurcation of the trachea to the right and left lung. There is an inflatable balloon to protect the airway in the event any stomach contents come up the esophagus.
Fun fact, an endotracheal tube sitting ON the carina is very stimulating, and if an endotracheal tube goes past the carina it typically goes into the right lung as the right lung bronchus is at a less acute angle than the left. Therefore if an endotracheal tube is placed too deep, past the carina, it will only ventilate the right lung, that is why it is vital to auscultate both lungs after placing a breathing tube.
One side effect of a prolonged intubation with a breathing tube is ventilator acquired pneumonia.
Endotracheal tubes are placed using laryngoscopy technique with a miller blade or macintosh blade or in the case of difficult airway a video scope or fiberoptic scope. There are many schools of thought on which blade is better but it does come down to personal preference of the person placing the endotracheal tube.

ETT https://commons.wikimedia.org/wiki/File:Endotracheal_Tube.png
MAC blade: https://commons.wikimedia.org/wiki/File:Laryngoscope.jpg
Miller blade: https://commons.wikimedia.org/wiki/File:LaryngoskopMiller.jpg

INVASIVE

- Tracheotomy



Slide 15

A tracheotomy is done by a surgical incision between the second and third tracheal ring. This is done for a variety of reasons, the need for long term mechanical ventilation using a ventilator, high-level paralysis, meaning damage of the spinal column high up that will affect breathing. The saying goes C3, 4, 5 keeps the diaphragm alive so damage to any of those, basically above the level of C 6 will cause respiratory failure. Other reasons include respiratory failure, meaning for some medical reason the person is unable to support their own ventilation and has been intubated orally for some length of time as well as in head and neck cancers.

Trachetomoy -
https://www.openpediatrics.org/clinicalimagelibrary/medicaltechnologies/ventilation-through-tracheostomy-tube

VENTILATION SUPPORT

Servo I ventilator
https://commons.wikimedia.org/wiki/File:Servo_I_Ventilator.jpg
CC by SA

Ambu-bag valve mask
https://commons.wikimedia.org/wiki/File:Ambu_Bag_valve_mask.jpg
CC by SA

Slide 16

Ventilation for the invasive methods of airway management can include a ventilator that is seen on the left. A ventilator allows for various settings in volume of each breath, or pressure that the ventilator delivers, how much oxygen to provide, pressure to keep the little alveoli open and even the time of an inhalation and exhalation.

On the right is an ambu-bag that consists of a mask, used for non0invasive ventilation support or you can pop the mask off and attach it to one of the invasive airway devices. It is hooked up to oxygen and the large chamber filled with oxygen is squeezed to assist ventilations.