مادة أسس التخدير 1 الكورس الاول

SAWA UNIVERSITY

جامعة ساوة الاهلية
كلية التقنيات الصحية والطبية
قسم التخدير - اللجنة العلمية

Intraoperative patient monitoring) part 2)

جامعـــــــة ســـــــــاوة الاهلية	Sawa University
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قسم تقنيـــات التخديـــــــر	Department of Anesthesia
. المرحلـــــــــــــة .الثانية	.Second .. Stage

نظـــــــري ... محاضرة رقم 12

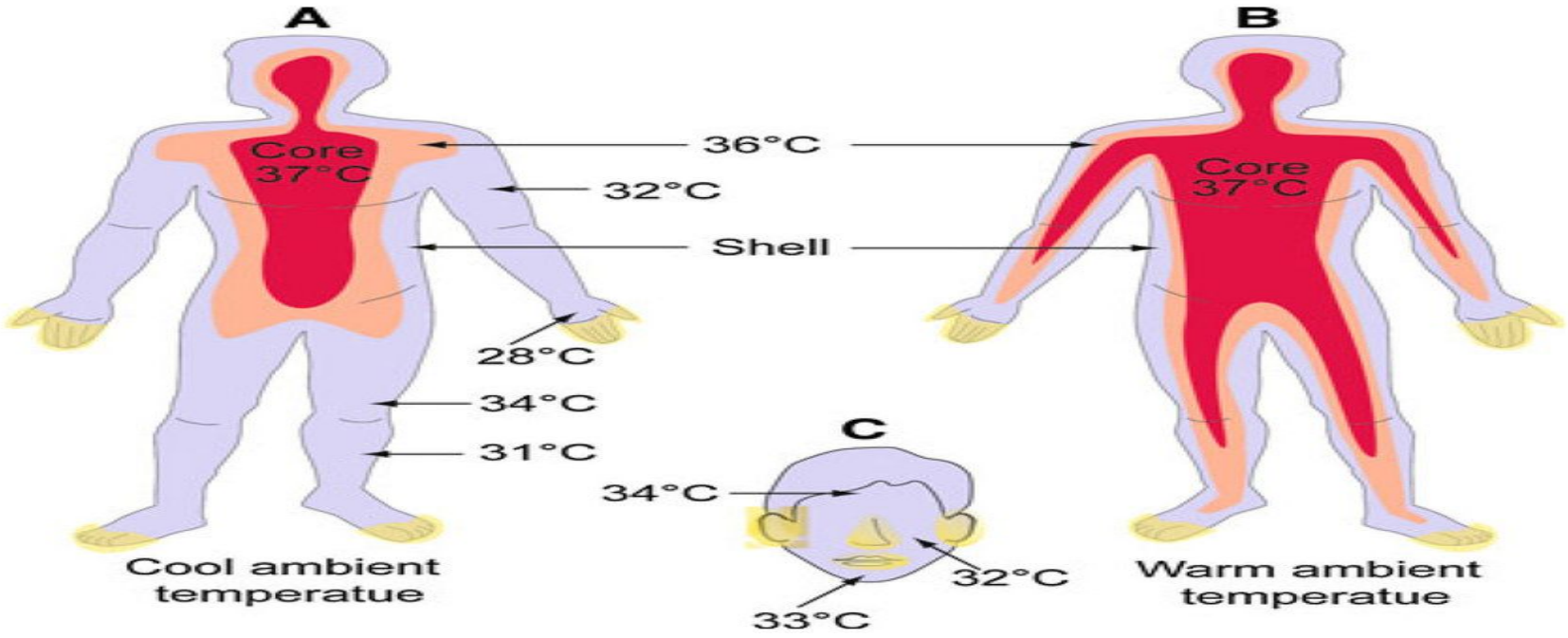
Theoretical ..... Lecture No.12

استاذ المادة : .د. حسن جساب البركي

Body temperature:

The **core body temperature** is tightly controlled in humans, because all body tissues function optimally within a narrow range of temperature.

This is usually **2 to 4 degrees warmer** than the **skin temperature** over the limbs, which depends on many other factors such as the **ambient heat exposure, and vasoconstriction**.



When surgical operations are performed the patient **is typically exposed to :**

- ✔ **Acold environment**
- ✔ **Dilution of the warm body fluids by colder intravenous infusions.**
- ✔ **Surgical incision also contributes to heat loss from the body via evaporation of various fluids from the opening**.

However, this alone is insufficient to induce hypothermia in a normal patient. Instead, the normal process of thermoregulation drives up the body heat production to maintain an even temperature

Anesthesia can cause hypothermia if the surgical patient is not monitored carefully.

Core temperature may be directly measured at sites such as

- ✔ **Distal esophagus**
- ✔ **pulmonary artery**
- ✔ **Ear drum** (tympanic membrane)
- ✔ **Bladder**
- ✔ **Rectum**
- ✔ **Axilla**

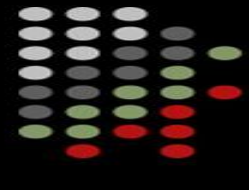
Hypothermia has consistently been shown to worsen the postoperative course of the patient, inducing complications such as:

1. **Myocardial stress** because the drop in core temperature activates the sympathetic system
2. **Coagulation system dysfunction**
3. **Wound infections**
4. **Poor wound healing**
5. **Longer hospital stays**
6. **Patient discomfort and shivering**
7. **Delay recovery from anesthesia (delays drug metabolism)**.

Spinal anesthesia can also cause **hypothermia,** but the fall in core temperature may not be as marked as that following the use of a general anesthetic.

These patients are **unable to sense the hypothermia** as a result of **autonomic impairment**, coupled with **failure of regulatory mechanisms.**

Postoperative Shivering



- Cause
  - Temperature often normal
  - ?Anaesthetic Agents block descending inhibition of spinal reflexes
    - GA / Epidural / ?Spinal
- Physiological Effects
  - Upto 6 x increase metabolic rate
  - Upto 3 x Increase O2 consumption
- Management
  - ABC
  - Oxygen
  - Check Temperature - +/- warming
  - Pethidine 25mg iv

Capnography

Capnography

Capnography monitoring is an essential component during anesthesia.

This technology closely monitors the **concentration of carbon dioxide** in **exhaled breath** and can help immediately detect unexpected changes in respiration when a patient is sedated during a procedure.

This information is critical during surgery and could **potentially save a patient's life** with early detection of cardiorespiratory problems, like **hypoventilation** or **inadvertent esophageal intubation**.

Our CO2 relies on :

Aside stream method

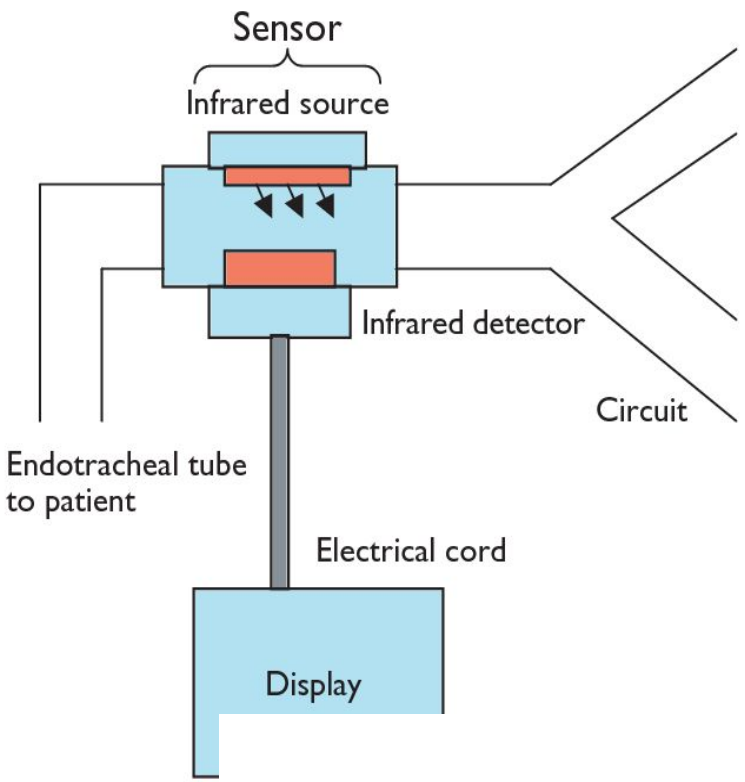
That is appropriate for both **intubated and non-intubated** patients and has simple connection sample lines that make the system one of the lowest costs per patient end tidal CO2 measurement systems on the market.

End tidal CO2. Or, the **maximum** amount of carbon dioxide measured at the **end of expiration**.

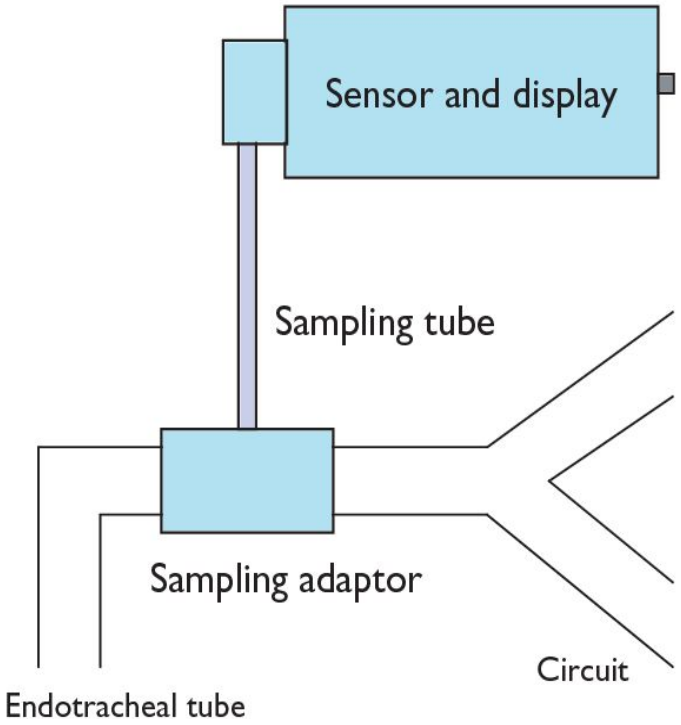
It's measured using **infra-red capnography**.

It can help to **confirm the correct positioning of an ETT** and is vital for **monitoring during mechanical ventilation**

Mainstream



Sidestream



It can be used as a guide to PCO2, and different capnography wave forms can be used as adiagnostic aid to identify different respiratory pathologies.

A normal ETCO2 reading is :

4.5-6.0 kPa, or 35-45 mmHg.

This is the same as the normal readings for PCO2 on a blood gas when the patient is generally cardiorespiratory stable and normothermic, and therefore an **ETCO2 can be used to approximate PCO2 readings.**

A large difference in figures could indicate :

- **An increase in physiological dead space:**

(ventilation of poorly perfused alveoli)

Meaning areas of functional lung tissue are not participating in gas exchange or

- **Intra-pulmonary shunting**

(lack of ventilation to perfused alveoli)

Meaning gas exchange is not happening as blood passes alveoli.

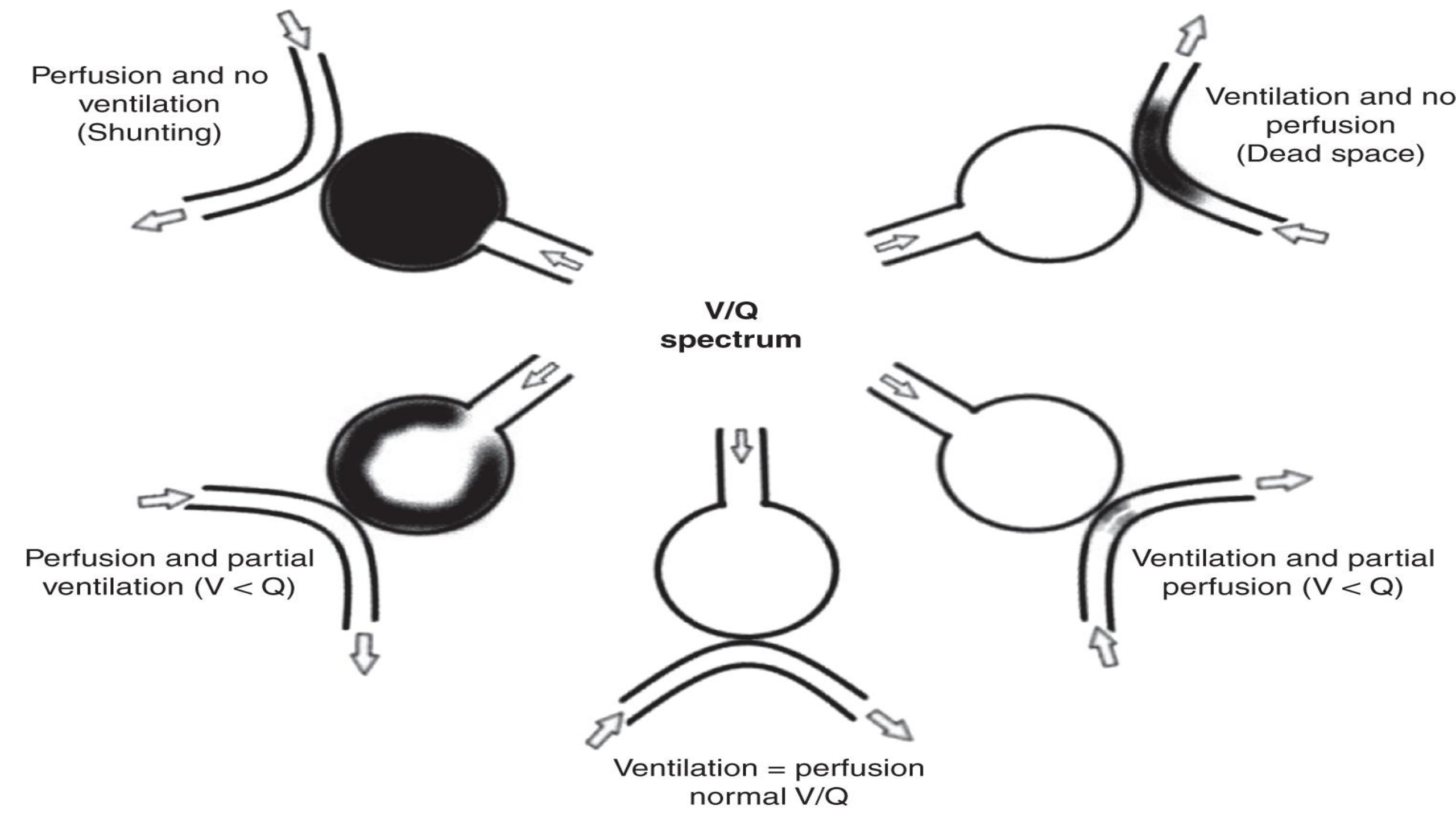
- These are both forms of V/Q mismatch.

✔ Normal V (ventilation) is 4 L of air per minute.

✔ Normal Q (perfusion) is 5L of blood per minute.

❑ **So Normal V/Q ratio is 4/5 or 0.8.**

- When the V/Q is higher than 0.8, it means ventilation exceeds perfusion.
- When the V/Q is < 0.8, there is a VQ mismatch caused by poor ventilation.


Perfusion and no ventilation (Shunting)
Ventilation and no perfusion (Dead space)
V/Q spectrum
Perfusion and partial ventilation (V < Q)
Ventilation and partial perfusion (V < Q)
Ventilation = perfusion normal V/Q

1. An absent waveform can be indicative of:

- ✔ An absent (extubated) airway
- ✔ Esophageal intubation (there's no CO2 in the esophagus)
- ✔ Apnea or respiratory arrest (there will be no end tidal CO2 if there is no *tidal*)
- ✔ Ventilator disconnection.

2.A low ETCO2 reading can indicate :

- ✔ A low metabolic production of CO2 (e.g., hypothermia)
- ✔ Increased removal of CO2 if some one is hyperventilating (there may be a progressive drop in CO2 as they blow it all off).

3.Conversely,aprogressive rise in CO_2 could indicate:

- ✔ **Rebreathing CO_2**

(where an increase in baseline will be seen alongside overall increases)

- ✔ **Hypoventilation**
- ✔ **Increased CO_2 production** due to an increased metabolic rate (e.g., fever)
- ✔ **An airway obstruction** leading to impaired removal of CO_2

(this will usually also present with high airway pressures).

4.A sudden rise in CO2 could be indicative of:

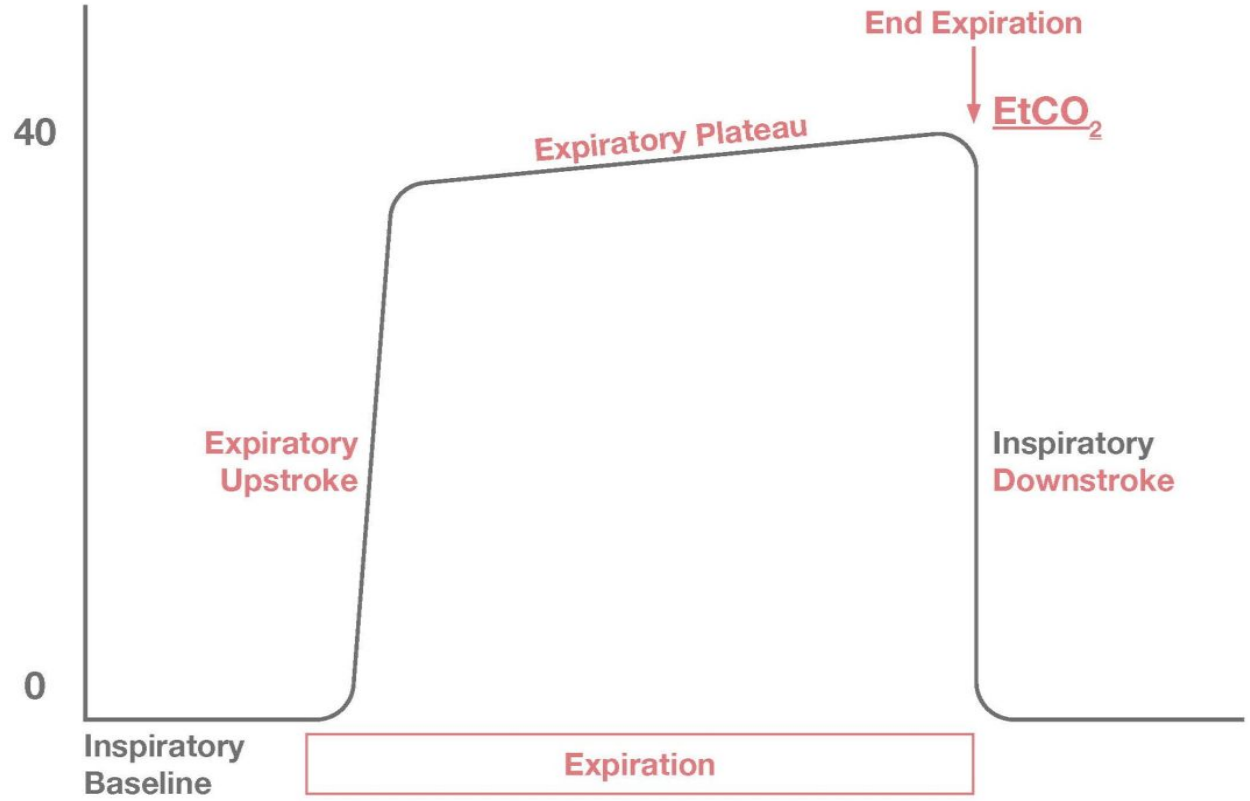
Return of spontaneous circulation (ROSC) following CPR for cardiorespiratory arrest, as the patient starts breathing again.

During CPR, there should be some type of wave form present (see pic. below) which indicates good quality CPR

Capnography

Acapnography wave form has 4 phases:

1. **Inspiratory baseline**
2. **Expiratory upstroke**
3. **Alveolar plateau**
4. **Inspiratory downstroke.**



1. INSPIRATORY BASELINE

Flat, as inspired gas at the beginning of expiration usually doesn't have any CO2.

If base line is high, could indicate rebreathing,

2. EXPIRATORY UPSTROKE

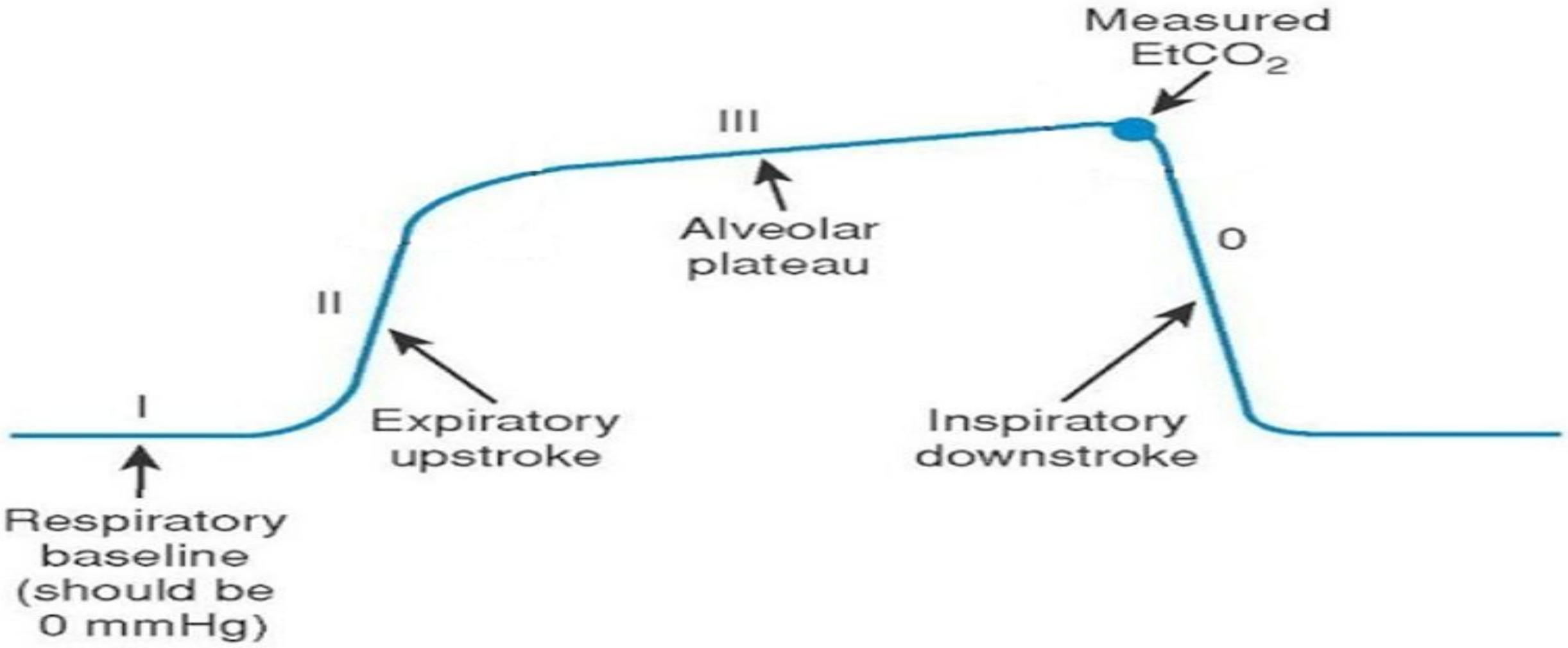
Rapid increase as alveolar gas exchange begins. O2 exchanged for CO2 and expiration of CO2-rich gas begins.

3. ALVEOLAR PLATEAU

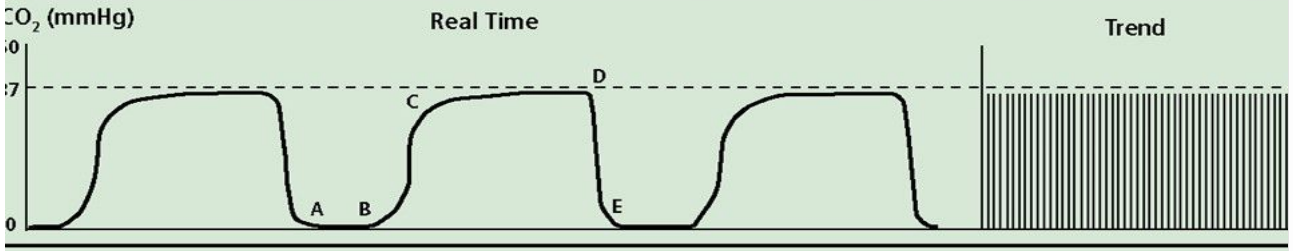
Usually gradually increases as alveolar gas exchange continues during expiration. Airway obstruction will cause a greater increase (**could appear as shark fin waveform, e.g., in asthma**). **ETCO2 reading taken at peak of plateau** (as this is the end of expiration).

4. INSPIRATORY DOWNSTROKE

Rapid fall in CO2 concentration as inspiration starts and O2 rich air arrives.



Normal capnogram — Normal $EtCO_2$: 35–45 mmHg

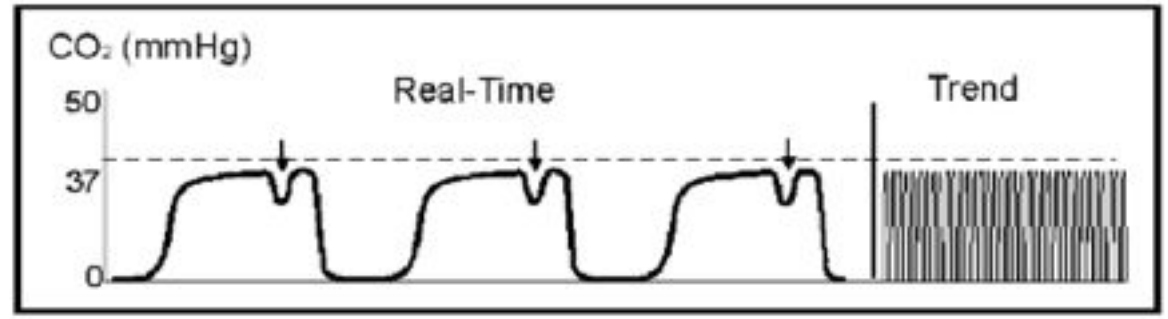


he 'normal' capnogram is a waveform which represents the varying CO_2 level throughout
ne breath cycle.

Waveform Characteristics

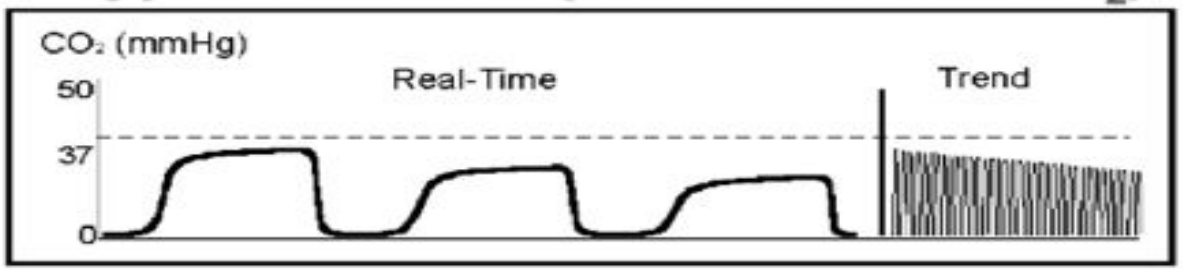
A-B	Baseline	D	End-Tidal concentration
B-C	Expiratory upstroke	D-E	Inspiration
C-D	Expiratory plateau		

Muscle Relaxants (curare cleft)



- Appear when muscle relaxants begin to subside
- Depth of cleft is inversely proportional to degree of drug activity

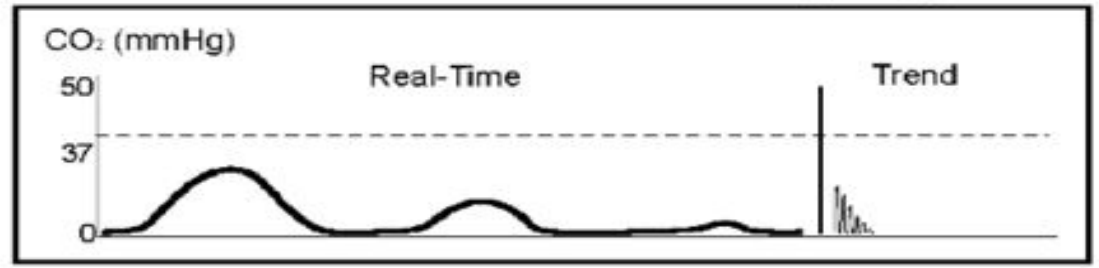
Hyperventilation (Decrease in $ETCO_2$)



Possible Causes:

- Increase in respiratory rate
- Increase in tidal volume
- Decrease in metabolic rate
- Fall in body temperature

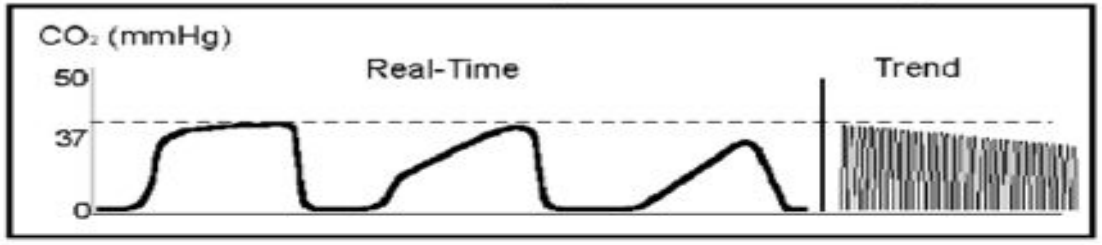
Endotracheal Tube in Esophagus



Possible Causes:

- Missed intubation
- A normal capnogram is the best evidence that the ET tube is correctly positioned
- With ET tube in the esophagus, little or no CO_2 is present

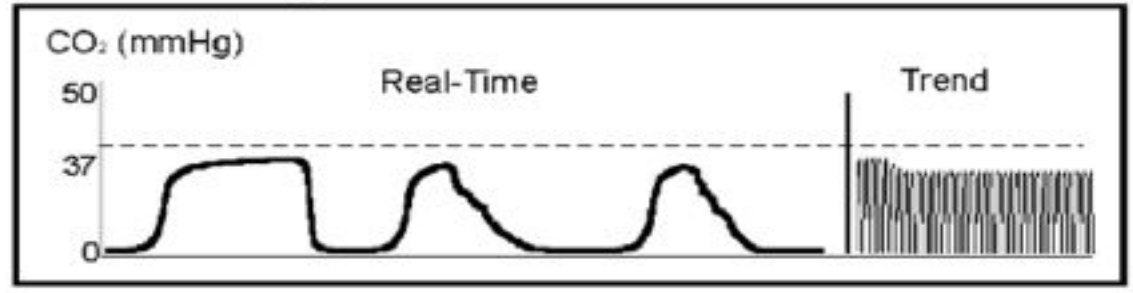
Obstruction in Airway or Breathing Circuit



Possible Causes:

- Partially kinked or occluded artificial airway
- Presence of foreign body in the airway
- Obstruction in expiratory limb of breathing circuit
- Bronchospasm

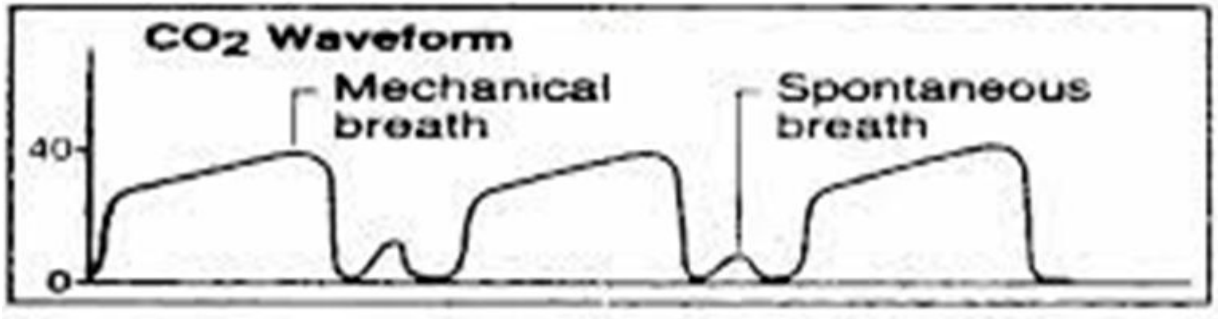
Inadequate Seal Around ET Tube

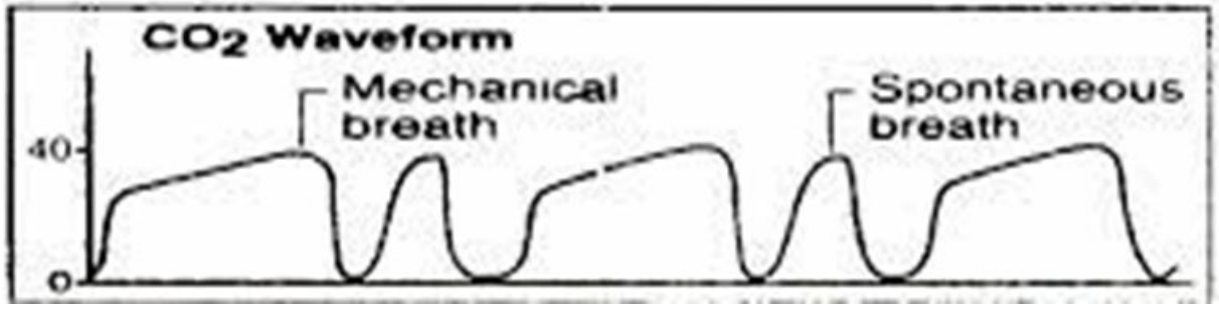


Possible Causes:

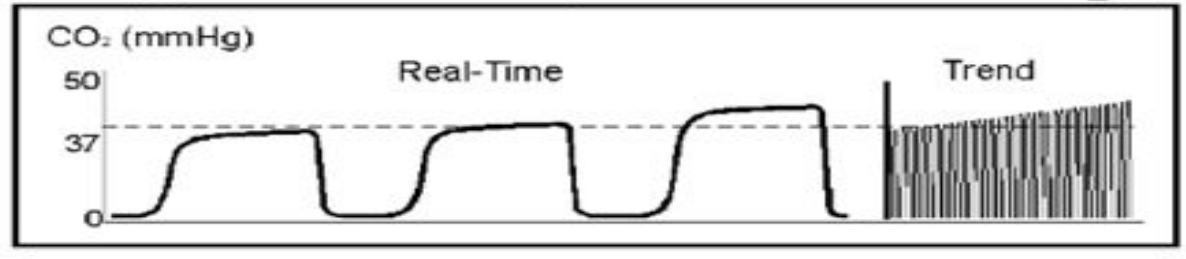
- Leaky or deflated endotracheal or tracheostomy cuff
- Artificial airway is too small for the patient

Spontaneous breathing during mechanical ventilation:





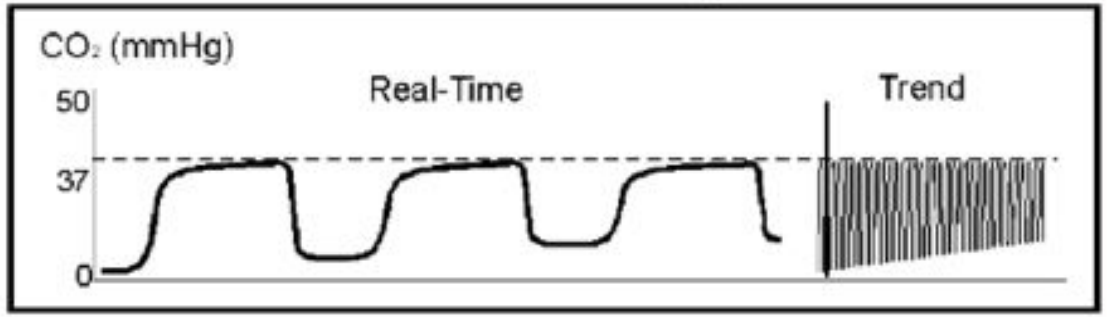
Hypoventilation (Increase in $ETCO_2$)



Possible Causes:

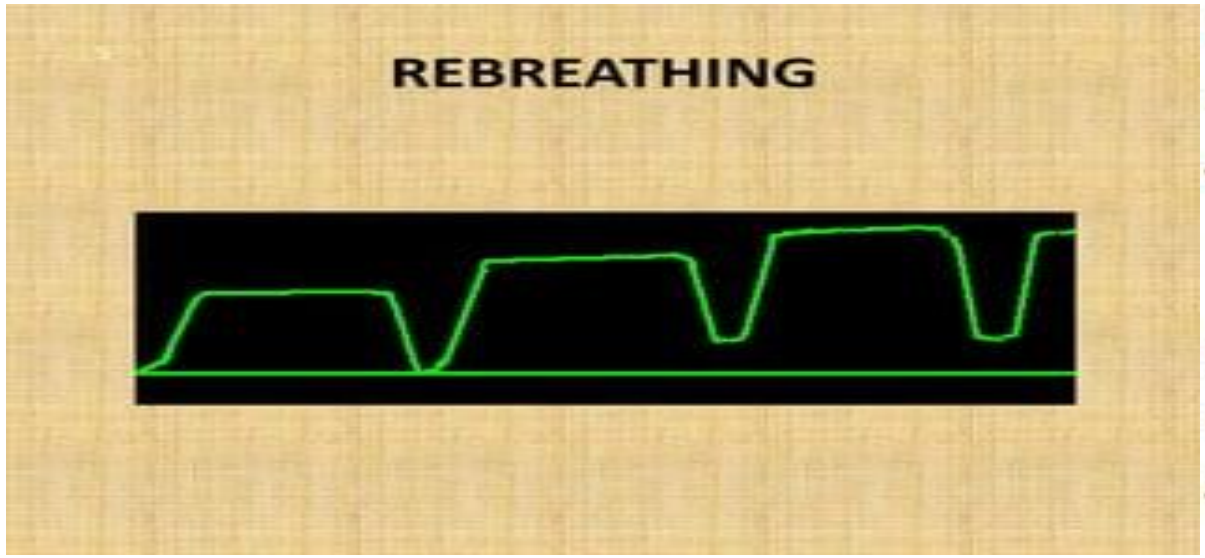
- Decrease in respiratory rate
- Decrease in tidal volume
- Increase in metabolic rate
- Rapid rise in body temperature (hyperthermia)

Rebreathing



Possible Causes:

- Faulty expiratory valve
- Inadequate inspiratory flow
- Insufficient expiratory time
- Malfunction of CO_2 absorber system



Sudden loss of waveform

ETT disconnected, dislodged, kinked or obstructed, loss of circulatory function

Decreasing $EtCO_2$

ETT cuff leak, ETT in hypopharynx, partial obstruction

CPR assessment

Attempt to maintain minimum of 10 mmHg

Sudden increase in $EtCO_2$

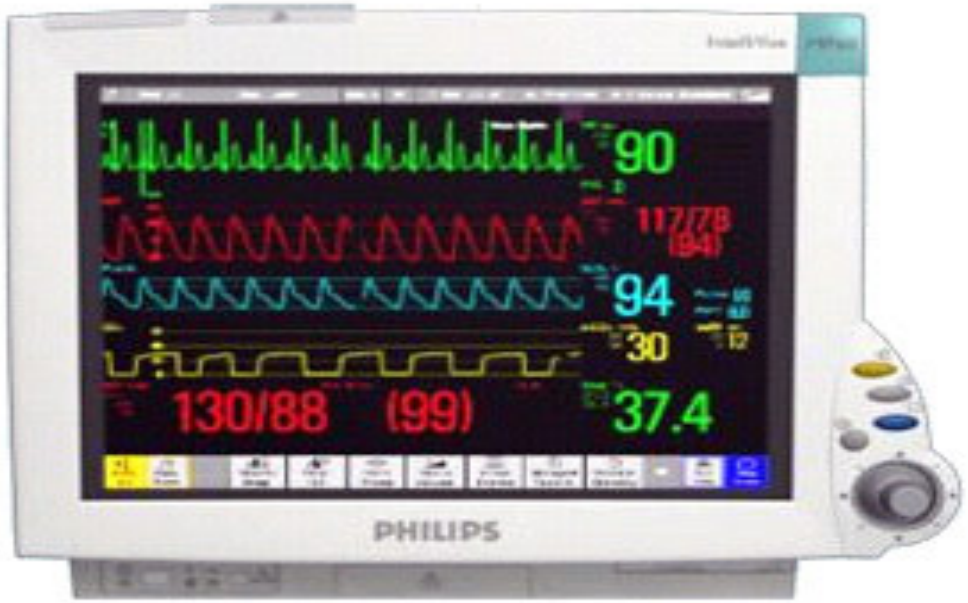
Return of ROSC

To Summarize:

"How do I monitor the patient in OR?"

The 4 basic monitors displayed on the screen:

1) **ECG.**
2) **BP.**
3) **SpO2.**
4) **± Capnogram (EtCO2).**



Normal target values for an adult under GA:

- **HR:** 60-100 beats per minute (BPM) > 100 = tachycardia. < 60 = bradycardia).
- **BP:** 90/60 – 140/90.
- MAP > 60 mmHg (cerebral&renal autoregulation)
- Diastolic BP >50 mmHg(coronary perfusion pressure)
- **SpO2** > 96% on 100% O2

- **EtCO2** = 35-45 mmHg.

LISTEN

- **Listen** to the monitor **the whole time**:

  To the **pulse oximeter** tone to identify:

  1-Heart rate

  2- **O2 saturation** from the tone (pitch) of pulse oximeter.

  To the sound of the **ventilator**, to any abnormal sounds, any alarms.

- **RULE: NO silent monitors**. **ALWAYS** keep the **HR sound on**. If your monitor is **silent** (sound is not working) you **have to look** at your monitor the **WHOLE time**.

XX NEVER XX

LööK

- Every **5 minutes** to note the new **BP reading.**
- If there is any **change in the tone** of the pulse oximeter.
- If there is any **irregularity in heart rate** & **during the use of diathermy**.

Any questions?