• **Pulse Oximetry:**

A non-invasive method for monitoring person’s oxygen saturation (So2), though its reading of So2 isn’t always identical to reading through **ABG analysis**, which is the invasive method, but it consider a **safe, convenient, noninvasive and not expensive method for monitoring So2**.

**Timing of SpO2 monitoring**: Before intubation >> Throughout the surgery >> After extubation and Recovery.
Con’t...

• Allows beat to beat analysis of oxygenation.
• Red and Infra-red light frequencies transmitted through a translucent portion. (finger-tip or earlobe)
• Depends on differences in light absorption between oxyHb and deoxyHb.
• Microprocessors then analyze amount of light absorbed by the 2 wavelengths, comparing measured values, then determining concentrations of oxygenated and deoxygenated forms through only arterial blood
Con’t ...

- It is uncertain when there is severe vasoconstriction, due to the reduced pulsatile component of the signal, also in shock or cold extremities.

- It is uncertain with certain hemoglobin:
  1. when carboxyhemoglobin is present, it overestimates SaO2
  2. when methemoglobin is present, at an SaO2 > 85%, it underestimates the saturation.

- It progressively under-reads the saturation as the hemoglobin falls (but it is not affected by polycythemia).

- It is affected by extraneous light.

- It is uncertain when there is excessive movement of the patient.
Con’t...

Pulse oximetry give us many information:

• SpO2: arterial O2 saturation (oxygenation of the pt).
• HR.
• Peripheral perfusion status

**Example:** loss of waveform in hypoperfusion states: hypotension and cold extremities.

• Give an idea about the rhythm from plethysmography wave (arterial waveform), Cannot identify the type of arrhythmia but can recognize it if irregularity is present.
• Cardiac arrest

**Note:** The pulse oximeter is not an indicator of the adequacy of alveolar ventilation
Blood pressure monitoring:

• Non invasive blood pressure monitoring:
  This is the most common method of obtaining the patient’s blood pressure during anesthesia and surgery.
• A pneumatic cuff with a width 40% of the arm circumference must be used and the internal inflatable bladder should encircle at least half the arm. If the cuff is too small, the blood pressure will be overestimated, and if it is too large it will be underestimated.
Con’t...

• **NIBP** can give rapid and accurate (± 9 mmHg) readings for: systolic BP, diastolic BP, and MAP.

Mean Arterial Pressure (MAP) = DBP + 1/3(SBP – DBP)

• Goal of NIBP monitoring: Avoid and Manage severe Hypotension or Hypertension.

• Risk of **Hypotension** episodes:
  myocardial ischemia, ischemic stroke, hypoperfusion state, metabolic acidosis, delayed recovery, renal shutdown

• Risk of **Hypertension** episodes:
  myocardial ischemia, pulmonary edema, hemorrhagic stroke, hypertensive encephalopathy.
Non-invasive BP measurement provides either intermittent or continuous readings. **For intermittent:**

- By default every 5 minutes.
- Every 3 minutes: immediately after spinal anesthesia, in conditions of hemodynamic instability, during hypotensive anesthesia.
- Every 10 minutes: In awake patient under local anesthesia.

- Heart rate is also determined and displayed.
Con’t...

• **Invasive blood pressure monitoring** (Arterial BP): :

**Indications:**

- Rapid moment to moment BP changes
- Frequent blood sampling
- Major surgeries (cardiac, thoracic, vascular)
- Circulatory therapies: vasoactive drugs, deliberate hypotension
- Failure of indirect BP: burns, morbid obesity
- Sever metabolic abnormalities
- Major trauma

The radial artery at the wrist is the most common site for an arterial catheter. Alternatives are femoral, brachial and dorsalis pedis.
Con’t...

- Complications of arterial cannulation
  - Hematoma.
  - Vasospasm.
  - Thrombosis.
  - Embolization of air or thrombus.
  - Skin necrosis infection.
  - Nerve damage.
  - Disconnection and fatal blood loss
Central Venous line and Pressure (CVP)

• This is measured by inserting a catheter via a central vein, usually the internal jugular or subclavian, so that its tip lies at the junction of the superior vena cava and right atrium.

• It is then connected via a fluid-filled tube to a transducer that converts the pressure signal to an electrical signal.

• Then, this is amplified and displayed as both a waveform and pressure.

• CVP is usually monitored in operations during which there is the potential for major fluid shifts (e.g. prolonged abdominal surgery) or blood loss (e.g. major orthopedic and trauma surgery).
Ventilation monitoring:

- As we know before, we must monitor a patient to ensure adequate ventilation of the patient.

  **Clinically**, we monitor it through a correctly positioned **endotracheal tube**, also observing **chest expansion**, and **breath sounds** over both lungs.

  **Quantitatively** by capnography and **ETCO2 analysis**, and by Arterial blood gas analysis for assessing both oxygen and ventilation.
What is Capnography?
Continuous CO2 measurement displayed as a waveform sampled from the patient’s airway during ventilation.

What is EtCO2?
A point on the capnogram.
It is the final measurement at the endpoint of the patient’s expiration before inspiration begins.
It is usually the highest CO2 measurement during ventilation.
Con’t...

• Phases of the capnogram:
  • Inspiratory baseline
  • Expiratory Upstroke
  • Expiratory Plateau
  • End-tidal (EtCO2)
  • Expiratory Downstroke
• End-tidal CO$_2$ monitoring is standard for all patients undergoing GA with mechanical ventilation.

• It is an important safety monitor and a valuable monitor of the patient’s physiologic status, and it has been an important factor in reducing anesthesia-related mortality and morbidity.

• Co$_2$ monitoring is considered the best method for verifying successful intubation and extubation procedures.

• Also it aids in diagnosis of PE, recognition of a partial airway obstruction, and indirect measurement of airway reactivity (bronchospasm).

• ETCO$_2$ levels have also been used to predict outcome of resuscitation.

• Normal range: 35-45 mmHg.
**RULES NEVER to FORGET:**

- Never start induction with a missing monitor: ECG, BP, SpO2.
- Never remove any monitors before extubation & recovery.
- Never ignore an alarm

**ALWAYS**

Remember that your clinical sense and judgement is better than and superior to any monitor.

You are a doctor you are not a robot, the monitor is present to help you not to be ignored and not to cancel you brain.