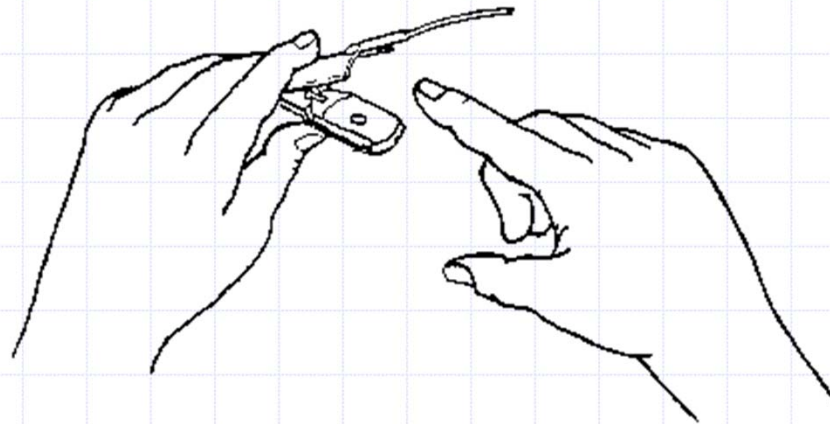


ADVANCED ASSESSMENT

Principles Of Oximetry



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Principles Of Oximetry

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How it works

- ❖ A pulse oximeter (SpO₂ monitor) is a non-invasive device which measures the percentage of hemoglobin saturated with oxygen.
- ❖ It emits red and infrared light through vascular tissue and measures the amount of absorbed light on the other side.
- ❖ Hemoglobin changes its shape depending on whether or not it's carrying oxygen molecules.
- ❖ Light absorption also changes depending on whether the hemoglobin is carrying oxygen.
- ❖ This is how a percentage of oxygen “saturation” is derived.

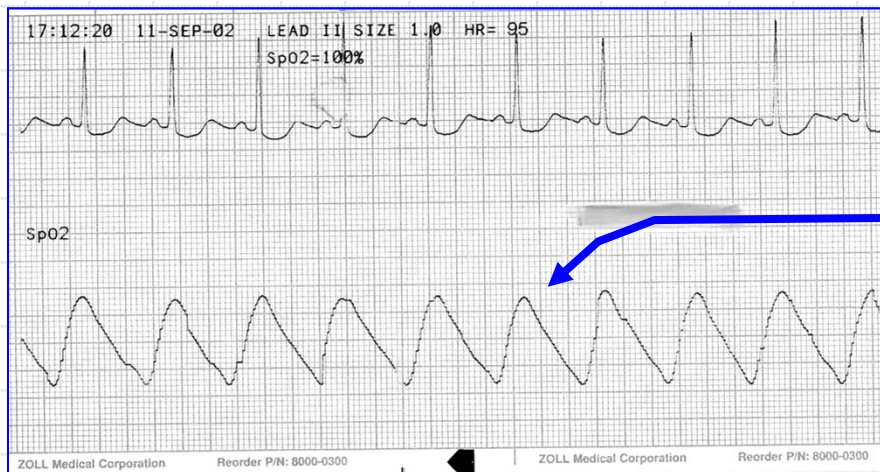
How it works

- ❖ 98% of oxygen is transported bound to hemoglobin – the rest is transported dissolved in blood plasma
- ❖ hemoglobin is part of the red blood cell
- ❖ each hemoglobin can carry 4 molecules of O₂ (said to be fully saturated)
- ❖ normal saturation is 95-98% (or as high as 100%) on room air
- ❖ a saturation of 94% = hypoxemia (strict definition of hypoxemia is: PaO₂ less than 80 mmHg)

How it works

- ❖ tissue displacement is also incorporated into the SpO₂ calculation for accuracy.
- ❖ Tissue displacement is represented on the SpO₂ monitor in the form of a plethysmograph - sometimes called the “pleth” for short or a “pulse waveform”.
- ❖ Note: SpO₂ monitors are sometimes sensitive to motion artifact. If you look at the plethysmograph and the waveform morphology (shape) is the same with each pulse, then the numeric value (% saturation) will be accurate.

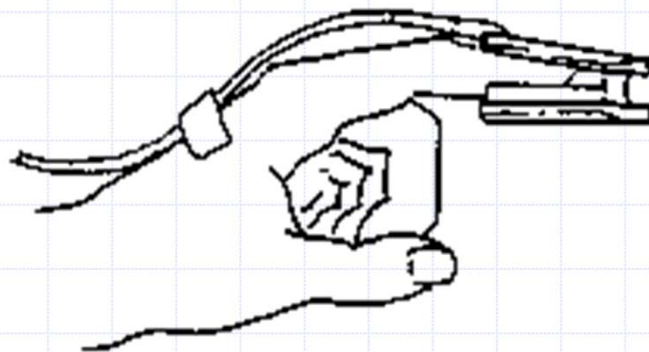
plethysmograph



Note that the shape of the “Pleth” is consistent and that each wave corresponds to an ECG wave above. This tells you that the numeric value is accurate

How it works - adult

- ❖ In an adult, you generally apply the SpO₂ probe to the finger (see below).
- ❖ Be sure that the light source is directly over the sensor - i.e. be careful not to push the probe on too far. The light source should be directly over the nailbed



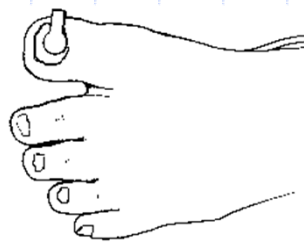
Finger probe

How it works - pediatric

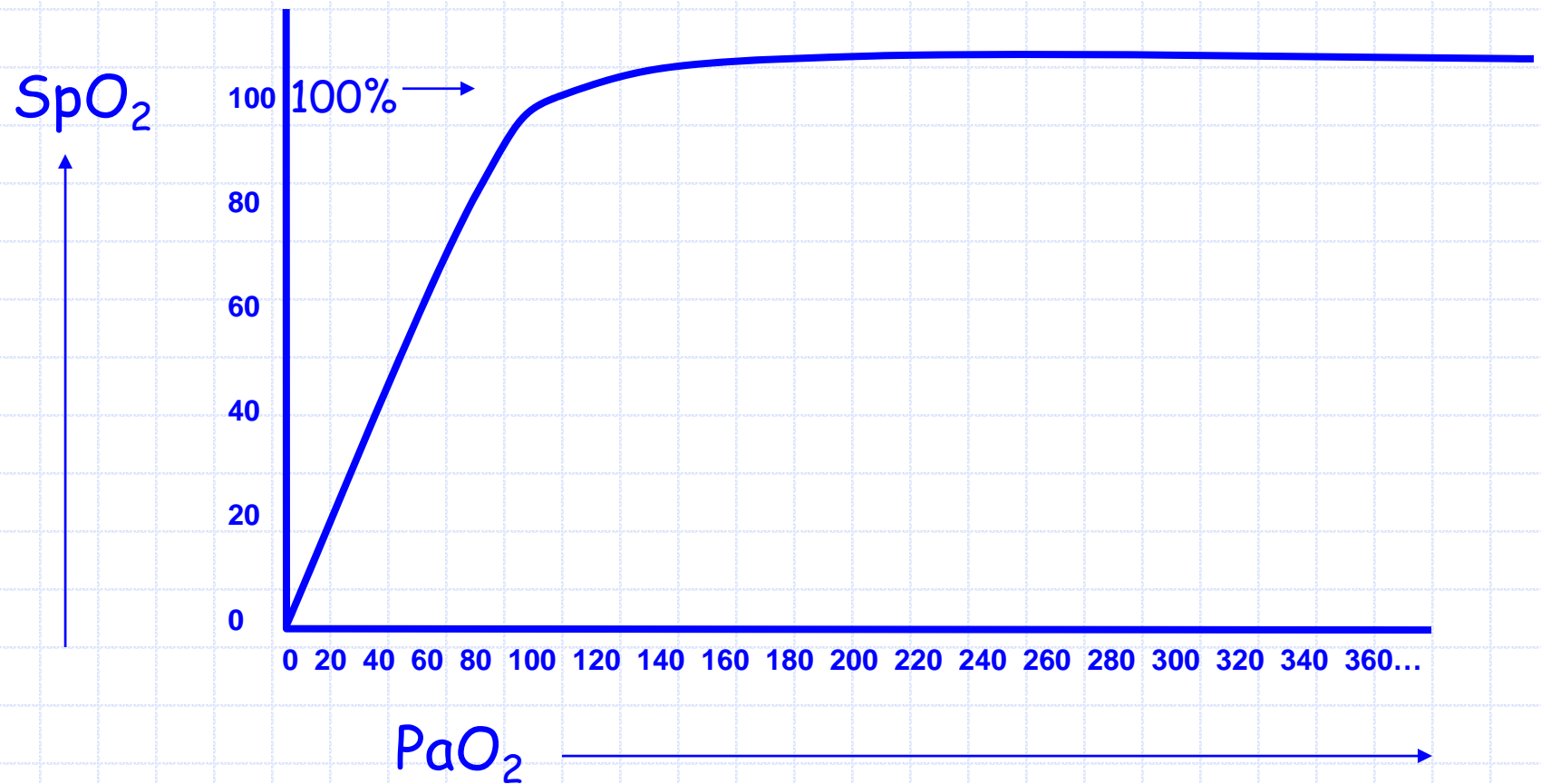
- ❖ In an infant you might choose a disposable probe to place around the big toe.



Disposable probe



Wrap and secure toe so that the light source is directly over the sensor

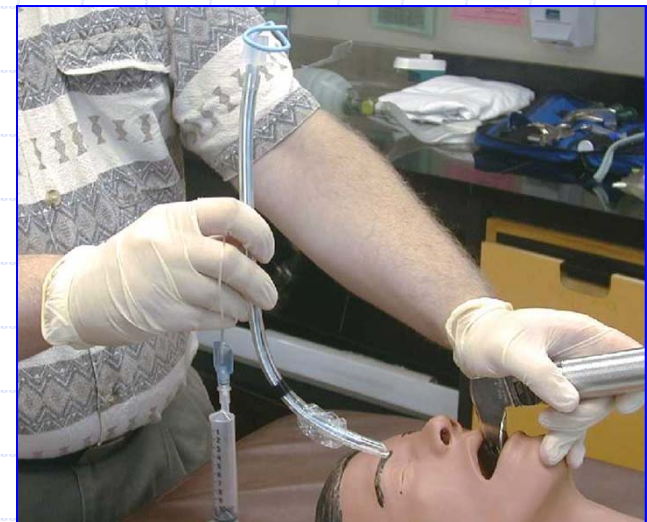


Indications for SpO₂ monitoring

- ❖ any patient who requires supplemental O₂
- ❖ any patient receiving analgesia and/or sedation
- ❖ as an adjunct assessment tool for anyone requiring positive pressure ventilation (PPV) by mask or by ETT
- ❖ to assist in ruling out the need for O₂ therapy
- ❖ any patient to be transported by air

Benefits of SpO₂ monitoring (cautious)

- ❖ continuous monitoring of oxygenation status
- ❖ to monitor the efficacy of therapeutic interventions. e.g. O₂ therapy, treatment with Salbutamol, NTG for A.P.E., etc
- ❖ guide for efficacy of ventilation-oxygenation of the patient who is receiving PPV
- ❖ guide for oxygenation needs in the patient who is being intubated



Clinical points

- ❖ Whenever possible, the Paramedic should attempt to obtain an SpO₂ reading on room air, followed by a reading with supplemental oxygen
- ❖ Important: NEVER withhold oxygen from the patient in severe respiratory distress

A drop in SpO₂ may occur before the development of cyanosis in a patient whose respiratory status is deteriorating – therefore SpO₂ may provide an early warning sign

Limitations of of SpO₂ monitoring

- ❖ Anemia - the anemic patient may be 100% saturated, but his/her oxygen carrying capacity will be low due to decreased circulating red blood cells (hemoglobin)
- ❖ O₂ therapy may be indicated to fully saturate the existing hemoglobin and add to the amount of dissolved O₂ in the blood plasma

e.g. various types of anemia's - pregnancy

e.g. hypovolemia

Limitations of SpO₂ monitoring

EXAMPLES

- ❖ carboxyhemoglobin - the patient who has CO poisoning may have a high SpO₂ reading, however this is because the pulse oximeter cannot distinguish between CO bound to hemoglobin from O₂ bound to hemoglobin
- ❖ hypoperfusion - inadequate pulsations
- ❖ arterial compression or disruption- i.e. from injury or from application of a blood pressure cuff on the same arm that is used to get the SpO₂ reading
- ❖ ambient light
- ❖ nail polish

Limitations of SpO₂ monitoring

EXAMPLES

- ❖ motion artifact
- ❖ patients with chronically impaired oxygenation (e.g. emphysemics) will normally saturate low. - if an emphysemic is saturating at 91% but is otherwise in no distress whatsoever, then 91% should not be taken as seriously as one would take a saturation of 91% in a patient with normally healthy lungs.

SpO₂ summary

- ❖ monitors oxygenation
- ❖ guide to the efficacy of interventions
- ❖ early warning device
- ❖ has its limitations

Well Done!

Ontario Base Hospital Group
Self-directed Education Program

