Use of Pulse Oximetry
(SpO$_2$)
Promise Hospital – Competency Presentation
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What is pulse oximetry?

- Procedure used to measure percentage of oxygen carried in blood and delivered to peripheral tissues

**Pulse oximetry is useful to assess:**

- ...the severity of disease.
- ...the need for supplemental oxygen.
- ...the effectiveness of therapeutic interventions.
What is normal?

- Normal = more than 89%  
- Low level of oxygen can cause damage to cells, place strain on the heart and lungs, and cause the body to work improperly

Clinical effects of hypoxia range from:

- ...Nausea, Incoordination, Vertigo, and Impaired athletic performance...
- ...to Neurological deficits and Death.
Pulse oximetry alone is not a reliable predictor of the patient’s status.

- The entire clinical picture is necessary for an accurate and reliable predictor of the patient’s status.
- Place (2000): “…the technology is a valuable contributor to nurses’ assessment skills, though…it (is not) to be a replacement for it.”
- Jevon and Ewens (2000): “…it is simply an aid to observation and holistic care, and not a substitute.”
- Harrahil (1991): “…peripheral oxygen saturation (SpO₂) is only one aspect of the assessment process.”
- Jensen et al. (1998): “…the technology can only be considered valuable if combined with an insight to its operation and limitation.”
Limitations of pulse oximetry include:

- **Internal (to the client) factors:**
  - Low peripheral vascular perfusion
  - Venous congestion
  - Vasoconstriction from hypothermia
  - Hypovolemia

- **External (to the client) factors:**
  - Cardiogenic shock
  - Anemia
  - Abnormal hemoglobin
  - Skin pigmentation

- **Interpretation of pulse ox reading**
  - Motion artifact
  - Interference by electrical energy
  - Interference by stray light

- **Interference by electrical energy**
  - Intravascular dyes
  - Nail polish
Oximeters respond to carboxyhemoglobin as if it were oxyhemoglobin.

- If a patient has significant elevation of HbCO, their oxygen content may be overestimated when in fact oxygen delivery to tissues is too low.
  - Cigarette smokers
  - Fire fighters

**Instantaneous changes in readings:**

- It is physiologically impossible for the human body to experience extreme fluctuations in SpO$_2$.
- For example, a quick drop from 99% to 85% should not be a major cause for concern.
Accuracy and Reliability

- The predictive accuracy of pulse oximetry tends to be overstated.
- Most manufacturers specify that their oximeter readings can be expected to have a 2-3% standard deviation in the 70-100% saturation range.
  - For example, there is a 95% probability that a pulse oximeter reading of 90% corresponds to an arterial blood saturation reading between 84% and 96%.
  - Note: Oximeters have been proven to reliably indicate the development of hypoxemia before harm comes to the patient.
- Accuracy of pulse oximetry readings diminishes the further it is from the norm.
  - Therapists should be wary of readings less than or equal to 68% - 78%, unless the reading is validated by arterial blood sampling.
For best results with use of pulse oximetry, therapists should follow these steps:

- Secure the probe.
- Monitor signal strength.
- Be aware of whether the patient smokes.
- Validate pulse oximetry readings with arterial blood sampling.
Conclusions and Recommendations

- Increasing cost of health care today makes the use of noninvasive pulse oximetry attractive.
- Despite being less sensitive to developing ventilation-perfusion mismatching than arterial blood gas determination, it is offset by the ability of pulse oximetry to provide continuous, rather than intermittent, data.
- Clinicians cannot rely entirely on the pulse oximetry reading. We must always verify results by looking at the whole clinical picture, including:
  - Skin pallor
  - Presence of cyanosis (to rule out circulation problems)
  - Arterial blood gas reading.
**References**


