Arterial Oxygen Saturation

Examples of Arterial Oxygen Saturation:

- **SaO₂ 100%**
- **SaO₂ 75%**

Oxygen Saturation: The Fifth Vital Sign™

Pulse Oximetry

Pulse oximetry works by applying a sensor to a pulsating arteriolar vascular bed. The sensor contains a dual light source and photodetector.

Bone, tissue, pigmentation and venous vessels normally absorb a constant amount of light over time. The arteriolar bed normally pulsates and absorbs variable amounts of light during systole and diastole, as blood volume increases and decreases. The ratio of light absorbed at systole and diastole is translated into an oxygen saturation measurement. An oxygen saturation measurement provided by a pulse oximeter is commonly referred to as SpO₂.

Oxygen Content in Arterial Blood

Normally, 98% to 99% of the oxygen present in the blood is combined with the hemoglobin molecule:

- **SaO₂** indicates oxygen carried on arterial hemoglobin.
- **PaO₂** indicates oxygen dissolved in arterial plasma.

Total arterial oxygen content is comprised of oxygen carried on arterial hemoglobin and oxygen dissolved in plasma. Whenever SaO₂ falls, arterial oxygen content decreases and the risk of tissue hypoxia may increase.

Arterial hemoglobin oxygen saturation may be determined by a measurement of an arterial blood sample (SaO₂) or by a pulse oximeter (SpO₂). The normal range is 95% to 99%.

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- **SaO₂ 75%**

Anemia

Hemoglobin values must be considered when assessing the adequacy of arterial oxygen content. The anemic patient has fewer hemoglobin molecules than a normal patient. Consider an anemic patient and a normal patient who both have an SpO₂ close to 100%. Although all of the hemoglobin molecules in both patients are carrying oxygen, the total arterial oxygen content for the anemic patient is lower because there are fewer hemoglobin molecules to carry oxygen. This patient is at greater risk whenever oxygen demand increases or oxygen supply decreases.

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Nellcor Sensors: Basic Principles

Adhesive and reusable sensors are available. The following considerations should be evaluated when choosing a sensor for your patient:

- Patient’s body weight
- Duration of use (long-term, short-term, spot-check)
- Patient activity
- Infection control concerns

Tips for use:

- Ensure that the optical components of the sensor are properly aligned as outlined in the directions for use.
- Check adhesive sensor sites at least every 8 hours and move to a new site if necessary. Move reusable sensors to a new site at least every 4 hours.
- Reuse adhesive digit sensors on the same patient if the adhesive tape attaches without slipping. Replace the sensor whenever the adhesive quality is depleted.
- When selecting a sensor site, give priority to an extremity free of an arterial catheter, blood pressure cuff or intravascular infusion line.
- Clean reusable sensors between patients. Refer to directions for use.

Pulse Oximetry: Clinical Considerations and Recommendations

Certain conditions may result in pulse oximetry readings that are unreliable, incorrect or less informative, as described below:

<table>
<thead>
<tr>
<th>Consideration</th>
<th>Recommendation</th>
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<tbody>
<tr>
<td>Motion</td>
<td>Move sensor to a less active site or replace adhesive. Place a reflectance sensor on the forehead if the patient is not on a ventilator or in a Trendelenburg or supine position. Adjust averaging time on pulse oximeter if possible. Use Nellcor Oxismart® XL or Oxismart pulse oximetry technology if available.</td>
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<td>Nuisance Alarms</td>
<td>Nuisance alarms may be caused by short, clinically insignificant desaturations that cross the alarm threshold for very brief periods. Initiate SatSeconds™ Alarm Management feature, if available, to reduce these alarms. Use Nellcor Oxismart XL or Oxismart technology to reduce false alarms caused from motion artifact.</td>
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<td>Poor Perfusion</td>
<td>Use an adhesive digit sensor or apply an R-15 nasal sensor if the patient is immobile. Protect sensor site from heat loss or rewarm sensor site as permitted by hospital policy. Use Nellcor Oxismart XL or Oxismart technology if available.</td>
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<tr>
<td>Venous Pulsation</td>
<td>Position digit sensor at heart level. Avoid restrictive taping. Use care when interpreting SpO2 values in patients with elevated venous pressure.</td>
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<tr>
<td>Edema</td>
<td>Position the sensor on nonedematous application sites. Otherwise, the fluid in the edematous tissue may cause the light from the LEDs to scatter and affect the SpO2 readings.</td>
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<td>Light Interference</td>
<td>Cover the sensor with an opaque material in the presence of bright light sources, including direct sunlight, surgical lamps, infrared warming lamps and phototherapy lights.</td>
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<td>Nail Polish</td>
<td>Remove nail polish (especially browns, blue, green) or apply sensor to unpolished site.</td>
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<td>Intravascular Dyes</td>
<td>Use care when interpreting SpO2 values after injection of intravascular dyes, which may affect the reading.</td>
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<td>Dyshemoglobins</td>
<td>Dysfunctional hemoglobins such as carboxyhemoglobin or methemoglobin are unable to carry oxygen. SpO2 readings may appear normal; however, a patient may be hypoxic because less hemoglobin is available to carry oxygen. Further assessment of oxygenation beyond pulse oximetry is recommended.</td>
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<tr>
<td>Anemia</td>
<td>Anemia causes decreased arterial oxygen content. Although SpO2 readings may appear normal, an anemic patient may be hypoxic. The pulse oximeter may fail to provide an SpO2 if hemoglobin levels fall below 5 gm/dl. Correcting anemia can improve arterial oxygen content.</td>
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