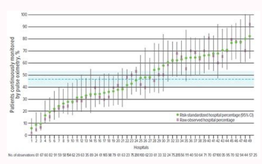
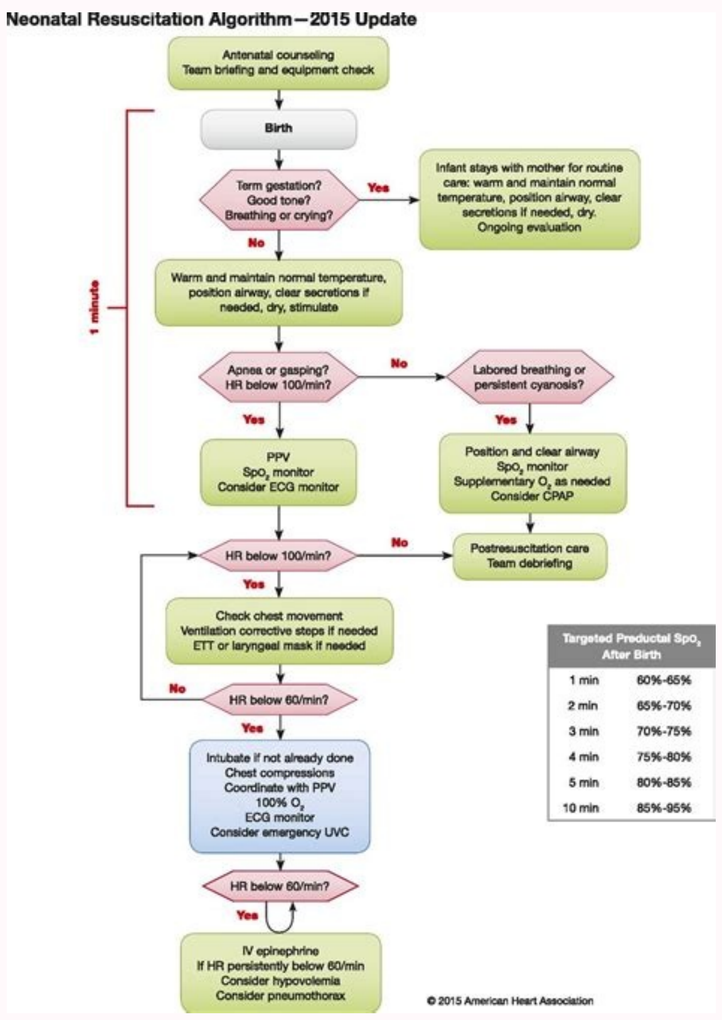
Pulse oximetry procedure pdf





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The pulse oximeter is used to measure the oxygen level (oxygen saturation) of the blood. A pulse oximeter is useful for estimating blood oxygen levels. It uses light beams to estimate the oxygen saturation of the blood and the pulse rate. Oxygen saturation gives information about the amount of oxygen carried in the blood. The pulse oximeter can estimate the amount of oxygen in the blood without having to draw a blood sample. The government shared a step-by-step guideline on how to use the pulse oximeter on its Twitter handle. Oximeter plays a role only in giving a clue that the patient is otherwise normal, but he has a sudden drop in the oxygen level.Take a look here at the step-by-step guide to use a pulse oximeter.Here is how to use a Pulse Oximeter: Step 1: Remove any nail polish/false nails & warm your hand if cold.Step 2: Rest for at least 5 minutes before taking your measurement.Step 3: Rest your hand on your chest at heart level & hold it still.Step 4: Switch on the oximeter & place it on your middle or index finger.Step 5: The reading takes time to steady, Keep the oximeter in place for at least a minute or longer if the reading is not stable.Step 6: Record the highest result once it has not changed for 5 seconds.Step 7: Identify each reading carefully.Step 8: Start recording from baseline & record three times a day at the same time. Take extra measures if you feel a change in your health.Note: Call 1075 if you:Feel seriously ill.Are unable to complete short sentences, while resting, due to breathlessness.Your oxygen level is 92% or less.The pulse oximeter is used to measure the oxygen level (oxygen saturation) of the blood. But do you know how does it work? Take a look! #IndiaFightsCorona pic.twitter.com/YATOaH8hIq— MyGovIndia (@mygovindia) April 24, 2021READ: What is KN95 mask, check details here last modified on: Tue, 10/03/2017 - 22:30 return to: Pulse Oximetry common misconceptions regarding use IntroductionPulse oximetry is considered by some as the '5th' vital sign.The pulse oximeter gives a rapid estimation of the peripheral oxygen saturation, providing valuable clinical data in a very efficient, non-invasive and convenient manner. Figure 1: An example of one type of pulse oximeter (By Teutotechnik, Med. Produktions- und Vertriebs-GmbH, Niedersachsenstr. 7,49186 Bad Iburg ([GFDL (or CC-BY-SA-3.0 ( ], via Wikimedia Commons)BackgroundHemoglobin (Hb) exhibits positive cooperativity.When one O2 molecule binds to one of hemoglobin's four binding sites, the affinity to oxygen of the three remaining available binding sites increases; i.e. oxygen is more likely to bind to a hemoglobin bound to one oxygen than to an unbound hemoglobin.This property results in a sigmoidal oxygen dissociation curve allowing for more rapid loading of oxygen molecules in oxygen rich environments (i.e. alveolar capillaries of the lungs) and easier offloading in oxygen-deficient environments (i.e. metabolically active tissues). Figure 2: Animation demonstrating the oxygenated and deoxygenated configuration of Hb molecule.(By en:User:BerserkerBen (Uploaded by Habj) [GFDL (or CC-BY-SA-3.0 ( ], via Wikimedia Commons)Hemoglobin is composed of 4 subunits (2 alpha, 2 beta in adults) and exists in two forms: Taut (T): deoxygenated form with low affinity for O2, therefore it promotes release/unloading of O2. Relaxed (R): oxygenated form with high affinity for O2, therefore oxygen loading is favored. T and R configurations lead to different electromagnetic absorption and therefore different emission of light.Oximeters operate based on this principle of different absorption and light emission of the T and R configurations. The oximeter utilizes an electronic processor and a pair of small light-emitting diodes (LEDs) facing a photodiode through a translucent part of the patient's body, usually a fingertip or an earlobe.One LED is red, with wavelength of 660 nm, and the other is infrared with a wavelength of 940 nm.Absorption of light at these wavelengths differs significantly between blood loaded with oxygen and blood lacking oxygen.Oxygenated hemoglobin absorbs more infrared light and allows more red light to pass through.Deoxygenated hemoglobin allows more infrared light to pass through and absorbs more red light.Figure 3: Oxy and Deoxy Hemoglobin AbsorptionThe LEDs sequence through their cycle of one on, then the other, then both off about thirty times per second. The amount of light that is transmitted (in other words, that is not absorbed) is measured.These signals fluctuate in time because the amount of arterial blood that is present increases (literally pulses) with each heartbeat. By subtracting the minimum transmitted light from the peak transmitted light in each wavelength, the effects of other tissues is corrected for allowing for measurement of only the arterial blood. The ratio of the red light measurement to the infrared light measurement is then calculated by the processor (which represents the ratio of oxygenated hemoglobin to deoxygenated hemoglobin). This ratio is then converted to SpO2 by the processor via a lookup table based on the Beer–Lambert law.Photoplethysomography: An important tool for any SpO2 reading is plethysmography tracings or "pleth" which is a measure of volumetric changes associated with pulsatile arterial blood flow. Inconsistent or distorted pleth may result in changes to the computer calculated value resulting in artificially HIGH or LOW SpO2 reading.Therefore, plethysomography ensures reliability of the calculated oxygen saturation. Figure 4: Representative PPG taken from an ear pulse oximeter. Variation in amplitude are from Respiratory Induced Variation.(Spl4 [Public domain or Public domain], via Wikimedia Commons) Interpretation TipsAlways evaluate plethysomograph in conjunction with SpO2 readings to ensure reliability. The oxygen saturation as determined by the oximeter is calculated using the ratio of Oxy-Hb/Deoxy-Hb. This is a useful piece of data to determine whether a patient is able to transfer oxygen into the bloodstream, however 100% saturation on the oximeter does not guarantee that tissues are sufficiently oxygenated.Hemoglobin can normally bind approximately 1.34 mL of O2/g Hb and a normal Hb of 15 g/dL making the O2 binding capacity approximately 20 mL O2/dL blood if 100% saturation. When the concentration of Hb is decreased, there is a decrease in total O2 content of the blood, but no change in the O2 saturation, hence oximetry is not an effective test to evaluate for anemia. For example, in a patient with normally functioning hemoglobin, but with a Hb concentration of 8 g/dL the O2 binding capacity is approximately 10.7 mL O2/dL. Essentially half of the amount of oxygen is being delivered, but the oximeter reading may still read 100%. Similarly, if a patient has abnormal hemoglobin molecules, such as in the case of sickle cell anemia where the oxygen dissociation curve is right-shifted, pulse oximetry is a poor measure of hypoxemia and may lead to over diagnosis and over treatment.Therefore, arterial blood gas determination of PaO2 and SaO2 is much more accurate in patients with abnormal hemoglobin dissociation curves. Pulse oximeters are often applied to areas of thin skin such as an ear lobe or finger tip.Fingernail polish and even different types of skin pigmentation may skew pulse oximeter results. In a patient with carboxyhemoglobin (i.e. carbon monoxide poisoning) or methemoblobinemia (i.e. hemoglobin with an oxidized iron atom resulting in increased O2 binding and reduced unloading), this abnormally bound hemoglobin has similar absorption spectrum as when O2 is bound in the R configuration.Therefore, the pulse oximeter may report a high saturation due to the large number of hemoglobin in the R configuration, but in reality the tissues are not receiving sufficient oxygen. SummaryPulse oximetry is a valuable non-invasive tool that provides data regarding the percentage of hemoglobin molecules loaded with oxygen in arterial blood in patients with normal oxygen-dissociation curves. Awareness of the value, nuances, and shortcomings of pulse oximetry will allow a clinician to better understand the true tissue oxygenation status of a patient and be better prepared for making treatment decisions. In patients with abnormal hemoglobin structure, abnormal hemoglobin levels, or hemoglobin abnormally bound to other molecules such as CO, pulse oximetry is not an accurate representation of oxygenation. Further ReadingJubran, A. (2015). Pulse oximetry. Critical Care, 19(1), 272. CJ, Goodman S, Clark K, Casella JF, Loughlin GM. Pulse Oximetry Is a Poor Predictor of Hypoxemia in Stable Children With Sickle Cell Disease. Arch Pediatr Adolesc Med. 2000;154(9):900–903. doi:10.1001/archpedi.154.9.900 Oxygen saturation, sometimes referred to as ‘‘the fifth vital sign,’’ should be checked by pulse oximetry in all breathless and acutely ill patients (British Thoracic Society, 2008). SpO2 and the inspired oxygen concentration should be recorded on the observation chart together with the oximetry result. The other vital signs of pulse, blood pressure, temperature, and respiratory rate should also be recorded in situations where supplemental oxygen is required. Pulse oximetry is a painless, non-invasive method to monitor SpO2 intermittently and continuously. The use of a pulse oximeter (see Figure 5.1) is indicated in patients who have, or are at risk for, impaired gaseous exchange or an unstable oxygen status. Figure 5.1 Pulse oximeter The pulse oximeter is a probe with a light-emitting diode (LED) that is attached to the patient’s finger, forehead, or ear. Beams of red and infrared light are emitted from the LED, and the light wavelengths are absorbed differently by the oxygenated and the deoxygenated hemoglobin (HgB) molecules. The receiving sensor measures the amount of light absorbed by the oxygenated and deoxygenated Hgb in the arterial (pulsatile) blood. The more HgB that is saturated with oxygen, the higher the SpO2, which should normally measure above 95%. Pulse oximeters have an indicator of signal strength (such as a bar graph, audible tone, waveform, or flashing light) to show how strong the receiving signal is. Measurements should be considered inaccurate if the signal strength is poor. Pulse oximeters will also indicate heart rate by counting the number of pulsatile signals. To ensure accuracy, count the patient’s pulse rate by taking the pulse and comparing it to the pulse rate shown on the pulse oximeter. Limitations The most common cause of inaccuracy with pulse oximeters is motion artifact. Patient movement can cause pulsatile venous flow to be incorrectly measured as arterial pulsations, thus producing an inaccurate oximetry and pulse-rate reading. Another common cause of inaccuracy is poor peripheral perfusion. Poor peripheral perfusion can be caused by conditions such as hypothermia, peripheral vascular disease, vasoconstriction, hypotension, or peripheral edema (Perry, Potter, & Ostendorf, 2014). A forehead probe can be used for patients with decreased peripheral perfusion. Conditions such as jaundice, as well as intravascular dyes and carbon monoxide in the blood, can also influence oximetry readings. Anemic patients with low Hgb may have a normal SpO2 reading, even though the available oxygen is not enough to meet the metabolic demands of the body. Patients with elevated bilirubin concentrations may also have falsely low SpO2 readings (Howell, 2002). Application of Pulse Oximetry If measuring SpO2 by attaching the probe to a finger or toe, check the radial or pedal pulse and capillary refill of the finger or toe you plan to use. If the patient’s extremities are cold, you could try to warm his or her hands in yours, or apply warm towels to improve perfusion. The patient’s finger or toe should be clean and dry. Check that the patient does not have artificial nails or nail polish, as both will influence the light transmission and should, therefore, be removed before applying pulse oximetry. Check that the probe is positioned properly so that optical shunting (when light from the transmitter passes directly into the receiver without going through the finger) does not occur. Bright ambient light may also affect the accuracy of pulse oximetry readings. Hazards of Pulse Oximetry Pulse oximetry is generally considered to be a safe procedure. However, tissue injury may occur at the measuring site as a result of probe misuse. Pressure sores or burns are possible effects of prolonged application (>2 hours). You are checking your patient’s SpO2 but the signal strength on the pulse oximeter is poor. What would be your next steps? Your patient has been admitted with a diagnosis of carbon monoxide poisoning with an SpO2 of

98%. What does this reading tell you?

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