Pulse oximeters measure the absorption of red and infrared light by pulsatile

Oxygenated blood absorbs light at 660nm (red light), whereas deoxygenated blood absorbs light preferentially at 940nm (infra-red). Pulse oximeters consist of two light emitting diodes, at 600nm and 940nm, and two light collecting sensors, which measure the amount of red and infra-red light emerging from tissues traversed by the light rays. The relative absorption of light by oxyhemoglobin (HbO) and deoxyhemoglobin is processed by the device and an oxygen saturation level is reported. The device directs its attention at pulsatile arterial blood and ignores local noise from the tissues. The result is a continuous qualitative measurement of the patients oxyhemoglobin status. Oximeters deliver data about pulse rate, oxygen saturation (SpO_2) and even cardiac output. They are, however, far from perfect monitors.

The use of pulse oximeters is limited by a number of factors: they are set up to measure oxygenated and deoxygenated haemoglobin, but no provision is made for measurement error in the presence of dyshemoglobin moieties – such as carboxyhemoglobin (COHb) and methemoglobinemia. COHb absorbs red light as well as HbO, and saturation levels are grossly over-represented. Arterial gas analysis or use of co-oximetery is essential in this situation. Co-oximeters measure reduced haemoglobin, HbO, COHb and methemoglobin. Abnormal movement, such as occurs with agitated patients, will cause interference with SpO_2 measurement. Low blood flow, hypotension, vasoconstriction and hypothermia will reduce the pulsatility of capillary blood, and the pulse-oximeter will under-read or not read at all. Conversely, increased venous pulsation, such as occurs with tricuspid regurgitation, may be misread by the pulse-oximeter as arterial blood, with a low resultant reading. Finally, it is generally accepted that the percentage saturation is unreliably reported on the steep part of the oxyhemoglobin dissociation curve. While the trend between the SaO_2 (arterial saturation) and SpO_2 appears accurate, the correlation between the two numbers is not. Thus a drop in the SpO_2 below 90% must be considered a significant clinical event.