Accuracy of pulse oximeters in measuring oxygen saturation in patients with poor peripheral perfusion: a systematic review

One of the most significant limitations of oximeters is their performance under poor perfusion conditions. This systematic review examines pulse oximeter model accuracy in adults under poor perfusion conditions. A multiple database search was conducted from inception to December 2020. The inclusion criteria were as follows: (1) adult participants (> 18 years) with explicitly stated conditions that cause poor peripheral perfusion (conditions localized at the oximeter placement site; or systemic conditions, including critical conditions such as hypothermia, hypotension, hypovolemia, and vasoconstricting agents use; or experimental conditions) (2) a comparison of arterial oxygen saturation and arterial blood gas values. A total of 22 studies were included and assessed for reliability and agreement using a modified Guidelines for Reporting Reliability and Agreement Studies tool. We calculated the accuracy root mean square error from bias and precision we extracted from the studies. Most oximeters (75%) were deemed accurate in patients with poor perfusion. Modern oximeters utilizing more complex algorithms were more likely to be accurate than older models. Earlobe placement of oximeters seemed more sensitive, with greater measurement accuracy, than on fingertip placement. Only one study controlled for skin pigmentation, and none strictly followed Food and Drug Association recommendations for experiments to determine oximeter accuracy. Oximeters are accurate in poorly perfused patients, especially newer oximeter models and those placed on earlobes. Further studies are needed that examine multiple oximeter models used on a diverse selection of patients while following FDA recommendations to examine oximeter accuracy.