Monitoring Carbon Dioxide Tension and Arterial Oxygen Saturation by a Single Earlobe Sensor in Patients with Critical Illness or Sleep Apnea.

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Objectives

The purpose of the study was to evaluate a novel, combined sensor for transcutaneous monitoring of arterial oxygen saturation and carbon dioxide tension.

Methods

Design: The new monitoring technique was compared to established reference methods.
Setting: ICU and sleep laboratory of a university hospital.
Patients: Eighteen critically ill adult patients with acute respiratory failure or heart failure, and 12 patients with sleep apnea (mean [+/- SD] apnea/hypopnea index, 43 +/- 24 events per hour).
Measurements: Continuous measurements were performed over several hours by the novel heated (temperature, 42 degrees C) earlobe sensor (TOSCA; Linde Medical Sensors; Basel, Switzerland), incorporating electrochemical and optical elements for carbon dioxide measurement (PtcCO2) and pulse oximetry (SpO2), respectively. The data were compared to the results of repeated arterial blood gas analyses in critically ill patients and to simultaneous nocturnal pulse oximetry performed with different devices with earlobe or finger sensors in sleep apnea patients.

Results

In critically ill patients, the mean difference and limits of agreement (bias +/- 2 SDs) of transcutaneous PtcCO2 vs arterial PaCO2 were 3 +/- 7 mm Hg; the corresponding values for changes in PtcCO2 vs PaCO2 were 1 +/- 6 mm Hg. The bias +/- 2 SDs for pulse oximetric SpO2 vs arterial oxygen saturation (SaO2) were 1 +/- 4%. In sleep apnea patients, the combined earlobe sensor identified more transient oxygen desaturations, and the rate of change in oxygen saturation during events was greater compared to those with other tested pulse oximeters, indicating a faster response.

Conclusions

Due to its ability to accurately assess both ventilation and oxygenation by a single transcutaneous sensor, the described noninvasive monitoring technique is a valuable tool for respiratory monitoring with potential applications in critical care and sleep medicine.