Estimation of Respiration Dependent Pao2 Oscillations by Measurement of Spo2 Oscillations in Pigs

Bodenstein M., Boehme S., Graybeal J., Wang H., Markstaller K. *Anesthesiology* 2008; 109 A1691

Introduction

High oscillations of the arterial PO2 during artificial ventilation reflect cyclic recruitment of atelectasis in animal models of ARDS. A non-invasive, bedside measurement technique like pulse oximetry could be of interest in order to depict cyclic recruitment of atelectasis non-invasively in mechanically ventilated patients. The aim of this report was (a) to develop a mathematical routine to calculate respiration cycle dependent changes of SpO2 into PaO2 and (b) to test the feasibility of this routine in an animal experiment.

Methods

(a) To compare both methods, a mathematical routine was adapted to calculate PaO2 oscillations using SpO2 values by adjustment of the species dependent oxygen-hemoglobin dissociation curve in accordance with temperature and acid-base state. (b) Therefore, and with IRB approval, three pigs with independent injury mechanisms (Surfactant depletion by lavage, oleic acid injury and pneumonia) were mechanically ventilated. Using a fluorescence quenching technique (Ocean Optics, Inc., USA), respiration dependent PaO2 oscillations were recorded when mean PaO2 reached values below 150 mmHg. Simultaneously SpO2 oscillations were measured by high resolution Fast Sat technology (Radical, Masimo, USA).

Results

The relative deviation between measured and calculated PaO2 oscillations in these subjects were: 10.6%, 12.3% and 32.1%.

Conclusion

In this feasibility study PaO2 oscillations could be estimated with adequate accuracy using SpO2 measurements. Systematic validation studies are required to evaluate the use of pulse oximetry as a non-invasive method to detect cyclic recruitment in patients of risk to ventilator associated lung injury.