

Novel Concept of Measuring Percutaneous Oxygen Saturation Monitor during Cardio-Pulmonary Bypass.

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Introduction

In cardiac surgery with cardiopulmonary bypass (CPB), most anesthesiologists monitor oxygenation by arterial blood gas analysis (ABG) every 30 minutes only. CPB blood flow may not generate pulsations; therefore, pulse oximeters may not detect oxygenation (SpO₂) during the CPB period.

Methods

During cardiac surgical cases with CPB, we attached a blood pressure cuff on forearm right beneath the elbow with a small pump prototype (Oscillation Plus). It inflates and deflates the cuff alternately from 0 to 30-50 mmHg pressure at 0.6-1Hz. Each patient had a cannula placed in a radial artery. During total bypass, this pump was activated. Then, fingertip SpO₂ was measured by a pulse oximeter (Masimo Radical). Comparison of the pulse oximeter SpO₂ to the CPB device ABG (C-SO₂) and radial artery ABG (R-SO₂) was made every 30 minutes.

Results

We studied 10 patients. SpO₂ was undetectable if the prototype pump did not stimulate the finger during CPB. With stimulation by Oscillation Plus, these pulse oximeters showed a plethysmographic waveform, pulse rate and blood oxygen saturation value during CPB. Plethysmographic waveform shapes were altered due the Oscillation Plus. Pulse rate was coincidence with oscillations of the pump or multiples thereof. At the point of blood sampling, the SpO₂, C-SO₂, R-SO₂ values showed 99.2 ± 1.03 , 99.66 ± 0.33 and 99.78 ± 0.28 (period of after the initiation of CPB), 99.6 ± 0.52 , 99.69 ± 0.31 and 99.83 ± 0.25 (period of during CPB), 99.7 ± 0.67 , 99.87 ± 0.21 and 99.75 ± 0.36 (period of just before coming off CPB), respectively.

Conclusion

Sampling of ABG every 30 minutes is not sufficient risk management during CPB. This technique has the possibility of non-invasive continuous oxygenation monitoring during CPB.

Comparison of the pulse oximeter SpO₂ to the CPB device ABG (C-SO₂) and radical artery ABG (R-SO₂) on each period.

	SpO ₂ (%)	C-SO ₂ (%)	R-SO ₂ (%)	Temp. (°C)
period of after the initiation of CPB	99.2±1.03	99.66±0.33	99.78±0.28	35.85±1.25
period of during CPB	99.6±0.52	99.69±0.31	99.83±0.25	29.6±2.54
period of just before coming off CPB	99.7±0.67	99.87±0.21	99.75±0.36	32.16±2.99

All data are expressed by mean (n=10) ± S.D. All difference between each data is not significant (n.s.). Temp. indicated finger tip temperature.

Figure 1

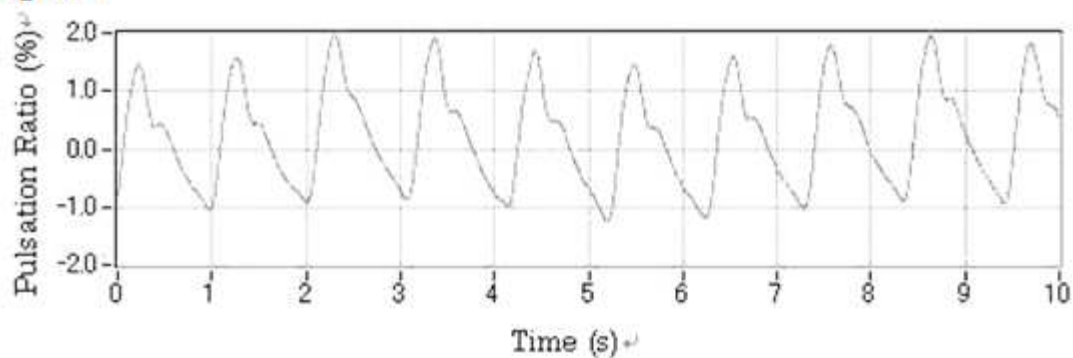


Figure 2

