

## **Reliability of Oxygen Saturation by Pulse Oximeter to Detect Hypoxemia of Patients in the Intensive Care Unit.**

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### **Introduction**

Pulse oximeter is generally used as a noninvasive monitor to alert respiratory dysfunction in the intensive care unit (ICU). SpO<sub>2</sub> (oxygen saturation by pulse oximeter / percutaneous oxygen saturation) are expected to be an indirect estimation of arterial oxygen saturation (SaO<sub>2</sub>). However, there often are gaps between SpO<sub>2</sub> and SaO<sub>2</sub>. In this study, we investigated the dissociation between SpO<sub>2</sub> and SaO<sub>2</sub> value of patients in the ICU, and examined whether SpO<sub>2</sub> can detect hypoxemia of patients in the ICU.

### **Methods**

We retrospectively evaluated 20717 arterial blood gas samples from 3120 patients who stayed in our ICU since January 2008 to December 2010. Data were excluded when SaO<sub>2</sub> were less than 85% or PaO<sub>2</sub> were higher than 100mmHg. We also excluded data from patients under 20 years of age. First, SpO<sub>2</sub> and SaO<sub>2</sub> values were compared by paired t-test. Second, we calculated the gaps between SaO<sub>2</sub> and SpO<sub>2</sub>. SaO<sub>2</sub> was analyzed by ABL 800 FLEX analyzer (Radiometer), and SpO<sub>2</sub> was sampled by Masimo SET LONPTM sensors. SpO<sub>2</sub> value was calculated as an average value of SpO<sub>2</sub> 0, 1, 2 and 3 minutes before blood sampling. The gaps between SpO<sub>2</sub> and SaO<sub>2</sub> were calculated as SpO<sub>2</sub> minus SaO<sub>2</sub>[SpO<sub>2</sub>- SaO<sub>2</sub>]. Third, we investigated serum lactic acid level measured simultaneously with SaO<sub>2</sub> level as a marker of hypoxia. Data are expressed as means ± SD.

### **Results**

A total of 8219 arterial blood gas samples from 1834 patients (1108 male and 726 female) were analyzed. SpO<sub>2</sub> was significantly higher than SaO<sub>2</sub> (97.4±2.4% v.s. 96.2±2.4%, p<0.05). The overall gaps between SpO<sub>2</sub>- SaO<sub>2</sub> [SpO<sub>2</sub>- SaO<sub>2</sub>] were 1.2±1.9. In the range of 85≤SaO<sub>2</sub><90%, 90≤SaO<sub>2</sub><92%, and 92≤SaO<sub>2</sub><95%, [SpO<sub>2</sub>-SaO<sub>2</sub>] were 3.5±4.2%, 2.7±3.1% and 2.1±2.1% (mean ± SD), respectively. 31% of patients with 90≤SpO<sub>2</sub><92% had hypoxemia (SaO<sub>2</sub><90%), and 5.6% of patients with 92≤SpO<sub>2</sub><95% had hypoxemia. Serum lactic acid levels measured simultaneously at 85≤SaO<sub>2</sub><90%, 90≤SaO<sub>2</sub><92%, and 92≤SaO<sub>2</sub><95% were 2.5±3.4, 2.2±3.3 and 1.9±2.6 mmol/L, respectively.

### **Discussion**

SpO<sub>2</sub> tended to show higher value than SaO<sub>2</sub>. This tendency was more apparent as SaO<sub>2</sub> decreased. These results suggest that keeping SpO<sub>2</sub> above 90% is not enough to avoid hypoxemia. As SpO<sub>2</sub><90% were associated with increased morbidity and mortality among outpatients with pneumonia compared with SpO<sub>2</sub><92%1), we suggest to keep SpO<sub>2</sub> above 92% to avoid hypoxemia in the ICU.

### **References**

Clin Infect Dis. 2011;52(3):325-31.