



**College of Intensive Care Medicine  
of Australia and New Zealand**

ABN: 16 134 292 103

**APPLICATION FOR FREE PAPER AND/OR POSTER PRESENTATION**  
**SUBMISSION 2012**

Name of the author (must be the first author):

Fatanah Suhaimi

Names of Co-authors:

J. Geoffrey Chase, Aaron Le Compte and Geoffrey M. Shaw.

Title of submission:

Assessing microcirculation function using a pulse oximeter.

**Abstract: Max 300 words in length – use 11pt font in Times Roman**

Sepsis patients normally suffer microcirculatory dysfunction, which results in organ failure and increased risk of death [1]. Importantly, microcirculatory distress is the only independent factor for predicting patient outcome if it is not treated within 48 hours [2]. Analyzing oxygen transport and utilization could potentially yield insight on microcirculation function to improve sepsis diagnosis.

A pulse oximeter is used to extract information on the absorption of red (R) and infrared (IR) light. The IR signal is related to the overall blood volume, (HbO<sub>2</sub> + Hb) and the R signal is related to the amount of reduced hemoglobin, (Hb). Differences between these two signals, measured in real-time, thus represent the amount of oxygenated hemoglobin, HbO<sub>2</sub> and can be used to estimate microcirculation function and extraction.

Healthy individuals participated in vascular occlusion tests (VOT, N=15) and physical exercise (PE, N=10), respectively. These tests artificially create changes in extraction, and are used to prove the concept. This study was approved by the University of Canterbury Human Ethics Committee, Christchurch, New Zealand.

In VOT, both red (R) and infrared (IR) signals rapidly decreased during vascular occlusion since less blood flows into the occluded area. During ischemia, the IR signals are almost constant and both the R and IR signals immediately increased after the occlusion is release, as a large amount of blood flows into the occluded area.

Median oxygen extraction increases from 39% during rest to 46.5% during following intense exercise. For further (repeated) PE tests yielded extraction of 45%, 44.2%, 45.5% and 44.2%. However, the increased rate varies across subjects showing significant inter-subject variability.

The pulse oximeter sensor concept presented is capable of extracting valuable information to assess microcirculation condition. Implementing this concept on ICU patients has the potential to aid sepsis diagnosis and provide more accurate tracking of patient state, sepsis status and response to treatment.

[1] P. E. Spronk, D. F. Zandstra, and C. Ince. Bench-to-bedside review: sepsis is a disease of the microcirculation. *Crit Care*, 8:462–468, Dec 2004.

[2] Y. Sakr, M. J. Dubois, D. De Backer, J. Creteur, and J. L. Vincent. Persistent microcirculatory alterations are associated with organ failure and death in patients with septic shock. *Crit. Care Med.*, 32:1825–1831, Sep 2004.