EQUIPMENT AND MONITORING III — OXYGEN MEASUREMENT

A404

TITLE: PERFORMANCE OF A LUMINESCENT SENSOR FOR CONTINUOUS ARTERIAL PaO2 MEASUREMENT

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Introduction. Continuous intravascular blood gas analysis has been accomplished by a method of luminescent quenching. Miniature optical sensors, consisting of glass fibers coated with optically active materials, become quantitatively interactive with oxygen when pulsed with ultraviolet light. In this abstract, we present the in vivo performance data of an intravascular phosphorescent probe for the real-time measurement of intraarterial blood oxygen tension.

Methods. 10 fiberoptic sensors (0.2mm O.D.) were passed to extend 3 millimeters beyond a 20 gauge angiocatheter placed percutaneously into the femoral arteries of 6 average weight anesthetized dogs. A total of 670 paired comparisons were made between sensor derived (Bard ABG 100 System, C.R. Bard, Inc., Tewksbury, MA) and arterial blood gas (ABG) derived (Corning 168 Blood Gas Analyzer, Medfield, MA) PaO2. Sensor PaO2 was compared to tonometry referenced (IR-237, Lexington, MA) ABG's with the use of correlation, bias (absolute difference of the means between sensor and ABG) and precision (standard deviation of the bias) statistics.

Results. Regression analysis showed excellent correlation (Y=0.98*X + 0.87, r=0.95, p<0.001) between sensor and ABG PaO2 values over a range of 57 to 142 mmHg. Bias ± precision values pooled for the entire range of measurement were -0.79 ± 4.25 mmHg. 85% (573/670) of the sensor derived PaO2 values were within ±5% of blood gas results; and 98% (655/670) of sensor derived PaO2 values were within ±10% of blood gas results.

Comment. This study shows that luminescent quenching is an accurate and feasible means of determining intravascular oxygen tension.


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TITLE: EFFECTS OF DEFAULT ALARM LIMIT SETTINGS ON ALARM DISTRIBUTION IN TELEMETRIC PULSE OXIMETRY NETWORK IN WARD SETTING

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Telemetric Pulse Oximetry Network (TPON) may improve the quality of care in the ward by monitoring patients with potential hypoxemia risk. The high incidence of alarms (both true and false alarms) may have prevented widespread applications. This study was designed to collect and analyze the frequency and duration of both true and false alarms in TPON, and also to study the effect of different default alarm limit settings on the frequency and duration of alarms.

After Institutional Review Board approval, informed consent was obtained from 43 post-caesarean section patients. Each patient was monitored by TPON for 24 hours post-operatively in the ward. Oxygen saturation (SpO2), heart rate and plethysmographic data were collected every 10 sec via TPON. A computer algorithm was designed to extract false alarms and categorize true alarms resulting from different default SpO2 alarm limits of <96%, <94%, <92%, <90%, <88%, <86% and <85%. The frequency and associated duration of false alarms were shown in fig. 1. The effects of different default SpO2 alarm limit settings on the frequency and duration of alarms were summarized in fig. 2. The differences in alarm frequencies among different default SpO2 alarm limit settings were statistically significant (P<0.05) by un-paired t-test. The maximum frequency of false alarms was 87 times/24hr/patient, but 88% of the false alarms lasted less than 60 sec. Incorporating a 60 sec wait-period can eliminate 88% of the false alarms. By lowering SpO2 alarm limit from <96% to <90% and simultaneously incorporating a 60 sec wait-period, the maximum frequency of alarms was reduced from 324 to 4 alarms/24hrs/patient.

This study has shown the distribution of false alarms and true alarms and how the default SpO2 alarm limit settings affect the frequency and duration of alarms in TPON. Our data has provided a rational basis for setting default alarm limits to decrease false alarms and insignificant alarms for TPON in the ward setting.

Fig. 1 Frequency of False Alarms in TPON in the Ward

Fig. 2 Maximum Frequency of Alarms and its Duration in TPON