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Oesophageal Pulse Oximetry: A New Monitoring Site

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Introduction

Pulse oximeter probes placed peripherally may fail to give accurate values of arterial blood oxygen saturation (SpO₂) when peripheral perfusion is poor. Since central blood flow may be preferentially preserved, the oesophagus was investigated as an alternative monitoring site.

Methods

A miniature opto-electronic reflectance pulse oximetry probe was constructed to allow SpO₂ measurements within the whole depth of the oesophagus [1]. A processing system was developed to detect and display the oesophageal photoplethysmographic (PPG) signals on a laptop computer. Software was implemented in *LabVIEW* to make continual estimations of oesophageal SpO₂. The system was evaluated on clinical measurements performed on 50 critically ill patients undergoing thoracic surgery, mainly cardiothoracic bypass. Oesophageal SpO₂ values were systematically compared with both conventional finger SpO₂ measurements and arterial blood oxygen saturation (SaO₂) values obtained from laboratory blood analysis.

Results

It was found that the oesophageal pulse oximeter was in good agreement with SaO₂ measurements obtained by a blood gas analyser and a CO-oximeter and with SpO₂ values from a commercial finger pulse oximeter. The means (\pm SD) of the differences between the oesophageal SpO₂ and SaO₂ results from blood gas analysis and CO-oximetry were $0.02 \pm 0.88\%$ and $-0.73 \pm 0.72\%$, respectively. A Bland and Altman statistical analysis showed that the oesophageal and finger pulse oximeters agreed sufficiently to allow them to be used interchangeably. In five patients SpO₂ readings from the commercial finger pulse oximeter probe failed for at least ten minutes while the oesophageal readings remained stable and reliable.

Conclusion

The results from the clinical measurements suggest that oesophageal pulse oximetry may be used as an alternative for patients with compromised peripheral perfusion.

References

[1] Kyriacou, PA, Moye, AR, Choi, DMA, Langford, RM, and Jones, DP. A system for investigating oesophageal photoplethysmographic signals in anaesthetised patients. *Med. & Biol. Eng. & Comput.*, 1999; 37: 639-43