Photoplethysmographic signals recorded from human abdominal organs using a fibre-optic probe

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There is a need for reliable continuous monitoring of visceral organ oxygen saturation (SpO_2) [1]. Splanchnic ischaemia may contribute to the development of multiple organ failures and increased mortality [2]. In an attempt to develop a suitable abdominal pulse oximeter we have recorded photoplethysmographic (PPG) signals from various abdominal organs to determine their suitability for pulse oximetry.

We constructed a reflectance fibre optic PPG probe. A transmitting fibre illuminated the tissue (using two wavelengths) and backscattered light from the tissues was returned to a photodetector via the detecting fibre. Ethics Committee approval has been obtained to study healthy adults undergoing elective laparotomy. The PPG probe was held for two minutes at each abdominal organ such as the bowel, liver, stomach and kidney. For comparison purposes an identical fibre optic PPG probe was also placed on the finger or toe. Both probes were connected to an electrically isolated processing system, with identical gain for each channel, and signals were displayed on a computer.

Figure 1 shows PPG traces obtained from the liver with the PPG amplitude approximately twice the simultaneous toe PPG. PPG's of good quality were obtained from all investigated organs.

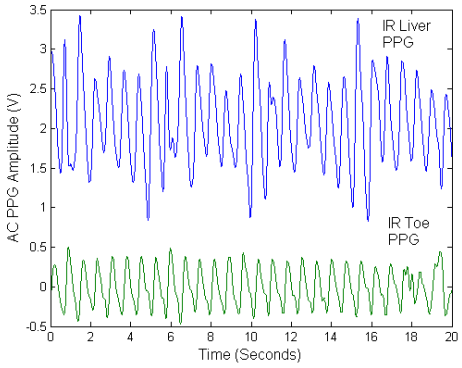

Figure 1: Infrared PPG Traces for the liver and toe

The red and infrared wavelengths used are suitable for pulse oximetry and the PPG amplitudes from the abdominal organs are consistently of good quality and of similar amplitude than those obtained from the extremity. Therefore, the new developed fibre optic PPG probe may well be suitable to estimate arterial oxygen saturation of abdominal organs.

1. Crerar-Gilbert AJ, Kyriacou PA, Jones DP and Langford RM. Anaesthesia 2002; 57: 442-445
2. Jury of the Consensu. Intensive Care Med 1996; 22: 1250-1257

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