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Citation: Moye, A. R., Kyriacou, P. A., Gregg, A., Jones, D. P. & Langford, R. M. (1999). Photoplethysmographic (PPG) signals recorded from the human oesophagus. *British Journal of Anaesthesia*, A-57,

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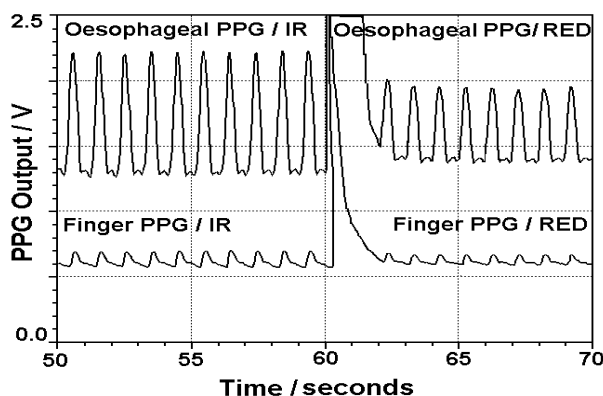
TITLE: PHOTOPLETHYSMOGRAPHIC (PPG)
SIGNALS RECORDED FROM THE HUMAN
OESOPHAGUS

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Background and Goal of study: Although a major advance in clinical monitoring, pulse oximetry may fail when peripheral perfusion is poor (1). Measurement of arterial oxygen saturation (SpO₂) at the cricopharyngeus has been attempted in anaesthetised patients, but readings varied with the orientation of the probe (2), and suffered from signal failure (3). We have recorded PPG signals from the lower oesophagus to determine optimal recording depth and signal quality.

Materials and Methods: We constructed a reflectance PPG probe using miniaturised light emitters, with peak emission wavelengths at 880nm (infra-red) and 655nm (red), and a photo-detector. These were mounted on a thin circuit board, which fits into a conventional 20 French gauge disposable transparent stomach tube. With Ethics Committee approval, we studied 20 healthy adults undergoing elective surgery, for which general anaesthesia included tracheal intubation. The PPG probe was inserted into the oesophagus at the time of direct laryngoscopy, and an identical probe placed on a finger. Both were connected to an electrically isolated processing system, with identical gain for each channel, and signals were displayed on a computer.



Results and Discussion: The example illustrated shows PPG traces with the oesophageal amplitude approximately six times greater than the simultaneous finger PPG. The artefact in the centre is due to switching between wavelengths. In all patients we were able to obtain oesophageal PPG's of good quality. For the majority, PPG signals of large amplitude were recorded at depths of 20, 25 and 30cm from the incisor teeth.

Conclusion: The red and infrared wavelengths used are suitable for pulse oximetry and the amplitudes of the oesophageal PPGs are consistently larger than those obtained from the finger. Therefore, the lower oesophagus may well provide more reliable SpO₂ monitoring in patients with poor peripheral circulation than upper oesophageal or peripheral placement.

References: 1: Reich DL *et al*: *Anesthesiology* 1996; **84**: 859-864. 2: Atlee JL, Branatow N: *Anesthesiology* 1995; **83**: A455. 3: Prielipp RC *et al*: *Anesthesiology* 1996; **85**: A485.

Acknowledgement: The authors thank the Joint Research Board of St. Bartholomew's Hospital for financial support.