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Abstract

Assessment of surgical stress during general anaesthesia

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BACKGROUND
Inadequate analgesia during general anaesthesia may present as undesirable haemodynamic responses. No objective measures of the adequacy of analgesia exist. We aimed at developing a simple numerical measure of the level of surgical stress in an anaesthetized patient.

METHODS
Sixty and 12 female patients were included in the development and validation data sets, respectively. All patients had elective surgery with propofol–remifentanil target controlled anaesthesia. Finger photoplethysmography and electrocardiography waveforms were recorded throughout anaesthesia and various waveform parameters were extracted off-line. Total surgical stress (TSS) for a patient was estimated based on stimulus intensity and remifentanil concentration. The surgical stress index* (SSI) was developed to correlate with the TSS estimate in the development data set. The performance of SSI was validated within the validation data set during and before surgery, especially at skin incision and during changes of the predicted remifentanil effect-site concentration.

RESULTS
SSI was computed as a combination of normalized heart beat interval (HBInorm) and plethysmographic pulse wave amplitude (PPGAnorm): SSI = 100–(0.7*PPGAnorm+0.3*HBInorm). SSI increased at skin incision and stayed higher during surgery than before surgery; SSI responded to remifentanil concentration changes and was higher at the lower concentrations of remifentanil.

CONCLUSIONS
SSI reacts to surgical nociceptive stimuli and analgesic drug concentration changes during propofol–remifentanil anaesthesia. Further validation studies of SSI are needed to elucidate its usefulness during other anaesthetic and surgical conditions.

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* Surgical stress index (SSI) is presently known as Surgical Pleth Index™ (SPI), and is not available in the U.S. and Canada.

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