

# 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-remifentanyl 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 remifentanyl 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 remifentanyl effect-site concentration.

## RESULTS

SSI was computed as a combination of normalized heart beat interval (HBI<sub>norm</sub>) and plethysmographic pulse wave amplitude (PPGA<sub>norm</sub>):  $SSI = 100 - (0.7 * PPGA_{norm} + 0.3 * HBI_{norm})$ . SSI increased at skin incision and stayed higher during surgery than before surgery; SSI responded to remifentanyl concentration changes and was higher at the lower concentrations of remifentanyl.

## CONCLUSIONS

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

Full article is available on the *British Journal of Anaesthesia* website <http://bj.oxfordjournals.org/content/98/4/447.full?sid=2a8a6158-1f97-43ea-b62e-481e90ae0137>

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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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