# Do parameters of skin conductance reflect both arousal and noxious stimuli during awakening after total intravenous anesthesia?

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## Background

The Stress Detector device based on the principles of skin conductance changes measures painful stimuli more specific and sensitive than heart rate and blood pressure because it measures directly sympathetic nerve activity (acetyl choline acting on muscarine receptors). The stress detector reacts immediately (1-2 sec delay). The stress detector therefore yields reliable results unaffected by heart disease, hypertension, lung disease and blood circulatory changes, as well as medications that influence the blood circulation.
Muscle relaxation does not influence the stress detector device (acetyl choline acting on nicotine receptors).
The Stress Detector device has been successfully used at preterm born infants, patients under general anaesthesia, artificially ventilated patients and at post operative pain to discover the noxious stimuli/pain in these patients (1,2,3,4,5,6).
The signals from the Stress Detector can be analysed to differentiate pain stimuli or lack of analgesics from awareness stimuli or lack of hypnotics (7).
Arousal after total intravenous anesthesia (TIVA) and intraoperative noxious stimuli have been reported to be detectable by monitoring of two parameters of skin conductance (SC), the number of fluctuations per second (NFSC) and the area under the SC curve (AUC).

## Aim

The aim of this comparative study of two investigations was to determine whether the calculated prediction probability (Pk) for SC parameters and BIS to distinguish between steady state anesthesia and awakening after TIVA is influenced by the timing of remifentanil cessation.

## Methods

Data of 50 TIVA (remifentanil/propofol) patients from two different investigations (25 patients each) was retrospectively compared: group Non-Remifentanil (NR): 25 subjects in whom remifentanil was ceased 10 minutes before the anticipated end of surgery, and group Remifentanil (R): a study in which remifentanil infusion was maintained until end of surgery.
Patients in both studies received propofol until end of surgery.
Pk-values for distinguishing steady state anesthesia (7.5 min before end of surgery) and awakening (at extubation) were calculated for NFSC, AUC and BIS for both studies.
In addition, values for SC parameters and BIS were compared between the groups at the two investigated time points (steady state anesthesia and extubation).

## Results

In group R, NFSC showed the highest Pk in distinguishing between "steady state anesthesia" versus "awake at extubation" (Pk NFSC 1.0, AUC 0.92, BIS 0.85).
In contrast, in group NR BIS distinguished best between the investigated clinical states (Pk BIS® 0.94, NFSC 0.55, AUC 0.55).
Pk values for NFSC and AUC were different between the two groups (PkD calculation, $p<0.001$), whereas the Pks for BIS were not significantly different.
Median values for NFSC and AUC were significantly different between the groups, but BIS values did not differ at the steady state anesthesia (table).

| | BIS steady state | BIS extubation | NFSC steady state | NFSC extubation | AUC steady state | AUC extubation |
|---|---|---|---|---|---|---|
| group NR | 41 (33-57) | 77 (68-85) | 0.2 (0-5.9) | 0.2 (0.2-0.55) | 0 (0-0.25) | 0.25 (0-1.0) |
| group R | 43 (41-53) | 59 (54-68) | 0 (0-0) | 0.17 (0.1-0.3) | 0 (0-0) | 1 (0.21-6.1) |
| P-value | 0.266 | 0.002 | 0.001 | 0.024 | 0.003 | <0.001 |

Wilcoxon Test, parameters given as median (25%-75% percentile)

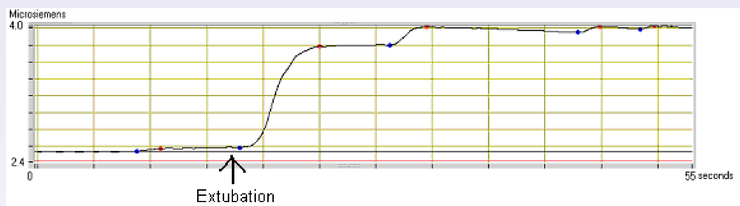


Fig. Skin conductance changes during emergence from surgery.

## Conclusions

In contrast to BIS, NFSC and AUC are significantly influenced by remifentanil. Early cessation of remifentanil before the end of surgery may lead to an impaired prediction probability of SC parameters to detect arousal.
The results suggest that SC parameters reflect both, analgesia and hypnosis, during awakening after TIVA.

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