Skin Conductance Response in ICU patients with various stressors: a case series

D.H.T. Tjan[1], R. Schellaars[1], J.H. Volders[1], H. Weda[2], M. Johnson[2]. M. Lubberding[2], E.O. Dijk[2], M. Ouwerkerk[2] , A.R.H. van Zanten[1].

[1] Department of Intensive Care, Gelderse Vallei Hospital and ACTOR in ICU collaborative Ede, The Netherlands.
[2] Philips Research, Eindhoven, The Netherlands

Introduction

Measuring stress levels in the ICU is not well defined and lacks reliable and valid methods of detection. ICU patients experience different kinds of stress like pain, dyspnoea, anxiety and general discomfort. Skin conductance has recently been shown to be a promising physiological indicator of pain assessment in the postoperative period and in premature and term infants. However, to our knowledge there are no case reports addressing skin conductance response (SCR) in ICU patients. We describe three cases of SCR with various stressors in an ICU setting.
A psychologist observed patients during SCR measurements. SCR was measured with a Nexus-10 physiological signals monitor.

Cases.

Case 1.

A 70-year old female was admitted to the ICU with severe sepsis (oligurie and hypotension) due to erysipelas of the right upper leg caused by a Group A Streptococcal infection. The skin lesions were erythematous, swollen, warm and very painful on palpation and movement. Numeric rating score (NRS) varied between 0 and 10. Patient was treated with flucloxacilline and received paracetamol as analgesic.
Figure 1 shows the SCR during movement of the infected leg. Values were low when patient was comfortable (NRS =0) and increased with pain on movement (NRS 8-10). Observations by the psychologist confirmed the physical distress and pain experienced by the patient during the same periods.

Case 2.

A 50-year old female was admitted after an autointoxication with 400 mg of clorazepate, 250 mg of promethazine and ten glasses of wodka. Blood alcohol level was 0.2 %. On admission she was comatose with a Glascow Coma Scale (GCS) of E2M3V2. Her vital signs were within normal limits.
Figure 2 shows the response after flumazenil 0.4 mg as an antidote for her benzodiazepine intoxication. She showed an immediate response, woke up and GCS improved to E4M6V4. SCR showed a significant increase after the flumazenil. Observation of the psychologist confirmed that patient woke up and was responsive. After 15 minutes the effects of flumazenil vanished and the patient fell asleep again which correlated with the decrease in SCR level and variability.

Case 3.

A 65-year old male was admitted with severe dyspnoea due to congestive heart failure. On arrival the patient was dyspnoeic, respiratory rate 30/min, oxygen saturation 88% with 15 liters of oxygen on a face mask. Bilateral crepitations were heard on auscultation.

Blood pressure was 180/100mmHg and heart rate 120/min. Intravenous nitrates and diuretics were given.
Figure 3 shows the SCR after initiation of non invasive positive pressure ventilation (NPPV). Clinically patient showed a positive response with a normalisation of the respiration rate and oxygenation and less discomfort due to dyspnoea, confirmed by the independent observer. Holding NPPV for nebulisation resulted in an increase of the work of breathing and a decrease in oxygen saturation. The observer confirmed that patient was clearly in more respiratory distress during this period.

Conclusions

These cases clearly demonstrate the potential of SCR monitoring as a valuable parameter for measuring different stressors in ICU patients. SCR increases with pain, wakefulness and dyspnoea. SCR might be a promising new tool for objective and continuous monitoring of stress, pain and anxiety in ICU patients.

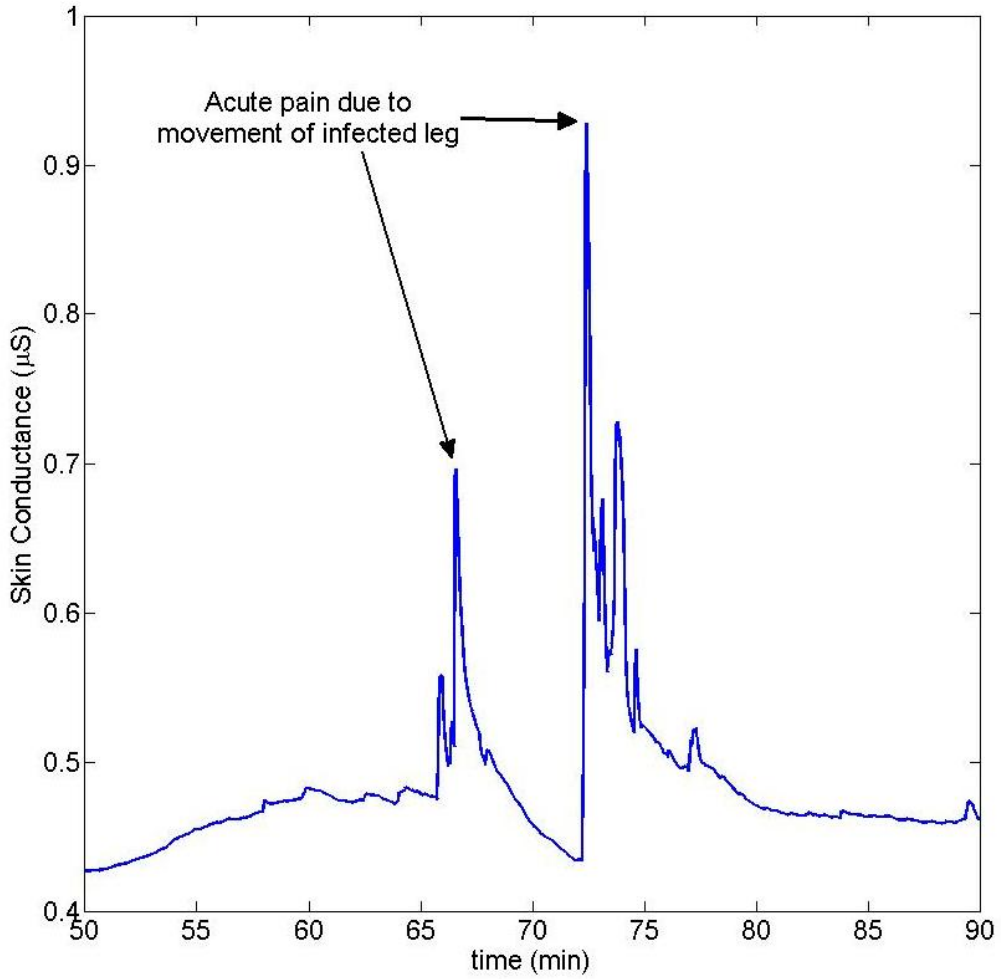

Figure 1: case 1 Pain on movement of infected leg

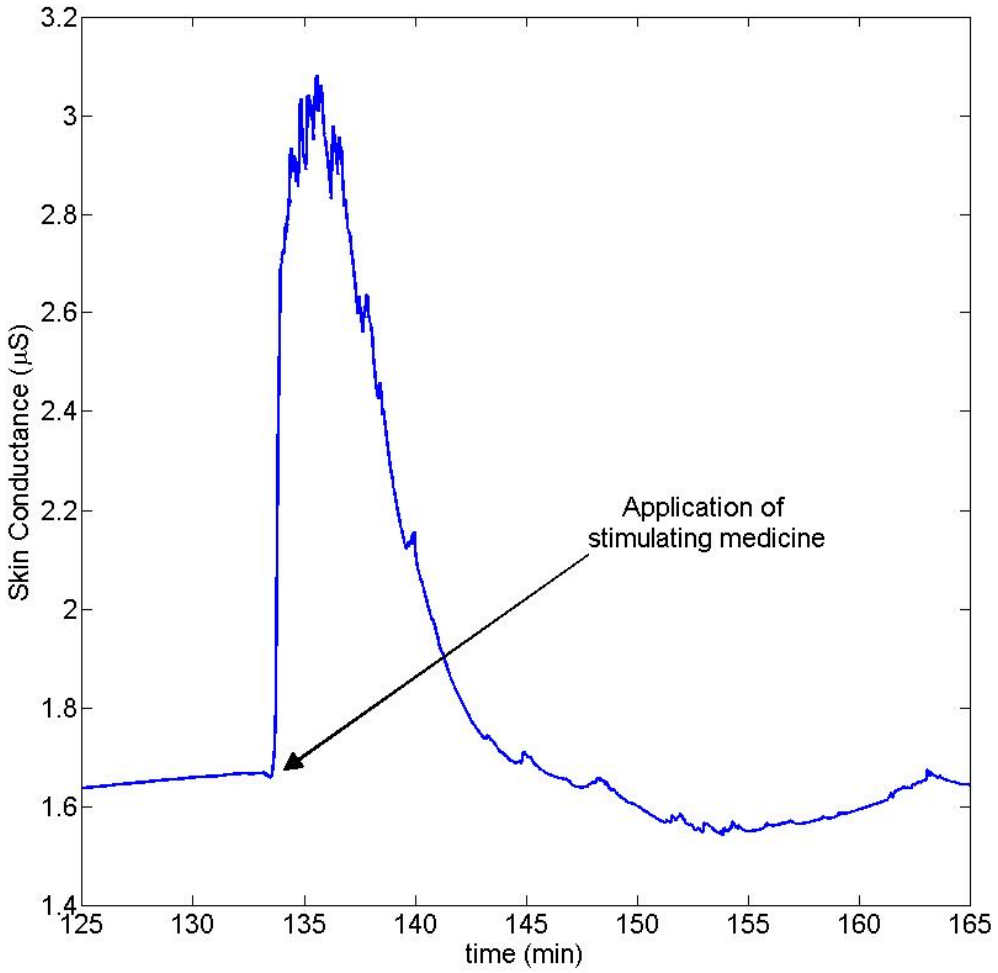

Figure 2: case 2 flumazenil administration

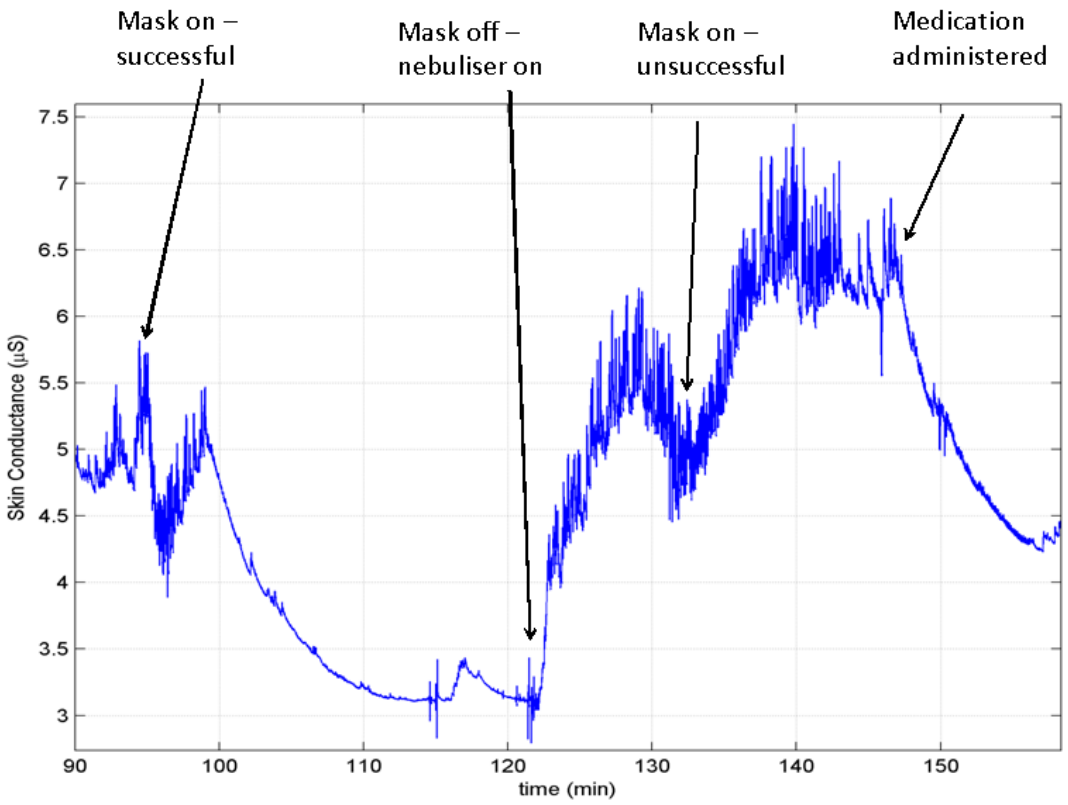

Figure 3: case 3 with non invasive positive pressure ventilation