

POSTER PRESENTATION

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# Relation of resting membrane polarization and insulin resistance in critically ill patients

S Koch<sup>1\*</sup>, T Wollersheim<sup>1</sup>, K Mai<sup>2</sup>, K Haas<sup>1</sup>, C Spies<sup>1</sup>, J Grosskreutz<sup>3</sup>, S Weber-Carstens<sup>1</sup>

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## Introduction

Critically ill patients feature depolarization of the resting membrane potential and reduced membrane excitability in motor nerve and muscle [1,2], which is correlated to ICU-acquired weakness and an increased insulin resistance [3].

## Objectives

Since insulin is one agonist of the Na-K-pump, controlling resting membrane potential in muscle and nerve, we hypothesized that insulin resistance is linked to motor nerve resting membrane depolarisation in critically ill patients.

## Methods

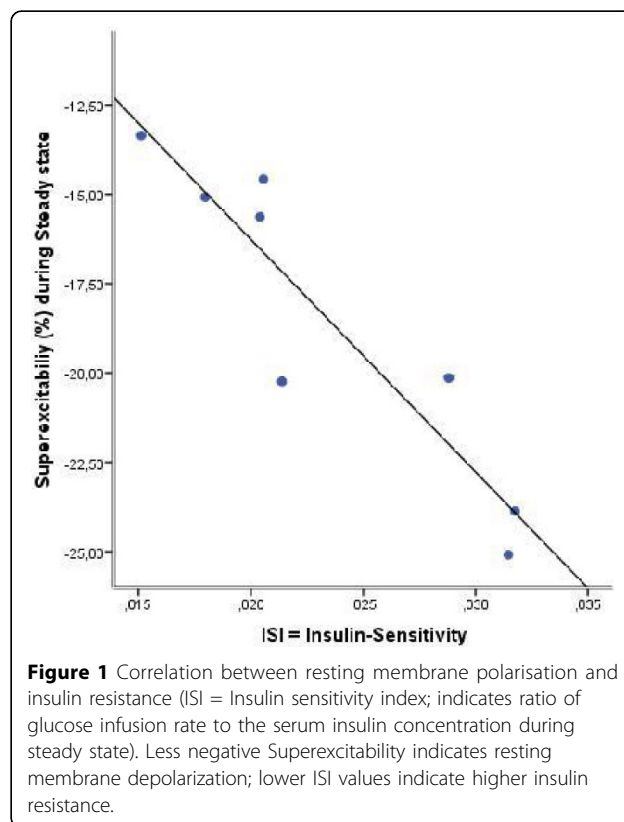
We recorded compound motor action potential from the abductor pollicis brevis muscle in ICU patients to test excitability measures of the median-nerve at baseline and during euglycemic-hyperinsulinemic clamp, proving resting membrane polarization. The recovery-of-excitability following a supra-maximal conditioning stimulus was tested at 18 conditioning test intervals, decreasing from 200 to 2 ms in geometric progression.

Insulin sensitivity index (ISI), as marker of myocellular insulin resistance, was calculated during steady state condition of euglycemic-hyperinsulinemic clamp.

## Results

10 ICU patients and 31 healthy controls were enrolled in this trial. Compared to control group, ICU-patients exhibited depolarization of resting membrane potential (superexcitability in healthy controls  $-25 \pm 6.1\%$  versus  $-18.5 \pm 4.5\%$  in ICU patients;  $p = 0.003$ ). The resting membrane depolarization was significantly correlated to

ISI ( $R^2 = 0.858$ ;  $p = 0.003$ ), where pronounced insulin resistance correlates with pronounced resting membrane depolarization (Figure 1), indicating that membrane repolarization after insulin stimulation of Na-K-pump is reduced in patients with severe insulin resistance. K<sup>+</sup> plasma levels were not correlated with membrane depolarization.



**Figure 1** Correlation between resting membrane polarisation and insulin resistance (ISI = Insulin sensitivity index; indicates ratio of glucose infusion rate to the serum insulin concentration during steady state). Less negative Superexcitability indicates resting membrane depolarization; lower ISI values indicate higher insulin resistance.

<sup>1</sup>Charité - Universitätsmedizin Berlin, Department of Anesthesiology and Intensive Care Medicine, Berlin, Germany  
Full list of author information is available at the end of the article

## Conclusions

Resting membrane depolarization in critically ill patients is correlated to insulin resistance. Patients with severe insulin resistance reveal a failure of repolarization, so that high dosage of insulin administration does not facilitate rectification of membrane polarization.

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## Authors' details

<sup>1</sup>Charité - Universitätsmedizin Berlin, Department of Anesthesiology and Intensive Care Medicine, Berlin, Germany. <sup>2</sup>Charité - Universitätsmedizin Berlin, Department of Endocrinology, Diabetes and Nutrition, Berlin, Germany. <sup>3</sup>University of Jena, Department of Neurology, Jena, Germany.

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