



Royal Netherlands Navy

# Quantitative electroencephalography

in a swine model of cerebral  
arterial gas embolism

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## Introduction

- cerebral arterial gas embolism (CAGE)
  - diving / iatrogenically
  - heterogeneous presentation
  - 50% of patients GCS < 8
- reliable assessment necessary
- quantitative electroencephalography (qEEG)
  - non-invasive
  - fast
  - high temporal resolution
  - sensitive



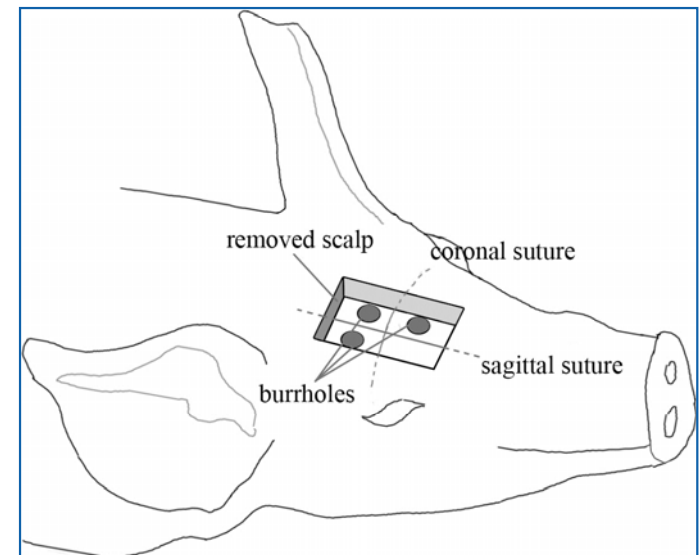
## Research question

- can qEEG detect CAGE and predict outcome?
- which qEEG parameters are most useful?



## Methods

- 16 pigs 35-40 kg, general anesthesia
- measurements
  - intracranial pressure (ICP)
  - brain oxygen (rPBrO<sub>2</sub>)
  - microdialysis → brain lactate
  - EEG
- catheter in asc. phar. artery
- injection of 0.05 ml/kg room air
- measurement during four hours
- animal killed





## Methods - qEEG

- mean amplitude (MAMP)
- alpha-delta ratio (ADR) = 8-13 Hz / 0.5-4 Hz
- spectral edge frequency (SEF<sub>90</sub>) = frequency below which 90% of the power is contained
- spatial brain symmetry index (sBSI)
  - left/right symmetry
- temporal brain symmetry index (tBSI)
  - temporal symmetry



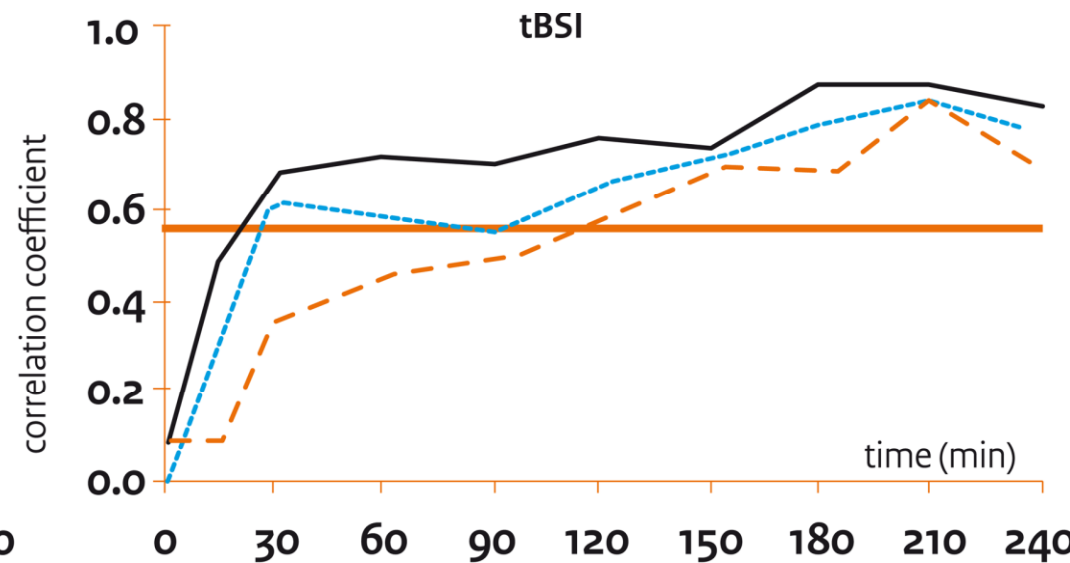
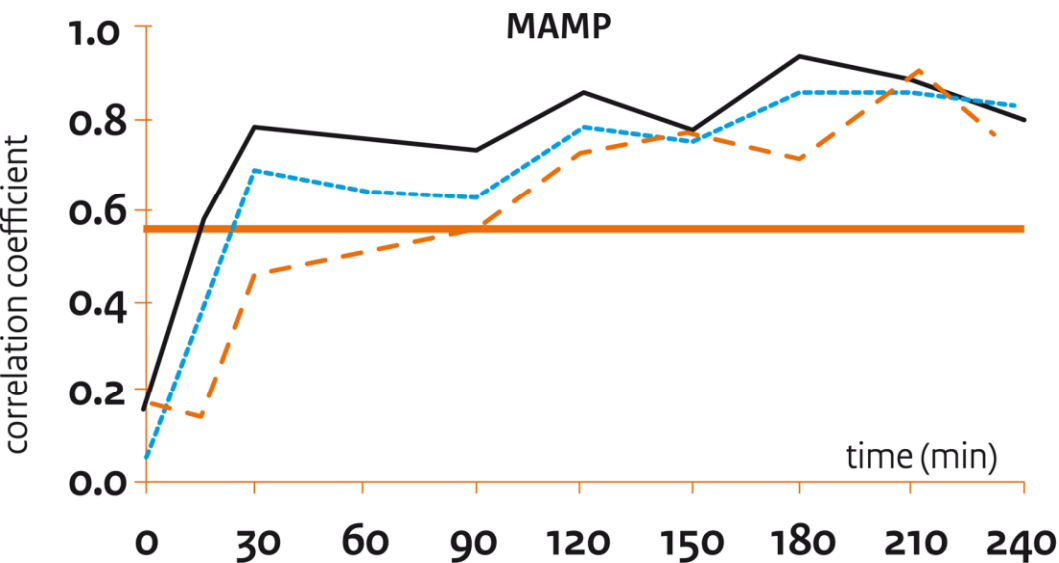
## Results

- large variation in reaction to air injection



## Results

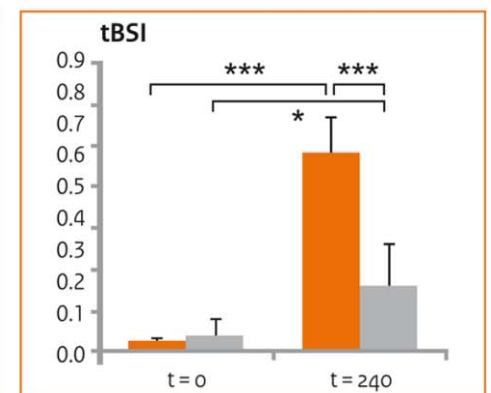
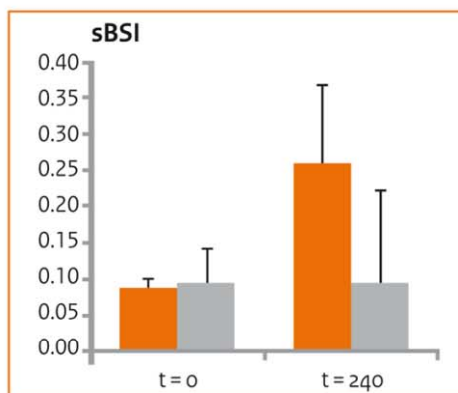
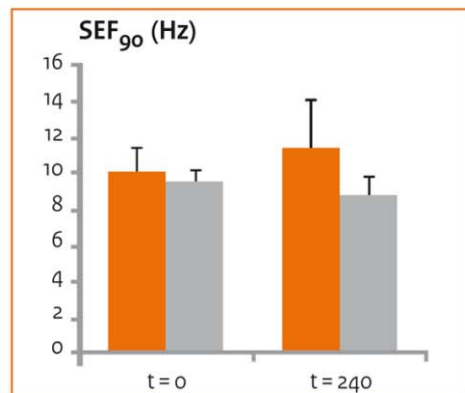
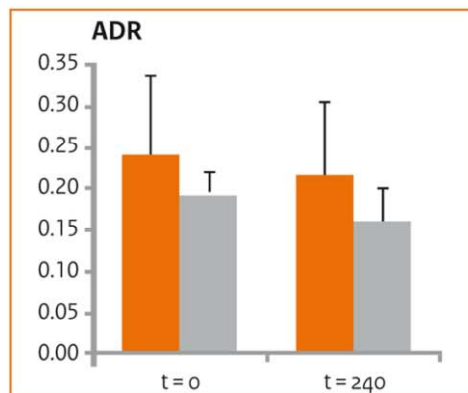
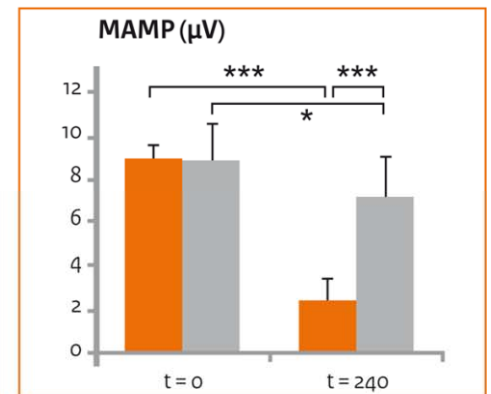
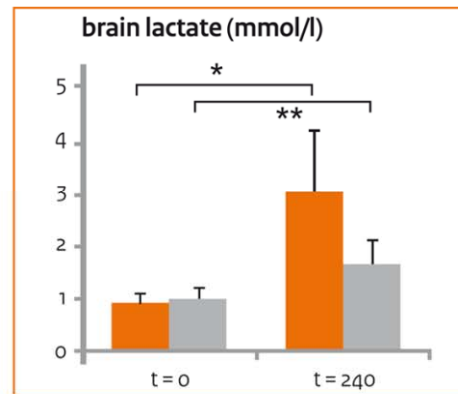
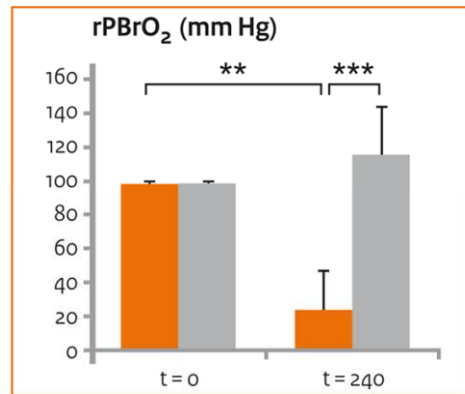
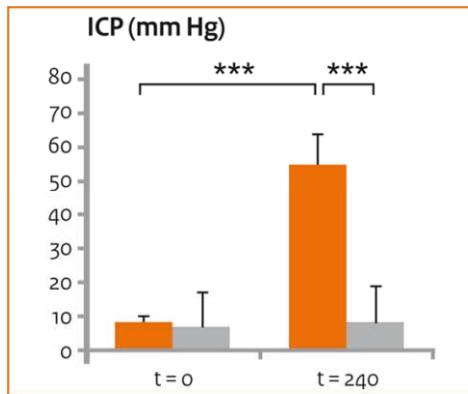
- correlation at  $t = 240$  min
  - MAMP and tBSI correlate well ( $|\rho| \approx 0.8$ ) with ICP / rPBrO<sub>2</sub> / brain lactate
- correlation during experiment





# Results

- division based on ICP at t = 240 min
- orange = ICP > 20 mmHg; grey = ICP ≤ 20 mmHg







## Conclusions

- MAMP and tBSI
  - can detect CAGE
  - correlate with ICP/rPBrO<sub>2</sub>/brain lactate early after induction of CAGE
  - can differentiate between good and bad outcome



## Discussion

- advantages over other measurements
- disadvantages
  - animal study
  - general anesthesia
  - tBSI requires baseline
- further research



## Research Group

This research was conducted in collaboration with the Dept. of Experimental Anesthesiology and the Dept. of Experimental Surgery, Academic Medical Center, Amsterdam, The Netherlands.



This work was accepted for publication in *Clinical Neurophysiology*.