Cortical excitability changes non-linearly in dexmedetomidine sedation

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Introduction and Aim

- Cortical excitability is modulated by conscious states (either stable or transient)
- Anaesthesia offers a controlled way to pharmacologically manipulate consciousness and cortical excitability.
- Dexmedetomidine (DEX), a noradrenergic alpha$_2$-agonist, partially mimics normal sleep, but its neural mechanisms are not fully understood.
- Understanding the effects of DEX on cortical excitability could elucidate its neural mechanism

Methods

- 20 healthy subjects (11 males, 23.85 ± 2.43 yo)
- TMS-EEG during DEX sedation
  - Frontal & parietal cortices, with neuronavigation
  - Intensity: 120 V/m
  - ~250 pulses/session
- 4 conditions based on DEX concentration and behaviour
- Data processed in MATLAB, using SSP and SPM
  - Channels and epoch rejection, filtering, down-sampled, epoching, baseline correction and robust average
- Excitability inferred by the first component (0-30 ms) of the TMS-Evoked Potential (Figure 1)
- Generalized Linear Mixed Models (GLMMs) on SPSS
  - Demographics, DEX concentration and responsiveness as covariates, and TMS parameters as random effects
  - Pairwise comparisons with Bonferroni-adjusted t-tests
  - Amplitude $p_{critical}$=0.006; slope, positive and negative latency $p_{critical}$ =0.05

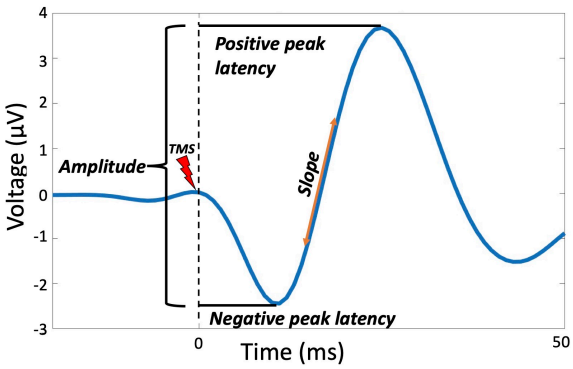

Figure 1: Representation of a prototypical first response (0-30 ms) of the TMS-Evoked Potential

Results

- DEX affects cortical excitability (Figure 2)
- Significant interaction between conditions and locations for amplitude (p=0.004) and slope (p=0.009).
- Latencies: Negative higher in parietal than in frontal; Positive lower at baseline than at light sedation.
- Light sedation had the highest excitability. Frontal region showed a higher excitability than parietal one.

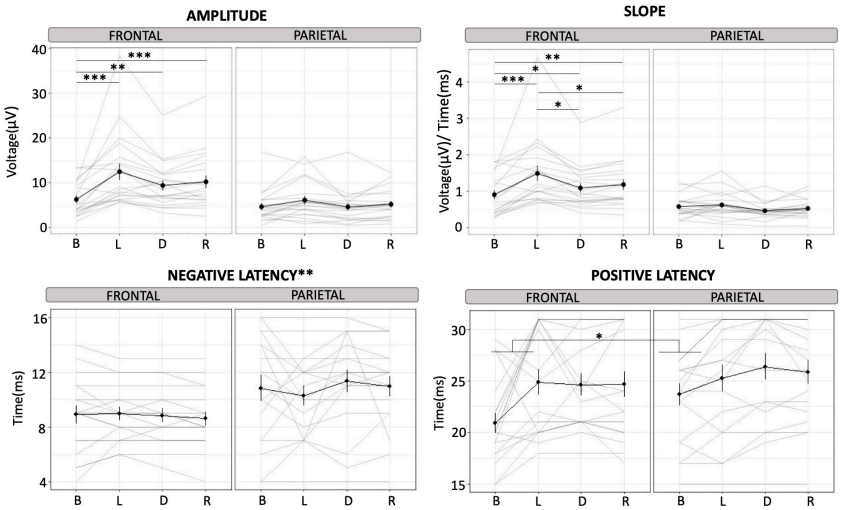

Figure 2: Results for the generalized linear models. Legend: B=Baseline, L=Light sedation, D=Deep sedation, R=Recovery. *=p<0.05; **=p<0.001; ***=p<0.0001

Conclusion

- Excitability changes as a function of the depth of DEX sedation, maximal in light anaesthesia.
- Effect is region-specific → Frontal cortex particularly susceptible to DEX?
- Drug-induced cortical dynamics of light sedation inform about intermediate states of consciousness.

Scan me!

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