Circadian and ultradian rhythmicity in patients with disorders of consciousness

Camargo, Aldo, Blandiaux, Séverine, Piarulli Andrea, Wolff, Audrey, Gossieres Olivia, Thibaut Aurore & Laureys Steven

Coma Science Group
GIGA Consciousness
Université & CHU de Liège

4rd Congress of the European Academy of Neurology, 2018, Lisbon
1. Introduction
Disorders Of Consciousness (DOC)

- Coma
- Altered states of consciousness:
  - Minimally Conscious State (MCS)
  - Unresponsive Wakefulness Syndrome (UWS) / Vegetative State

# Circadian & Ultradian rhythmicity

| Introduction | Methods | Results | Conclusion |

**Ultradian rhythms**

- cycles of $>1h$ and $<24h$
- repeated throughout a 24-hour day

**Circadian rhythms**

- cycles $>over 24h$ period
- sleep / wake cycle

---

Grutsch et al., *Journal of Circadian Rhythms*, 2011; Winnebeck, et al., *Current Biology*, 2018
Background

DOC patients
- changes in the oscillatory brain dynamics
- which affects the circadian and ultradian rhythmicity [5]

Previous results showed:
- no circadian rhythmicity in UWS and MCS
- spectral entropy =
Based on previous results:

**Hypothesis 1:** MCS and UWS patients have no circadian and ultradian rhythmicity.

**Hypothesis 2:** Spectral entropy can be used to differentiate patients in MCS from UWS.
2. Methods
Study design

- **N = 99 ; 18 UWS & 81 MCS ; 47 females**

- **Etiology**: Traumatic brain injury = 46 ; Not traumatic brain injury = 55

- **Actigraphy** = cost-effective method assessing movements
  - Camntech MotionWatch : n = 42
  - Phillips Activewatch : n = 57
Introduction | Methods | Results | Conclusion

**Study design**

- **Acquisition for +/- 7 days**
- **Extraction of useful data of 4 days**
- Compute the average & spectral entropy
- Compute the mean spectral amplitude for 24 hours & for 120 min
- Find the peaks in the mean SA
3. Results
Results: hypothesis 1

24h spectral amplitude (SA) plot

3 main peaks for 90% of MCS and 89% of UWS:

1. Ultradian rhythm (min) = [20, 240] & [240, 720]
2. Circadian rhythm (min) : [720, 1400]
Results: hypothesis 2

Spectral entropy differences between MCS and UWS for the 3 peaks

- **Peak 3** = circadian rhythm
  - \( p = 0.004 \)
  - only significant difference between MCS and UWS

* PEAK 3 = circadian rhythm

\[ * p = 0.004 \]
4. Conclusion
89% UWS & 90% MCS show circadian and ultradian rhythms

Actigraphy = promising non-invasive diagnostic tool

- Differentiate MCS from UWS patients
- Different circadian rhythmicity
Thank you