Assessing Sleep in the Early Stages of Traumatic Brain Injury: Can a Proxy Measure replace the Gold Standard?

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Introduction

- Post-traumatic amnesia (PTA) is the temporary state of confusion experienced early in recovery following traumatic brain injury (TBI)
- Sleep disturbance is a common symptom of PTA affecting 80% of patients, as well as disorientation, memory disturbance, agitation and restlessness
- Limited research evaluating sleep disturbance during PTA, have mainly used an indirect, proxy sleep measure (actigraphy). Its concordance with the gold-standard for sleep assessment (polysomnography) has not been evaluated in this group

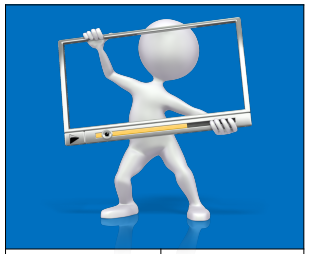
Aim

To evaluate how closely Actigraphy agrees with the gold-standard (PSG) for measuring overnight sleep-wake periods in patients in PTA following severe TBI

Methodology

- 24 inpatients in PTA recruited from Epworth's TBI Rehabilitation Unit
- Actigraphy (a wrist-watch with an accelerometer) quantifies sleep and wake periods based on activity
- Portable PSG is a sleep monitor where an individual's physiologic signals (e.g. brain waves, eye and muscle movement) are recorded to inform about sleep
- Both measures were administered concurrently overnight at patient bedside

Sample



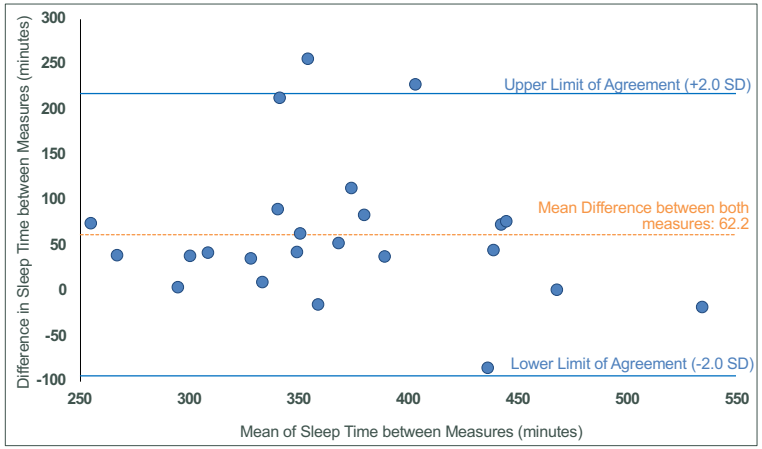
MEAN AGE:	GENDER:
48.3 years (18 – 81)	58.3% male
MEAN PTA DURATION	**DAYS POST INJURY**
59.6 days (20 – 155)	39.2 days (10 – 80)

Results

The table displays difference between Actigraphy and PSG in the measurement of sleep/wake variables. Overall, there are large inconsistencies which are outside the clinical agreement levels (defined in prior research). Agreement between measures (correlations) was low for all variables (a strong agreement = 0.9)

Parameter (minutes)	Mean Difference (minutes) (SD) between Measures	Actigraphy	Acceptable Difference between Measures	Lin's Concordance Correlation Coefficient
Time to Fall Asleep	-27.8 (38.3)	Underestimates	-	0.4
Sleep Time	62.2 (77.9)	Overestimates	≤ 30 minutes	0.4
Wake Time	-31.4 (62.5)	Underestimates	≤ 30 minutes	0.3
Sleep Efficiency (%)	12.9 (13.8)	Overestimates	≤ 5%	0.3

** **Sleep Efficiency:** ratio of time spent asleep compared with time in bed ; **SD:** standard deviation*



Bland Altman plot of total sleep time as an example. The Y-axis reflects the difference between Actigraphy/PSG and the X-axis reflects the mean of both measures. Dots closest to zero indicate that both measure are similar. It appears that as sleep time increases (x-axis), the larger the discrepancy between Actigraphy and PSG

Conclusions

This study suggests that proxy sleep assessment overestimates sleep during PTA. It is likely that a proxy measure can lead to inaccurate measures of sleep in inpatient populations with less activity (such as PTA). Whilst PSG is more challenging, it provides a clearer picture of sleep disturbance during PTA.

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