BSS2015 Hands-On Tech Breakfast

SCORING SLEEP USING AASM GUIDELINES: A BRIEF INTRODUCTION

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AIMS

• To review criteria for staging sleep as defined by international guidelines (AASM V2.2, 2015).
• To discuss the benefits and drawbacks of these guidelines.
• To apply the current AASM guidelines by identifying sleep stages during a practical exercise.

EXPERIENCE

• Completely new to scoring?
• A little experience of scoring PSG?
• Regularly scoring PSG?
• RPSGT (Registered Polysomnographic Technologist)?
• EST (ESRS Somnologist – Technologist)?
POLYSOMNOGRAPHY

- Objective measurement of sleep & wake (overnight or during the day)
- Gives information on
  - Duration/amount of sleep
  - Patterns of sleep
  - Quality of sleep
  - Behaviours during sleep
- Information from PSG can be used to define sleep stages

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AASM VERSION 2.2 - 2015

- Current version of guidelines
- Published July 2015
- Online access only
AASM MONTAGE

BENEFITS OF AASM GUIDELINES

- Standardised international guidelines
- Comprehensive manual
  - Setting up lab
  - Training staff
  - Reference guide
  - Lab accreditation
- Flexible online format
  - Updated annually

LIMITATIONS OF AASM GUIDELINES

- Staggered implementation → variation between centres
- Frequent revisions → “shifting goalposts”
  - Many changes related to US Medicare reimbursement
- Based on scoring full PSG
  - AASM also recommends use of portable monitoring
  - Collop et al. JCSM, 2007
  - Transferrable to limited studies?
  - ERS Task Force TF-2014-02 (2014-2016)
SCORING SLEEP STAGES

This session based on adult scoring rules –

AASM Version 2.2 (2015)

• Based on unit of epoch
  – 30s in most labs

• Each epoch reviewed in turn and assessed as a whole for its sleep stage

• In some situations, the page before or after can influence the decision

• To score a certain stage of sleep at least half the epoch (15 seconds) must be classified as that stage

STAGE W

• Alpha rhythm / posterior dominant rhythm
  – 8-13Hz
  – Majority of individuals (~10% do not generate alpha)
  – clearest on occipital EEG

  AND / OR

• Other findings consistent with W
  – Eye blinks
  – Rapid eye movements (REMs) with normal/high chin EMG
  – Reading eye movements

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STAGE W – EYES OPEN

STAGE W – EYES CLOSED

STAGE N1

Appearance of any of:

- Low amplitude, mixed frequency EEG (LAMF)
  - 4-7Hz
- Vertex sharp waves (V waves)
  - Central EEG
  - <0.5s duration
- Slow eye movements (SEMs)
STAGE N1

- Score N1 if majority of epoch meets criteria for N1 in the absence of evidence for any other sleep stage

- Keep scoring N1 until there is evidence of another sleep stage
  - Usually W, N2 or R

STAGE N1

Characteristics waveforms:

- Sleep spindle
  - Fast burst ($\geq 0.5s$) of 11-16Hz activity
  - Clearest on central EEG

- K complex
  - -ve EEG deflection followed by +ve ($\geq 0.5s$)
  - Clearest on frontal EEG
STAGE N2

- Start scoring N2 if a K complex and/or sleep spindle is present in the first half of the epoch or last half of preceding epoch
  - "Definite stage N2"
- Continue to score N2 in absence of spindle/K-complex if no arousals
- Epochs after a page of N3 are scored as N2 if they do not meet criteria for W, N3 or R
  - Do not score N1 after N3

STAGE N2

- Stop scoring N2 when
  - Transition to stage W, N3 or R
  - Arousal followed by LAMF, but not meeting criteria for R (N1)
  - Major body movement followed by SEM and LAMF (N1)
STAGE N3

- Slow waves in ≥20% (≥5s) of epoch
  - 0.5-2 Hz
  - ≥75µV in amplitude in frontal EEG
  - Irrespective of age

- Do not confuse K complexes with slow waves
  - K complexes separated in time
  - slow waves tend to occur in runs
  - K complexes develop into slow waves at transition from N2 to N3

- Spindles can persist into N3

STAGE N3

STAGE R

Characteristic waveforms:

- Bursts of rapid eye movements (REMs) on EOG
- Very low amplitude EMG (atonia)
- Sawtooth waves
  - clearest on central EEG
  - Often precede bursts of REMs
- Transient muscle activity
  - Duration <0.25s

From AASM
STAGE R

- “Definite stage R” scored in epochs with ALL of
  - LAMF without spindles/K complexes
  - Low chin EMG tone (atonia)
  - REMs

- Pages before and after “Definite stage R” scored as R in absence of REMs with ALL of
  - LAMF without spindles/K complexes
  - Low chin EMG tone (atonia)
  - No arousal
  - No SEMs

- R takes precedence over N2

STAGE R

- Stop scoring R if ANY of
  - Transition to W or N3
  - ↑ EMG tone and meets criteria for N1
  - Arousal followed by LAMF and SEMs (N1)
  - Major body movement followed by LAMF and SEMs without a sleep spindle or K complex (N1)
  - Sleep spindle or K complex in first half of epoch in absence of eye movements (even if chin EMG still low)

STAGE R

- Burst of rapid eye movements

STAGE R

- Delta activity / slow waves

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PRACTICAL SESSION

• Split into small groups
• Set of laminated sample epochs
• Assess each example as a group
  – EEG frequency
  – Distinct, measurable features
• Decide which sleep stage to score

EXAMPLE 1

EXAMPLE 2
EXAMPLE 15

CONCLUSION

- Electrophysiological changes during sleep can be measured using polysomnography.
- Distinct, measurable electrophysiological features are used to define different stages of sleep.
- International guidelines for sleep staging are available and are generally well-accepted as the “gold standard”.

FURTHER READING

- *The AASM annual for the Scoring of Sleep and Associated Events: Rules, Terminology and technical Specifications Version 2.2.*
  American Academy of Sleep Medicine (2015)


- *Essentials of Sleep Technology*
FURTHER TRAINING

- Practical Polysomnography – Edinburgh, UK
  - Various dates
- Edinburgh Sleep Medicine Course – Edinburgh, UK
  - March 2016
- International Sleep Medicine Course – Cardiff, UK
  - June 2016
- BSS Hands-On – Cardiff, UK
  - June 2016

Any questions?

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