Sleep Disorders in Childhood

Dr Andrea Whitney
PIERconference 2017
The physiology of sleep

<table>
<thead>
<tr>
<th>Discharge pattern</th>
<th>Cell location</th>
<th>Neurotransmitter</th>
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<tbody>
<tr>
<td>Wake on / REM off</td>
<td>DR, LC, PH, LH</td>
<td>5-HT, NE, HA, HCRT</td>
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<tr>
<td>REM on</td>
<td>LDT/PPT</td>
<td>ACh</td>
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<tr>
<td>Wake on / REM on</td>
<td>LDT, PPT, BF</td>
<td>ACh</td>
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<tr>
<td>NREM on</td>
<td>POA, AH, BF</td>
<td>GABA</td>
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<td>State independent</td>
<td>VTA, SN</td>
<td>DA</td>
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The rhythms of sleep

HYPNOGRAM

STAGES OF SLEEP

HOURS OF SLEEP

WAKE

REM
Non-REM Sleep stages

Alpha rhythm

Vertex sharp waves

Sleep spindles
REM sleep

- Paralysis or nearly absent muscle tone
- High levels of cortical activity
- DREAMING
- Episodic burst of eye movements

Consolidation of memory

20-25% of total sleep
Developmental aspects of sleep
Excessive daytime sleepiness

- **Mild**
  - Behavioural changes
  - Inattention, fidgety or hyperactive behaviour

- **Moderate**
  - Behavioural manifestations of tiredness
  - Yawning, drooping eyes, flat facial expression

- **Severe**
  - Napping in the day (school age)
  - Napping in unusual situations/locations
Sleep history

Is the child actually sleepy?
  • EDS - increased tendency to fall asleep improved by **sleep** versus **fatigue**
    • - feeling exhausted with no energy, usually improved by **rest**

Detailed 24 hour sleep history
  • Major sleep period
    • Duration – age appropriate?
    • Phase (weekday/weekend)
    • Does the child wake spontaneously feeling refreshed?
    • Extent and nature of daytime naps
Naps: Child Epworth Scale

‘likelihood of dozing v feeling tired’

1. Sitting and reading
2. Watching television
3. Sitting inactive in a public place (for example, a movie theater or classroom)
4. As a passenger in a car for an hour without a break
5. Lying down to rest in the afternoon when circumstances Permit
6. Sitting and talking to someone
7. Sitting quietly after lunch
8. Doing homework or taking a test

0 = would never doze or sleep
1 = slight chance of dozing or sleeping
2 = moderate chance of dozing or sleeping
3 = high chance of dozing or sleeping.

Melendres et al 2004 Pediatrics 114(3):768-75
Slow wave sleep & memory consolidation

- SWS slow oscillations (~0.75 Hz) facilitate hippocampal sharp-wave ripples and thalamo-cortical spindles
- These ‘spindle–ripple events’ are thought to promote integration of reactivated hippocampal memory information into the neocortex

*Figure from Wilhelm et al. (2012)*
Cognitive and behavioural ‘phenotype’ of sleep disruption

Executive function

Behaviour

ADHD

School performance

(Astill et al 2012)
Excessive daytime sleepiness

- Behavioural insomnia
- *Learn to self settle*
Excessive daytime sleepiness

- Phase disorders
- Sleep disorders disrupt the continuity of sleep
- Narcolepsy
Excessive daytime sleepiness

- Phase disorders
- Sleep disorders disrupt the continuity of sleep
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13 year old cannot fall asleep
Excessive daytime sleepiness

• Phase disorders
• Sleep disorders disrupt the continuity of sleep
  • Sleep related breathing disorders
  • Sleep related movement disorders
• Narcolepsy
Restless legs syndrome

• Affects 2-4% of school aged children and adolescents

• Sensorimotor disorder: core symptoms
  ▪ urge to move legs
  ▪ relieved by movement
  ▪ worse at rest
  ▪ worse in the evening and at night

• Family history common.
  • First degree relative in around 2/3 of cases
  • BTBD9 gene on chromosome 6p21.2 associated with 50% of population risk of RLS with PLMS*

8-year-old girl “Maybe wiggly or wiggling. Yeah, they were hurting, that’s when I have to get up and just like walk around, and maybe just go downstairs…get out of bed to just stretch my legs.”

12-year-old boy “Felt like tingling. Wiggling. Kind of like squirmy. Sometimes I’ll get this feeling where I have to move it, it bothers me if I don’t.”
Careful clinical history

- Often difficult for children with a developmental age < 5 years to describe feelings. Need to hear child’s account:
  - uncomfortable sensation in legs with urge to move
  - worse sitting still or lying
  - relief with movement
  - diurnal pattern
  - family history

Bedtime resistance
Restless legs syndrome and periodic limb movement disorder

- Restless legs syndrome: 80-90% also have PLMD
- Possible to diagnose isolated PLMD
Periodic limb movement disorder

- Periodic episodes of repetitive stereotyped limb movements in sleep (PLMS)
  - Typically extension of the great toes +/- ankle/knee/hip flexion
- Periodic limb movement index > 5/hour and associated with clinically significant sleep impairment
- Can be associated with cortical arousal or awakening
- Typically the child is unaware but may complain of unrefreshing sleep and EDS
- Strong association with restless legs syndrome
Excessive daytime sleepiness, ADHD, long sleep period...
REM
N3 sleep (5 minute epoch)
Pathophysiology

- Low CSF iron
- Increased tyrosine hydroxylase activity
- Increased dopamine synthesis
- Increased extra-cellular dopamine
- Down regulation of post-synaptic D receptors
- Evening dip in dopamine
Treatment

• Iron supplementation
  • Ferritin <50mcg/L
Comparison of Pregabalin with Pramipexole for Restless Legs Syndrome
Richard P. Allen, Ph.D., Crystal Chen, M.D., Diego Garcia-Borreguero, M.D., Ph.D., Olli Polo, M.D., Sarah DuBrava, M.S., Jeffrey Miceli, Ph.D., Lloyd Knapp, Pharm.D., and John W. Winkelman, M.D., Ph.D.

Conclusions
Pregabalin provided significantly improved treatment outcomes as compared with placebo, and augmentation rates were significantly lower with pregabalin than with 0.5 mg of pramipexole
Excessive daytime sleepiness

- Phase disorders
- Sleep disorders disrupt the continuity of sleep
  - Sleep related breathing disorders
  - Movement disorders of sleep
- Narcolepsy
Primary hypersomnia of central origin?

Narcolepsy with or without cataplexy

- **EDS** for > 3 months irresistible sleep urge - repeated daytime naps – not usually refreshing
  
  Background sense of being dozy.
  
  Children may fall asleep in stimulating situations e.g. riding a bike, at a party

- **Cataplexy**: abrupt loss of muscle tone precipitated by emotion e.g. laughing/fright. Child retains consciousness

- Vivid and disturbing **hallucinations**
  
  Hypnagogic
  
  Hypnopompic

- **Sleep paralysis**
Parasomnias

• Recurrent paroxysmal episodes of behaviour, experiences or physiological change that occur exclusively or predominantly from sleep.

• Uncoupling of sleep and waking behaviours
NREM arousal parasomnias

- Confusional arousal
- Somnambulism
- Night terrors

+ FHx

Range of behaviours:
- Confusion and disorientation
- Automatic behaviours
- Remains asleep during episode
- Unresponsive to environmental events
- Inconsolable
- Little or no recall of events
Confusional arousal

- Infants and toddlers
- Couple times/month-every night
- Begin with movements and moaning and progression to agitated behaviour and crying
- NOT associated with autonomic Sx or stereotyped movements
- Unresponsive to parents
- Last 5-30 minutes- spontaneous return to restful sleep
- Child fine the following morning
Somnambulism

• Common: up to 17% between 4-8yrs
• Eyes open, child may appear confused, may mumble, calmly walk around room or more complex routes known to the child
  • Urination in inappropriate places
• Accidental injury a serious risk
  • Complex motor behaviour
    • Unlocking doors, leaving house, climbing out of window
• Last approx 10 mins
• 10% of children continue for 10 years
Night terrors

- Typically aged 3 to 10 years [3% of children]
- Few times per week - two to three/month
- Child wakes abruptly:
  - loud vocalisation, appears agitated, flushed, sweating
- May jump out of bed and run out of room as if terrified
- Do not respond to calming efforts
- Terrifying to parents

- EEG may show high amplitude, rhythmic delta or theta activity.
Frontal lobe epilepsies

- Supplementary motor seizures
  - Speech arrest and fencing posture

- Cingulate
  - Complex motor gestural automatisms
  - Change in mood and affect

- Anterior fronto-polar
  - Forced thinking, loss of contact, head deviation+/-jerks

- Orbito-frontal
  - Motor and gestural automatisms
  - Olfactory illusions and hallucinations

- Opercular
  - Salivation, speech arrest fear and autonomic phenomena
  - Gustatory hallucinations

- Motor cortex
- NFLE
FLE: diagnostic pitfalls

- Bizarre and complex
- Abnormal postures
- Frequent falling when bilateral
- Frenetic gestural automatisms
- Vocalisations
- Short duration
- May be partially aware with minimal or no post-ictal confusion
- EEG may be normal
Parasomnia vs frontal lobe epilepsy

• Parasomnia
  – Onset 1<sup>st</sup> 3 hours
  – 5-30mins duration
  – No response or recollection
  – Single event

• Frontal lobe epilepsy
  – Any time
  – Brief
  – May have partial awareness
  – Frequent
    – **STEREOTYPICAL**
NREM Arousal Parasomnias and Their Distinction from Nocturnal Frontal Lobe Epilepsy: A Video EEG Analysis

Christopher P. Derry, PhD,¹,³ A. Simon Harvey, MD,¹,² Matthew C. Walker, PhD,³ John S. Duncan, MD,³ and Samuel F. Berkovic, FRS¹
video
Summary

• Sleep is important to your patients

• Sleep disorder a co-morbidity with other conditions

• Behavioural insomnia common

• Sleep disorders in the differential diagnosis of paroxysmal events

• Take a sleep history please!!!