Disclosures

No financial relationships to disclose.
Parasomnias

- Sleep disorders occurring during sleep onset, throughout sleep or during waking
- Typically the individual has no memory of the event
Parasomnias

- Confusional arousals
- Sleep walking, talking
- Night terrors
- REM Sleep Behavior Disorder
- Sleep Paralysis
- Periodic Limb Movement Disorder
- Catathrena (groaning)
- Sleep-related eating disorder
- Exploding Head Syndrome
Confusional/Partial Arousals

- Typically occur out of non-REM sleep
- Transition to lighter/partial stage of sleep leads to confusional behaviors
- Wide range/spectrum of possible behaviors
  - Mild arousal
  - Sleep Walking
  - Sleep Talking
  - Night Terror
Night Terror

• Partial arousal is associated with autonomic activation (fight or flight response)
• When agitated behavior is associated with a partial arousal, it is termed Night Terror
• There is some increased risk for injury
• Otherwise these are disruptive but benign events
Partial Arousals

- Anything that increases arousal can increase these events
  - Behavioral
  - Apnea
  - Other parasomnias
- Trying to intervene can make them escalate
- There is a partial familial tendency
Restless Legs Syndrome

• A clinical diagnosis based on reported symptoms. No specific test currently available.
• Urge to move legs, worse when sitting or lying, relief with movement, and worse at night.
• Children can use their own words to describe leg discomfort.
Periodic Limb Movements Disorder (PLMD)

- Requires PSG evidence of repetitive, highly stereotyped movements in a sequence of 4 or more.
- May or may not have associated arousal
- Abnormal in pediatrics if over 5 / hr
- “Disorder” if sleep is adversely affected
- Must rule out medical causes (e.g. not due to apnea)
PLMD and RLS associated with low IRON

- Low body stores of iron can be associated with increased risk of PLMD and RLS
- Possibly due to iron being a cofactor for dopamine synthesis
- Best marker is FERRITIN level less than 50 mcg/L
- CBC and other measures are inadequate in isolation.
PLMD and RLS associated with low IRON

- Iron testing (ferritin, CBC, TIBC) is often best done before PSG if suspecting PLMD
- Iron correction can reverse or reduce symptoms, but is not always effective
- Iron dosing in pediatrics can be challenging.
  - Iron tastes bad
  - Absorption can be poor
Toothgrinding/Bruxism

- Usually identified by history (the noise is often remarkable) or at times by dentist
- Can be associated with other parasomnias
- Can be associated with GERD
- Dental protection, mouth guard, is the usual treatment. Medications are not usually effective
Rare Parasomnias

- **REM Behavior Disorder**
  - Failure of the REM cycle to inhibit movement
  - Often associated with neurodegenerative disorders

- **Sleep Paralysis**
  - Overactive REM paralysis, intruding into wake
  - Can be disturbing to child/teen
  - Can be associated with narcolepsy, but usually is isolated

- **Catathrenia**
  - Sleep “groaning”
Nocturnal Enuresis

Definition

- No single definition, but some consensus:
  - episodic wetting AFTER 5 years of age
  - minimum two events / month, before 7
  - single event per month after the age of 7
  - may be clinical implications even if less frequent
- The *International Classification of Sleep Disorders-2 (ICSD-2)*
  - prefers “Sleep Enuresis” and categorizes it as an "Other Parasomnia"
  - polysomnogram not required, but absence of seizure activity if done
  - Rule out medical issue such as untreated diabetes, anomaly of the urinary tract, seizures, or the use of medications with diuretic properties.
- When other urinary symptoms are absent = “mono-symptomatic”
- Non-sleep criteria can unfortunately link the disorder to mental health and behavioral disorders
Definition
Primary v. Secondary

• Clinically relevant distinction
• PRIMARY
  • has not had a significant intervening period of (medication-free) dryness.
• SECONDARY
  • there has been a dry period of 3-6 months before wetting began again
INTRODUCTION

- Toileting skills are developmentally based
- Stigma is often attached to problems of incontinence
- Psychological and behavioral elements are key, but sometimes overstated
- Consideration of specific medical and neurodevelopmental problems is essential
Stigma of Toileting Problems

- May limit history taking
- Limits awareness that others have the same problem
- Toileting problems interfere with normal socialization of the child
- At times, problems of continence create a very negative child-parent dynamic
Micturition
Important Education

- Urine flow from kidney
- Down urethra
- To Bladder
- Bladder wall is muscular/nerve sensors
- Contraction triggered by filling
- Sphincter counteracts contraction and can result in wall relaxation.
Physiologic Variance

- Can be physiologic variant until age 7
- Present in 100% of infants
  - often resolves with daytime continence
- When night time continence lags there is a developmental trajectory
  - resolution about 15% per year
  - A 7 ½ year old prevalence of 15.5%
- Age 18 there is a 1% prevalence
- Twice as common in boys
Nocturnal Enuresis: prevalence by age

Fergusson, DM et al, Pediatrics 78:884; 1986
Pathophysiology

- Urine rate under circadian control, typically production should diminish at night
- There is a flow of urine from the kidneys to the bladder that is continuous through the night.
  - There is no difference in the circadian flow of urine nor the bladder capacity in children with enuresis compared to controls.
  - The sensation of an expanding bladder is transmitted to the central nervous system
- Signal must be received and interpreted properly during sleep (vigilance).
- Enuretic events tend to occur in the first half of the night, not necessarily associated with any specific stage of sleep.
Pathophysiology

- Autonomic arousal precedes enuretic events
- But not associated with alertness or activation of the urinary sphincters
  - imbalance
- The high rate of success using alarm systems
  - for most children the primary issue leading to nocturnal enuresis is the ability to arouse sufficiently at night to control bladder contraction and elicit sphincter control.
- When most young children are dry at night they do not wake to go to the bathroom, but rather hold their urine through the entire night.
- Any condition interfering with these steps can result in nocturnal enuresis.
Pathophysiology

- Secondary nocturnal enuresis
  - begins after at least three months of dryness
- Likely has a different natural history and etiology
  - more likely to be associated with a specific medical cause
  - Strong association with constipation
  - constipation symptoms may be occult
  - Other potential causes of secondary enuresis are myriad
    - urinary tract infections
    - Diabetes
    - Seizures
    - trauma to the urinary system
Link with Sleep Apnea

• Number of plausible mechanisms for OSA -> increase the risk of nocturnal enuresis
  • fragment sleep
  • increase sleep pressure
  • raise the arousal threshold

• Association between OSA and nocturnal enuresis is complicated
  • Clinically-referred population a higher rate of enuresis is present for children with a respiratory distress index (RDI) >1 compared with children with an RDI ≤1. However, in a more recent community-based sample, the risk of nocturnal enuresis was not increased for school-aged children with OSA.
  • greater risk of enuresis for children with apnea
  • But, children with sleep apnea do not uniformly have nocturnal enuresis
  • Vast majority of youngsters with nocturnal enuresis do not snore nor have signs of sleep apnea.
Additional Scientific Data

• **Sleep 2011**
  
  Cohen-Zrubavel V, Kushnir B, Kushnir J, Sadeh A.

  • Actigraphy in 32 enuretics and 94 controls.
  • More sleep fragmentation for the enuretics
  • More daytime sleepiness reported
  • Some possible associated with being wet, interventions to clean
  • Interpreted this as Fragmented sleep -> less able to arouse due to sleepiness
Genetics of Enuresis

- Family history is a factor in nocturnal enuresis.
  - higher concordance among monozygotic versus dizygotic twins
  - having one or both parent with delayed dryness at nighttime significantly increases the risk
  - Studies attempting to find specific genes have not yet yielded clinically-relevant information
    - one study has implicated a polymorphism on a gene for a 5-hydroxytryptamine receptor.
**Functional Link Between Bowel and Bladder Continence**

- Presence of constipation increases instability of bladder
- May also be linked to frequent UTIs
  - possibly on the basis of dysfunctional sphincter closure
- Can be a neurological link
  - spinal cord problems
  - neuromuscular disease
ENURESIS: Differential Diagnosis

- Increased urine output (e.g. Diabetes, renal)
- Increased bladder irritability, decreased stability (e.g. Cystitis, neurogenic bladder)
- Abnormal sphincter control
- Congenital Malformations
- Behavioral problem (decreased frequency of bathroom trips)
ENURESIS: Evaluation

• History
  – primary or secondary
  – day and/or night
  – GI symptoms?, especially constipation/continence
  – Family history
  – Rule out associated sleep symptoms, especially snoring (even though may not be causal)
ENURESIS: Evaluation

- Physical Examination focused on:
  - abdomen
  - external genitalia
  - spine and buttocks (dimples, stigmata)
  - lower extremity neurologic exam
ENURESIS: Evaluation

- **Laboratory**
  - urinalysis, urine culture
  - possibly KUB if constipation suspected

- **Poor-man’s bladder volume measure***
  - age (years) divided by 2 + 6 = capacity (ounces) for those 2 years old or older

- **Observe male child’s stream at home**

Nocturnal Enuresis: Hypothesized causes

- Genetics
- Smaller bladder capacity
- CNS differences (including ADH control)
- Sleep and arousal maturation
Treatment

• Option not to treat can be a legitimate course
  • Bed wetting will spontaneously remit in about 15% of affected children each year
  • for some families there is little to no concern for the events
  • no apparent impact on self-esteem or quality of life
• It is also necessary to state, however briefly, that approaches involving punishment or shaming must be avoided.

• Treatment targets:
  • rate of bladder filling
  • the propensity of the bladder wall to contract
  • ability for the individual to arouse and suppress micturition at night
Treatment – Non Pharm

- Fluid Restriction:
  - can certainly be effective, but likely already tried
  - however, after initially trying some families will have abandoned
  - it is still important to consider the amount of fluids taken just before bed
Treatment – Non Pharm

- Enuresis Alarm:
  - The most effective, lasting approach, usually successful after age of 7
  - Younger children, or with developmental concerns can achieve success with support.
  - The overall success rate with alarms is 55-75% of children
- A moisture sensor, affixed to an undergarment so as to remain in position.
- The alarm itself does not reduce wetting, it is an adjunct to a behavioral program
  - the alarm means that the child should quickly stop the stream of urine.
  - Swifter success if there are more frequent events. medication discontinued.
- Absorptive garments interfere with training: 1) directly interfere with the response to the alarm and 2) they continue feeling being protected against wetting and disregard
Treatment – Non Pharm

• Enuresis Alarm:
  • The motivation for arousal must overcome the motivation to ignore the internal signals of bladder distension and remain asleep. A stronger signal, such as the alarm provides, helps overcome that motivation threshold. Reviewing the night-time plan and practicing that plan before bed helps the child remember to hold their urine on waking.
Treatment – Non Pharm

- **Start-Stop Exercises:**
  - Children can be taught to stop their urinary stream. It is unlikely that this “strengthens” muscles, but does likely help them develop conscious awareness of this muscle group.
  - Practicing start-stop exercises can be a helpful addition to the use of an alarm, since stopping the urinary stream at night is the first task once the alarm rings.

- **Scheduled Wakings (“Lifting”):**
  - Parents can bring children to the bathroom in the middle of the night (the child may be awake or only partially awake.) By urinating at this time, they reduce the volume in the bladder and therefore reduce the likelihood of enuretic events. There is very limited research in this area. However, in clinical practice this is not highly effective and tends to result in sleep disruption for parents and children.
Treatment - Pharmacologic

- Medications can have a role
  - Work quickly
  - can be used on an as-needed basis for sleepovers
  - high relapse rate when discontinued, but the normal maturation process might result in ongoing dryness.

- Three main categories:
  - 1. Agents that reduce the flow of urine: Desmopressin (dDAVP)
  - 2. Agents that reduce bladder contractility: oxybutynin
  - 3. Agents that affect the arousal system: stimulants (these are used less frequently for this purpose.)
Treatment - Pharmacologic

- Early use of tricyclic antidepressants
  - Anti-cholinergic properties: relaxing the bladder wall musculature and possibly reducing the flow of urine
  - Not impossible secondary effect on sleep/arousal patterns, sleep stage cycling or other neurologic aspects of the sleep process that is just less well defined.
Complementary approaches to treating nocturnal enuresis might include hypnosis, acupuncture, herbal remedies, chiropractic treatment, homeopathy or dietary manipulations. The literature in this area is especially sparse, and no evidence currently exists to support these approaches.
ENURESIS: Pharmacologic treatment

- **DDAVP**
  - nasal spray
  - pills
- **Tricyclic antidepressants**
- **Anti-spasmodics**
- **Herbal / other remedies**
ENURESIS: Pharmacologic treatment

- **Imipramine 60-70 %**
  - (60 % regression rate)
- **DDAVP  60-70 %**
  - (60% regression rate)
- **Alarms 50-75 %**
  - (1-10 % regression rate)
ENURESIS: Non-pharmacologic treatment

- Wetting alarms
- Hypnosis
- Psychotherapy
- Waiting / outgrowing
ENURESIS: Treatment

- Spontaneous cure  15% (after age 5)
- Motivation  25 %
- “Bladder stretching”  35 %
- Hypnosis  60 - 80 %
Nocturnal Enuresis: Alarms

- Many different brands
  - Ease of use
  - Loudness of the alarm
  - Sensitivity

- Requires higher motivation

- Requires appropriate technique
  - Age, maturity, cognition
Nocturnal Enuresis: Adjuncts to Alarms

- Modified “Cognitive-Behavioral” approach
- Identify for child that expectations for night time can change night time behavior with practice
- Consider concrete example (e.g. Fireman)
- Create practice routine
Nocturnal Enuresis: *practice routine*

- Before bed set up alarm and prepare for night
  - have tissues, fresh pj’s, underwear and sheets
- Before night time urination, lie in bed and either test alarm or pretend to hear alarm
- Go through needed steps for alarm
Nocturnal Enuresis:

*practice routine, continued*

- Announce “that is my alarm”
- Stop urination
- Stop alarm from ringing (tissues to dry)
- Go to bathroom
- Pretend to change underwear, pj’s sheets
- Go to bed
Practical Issues

- Need to stop using pull-ups
- Parent may need to wake at first
- Bed protected
- Sibling may need to be out of the room
- Need to continue wearing the alarm for up to 3 weeks after last wetting
- Success measured in smaller volumes at first
Enuresis Take-away Points

• Ask all patients over 7 - may not report it and may not be aware that treatment is available.
• Assure that constipation is adequately treated, especially for secondary enuresis, and for older enuretics.
• Resolution of night time wetting is usually associated with holding the urine through the night rather than waking for a trip to the bathroom.
• Basic enuresis alarms are usually adequate, “special features” are not necessary. An alarm which is worn has advantages over pad systems that are stationary on the bed.
Take-away Points

• Effective treatment with an alarm system also incorporates behavioral factors, simply placing the alarm is usually inadequate to achieve success.

• Alarm should be worn for at least 2 weeks after last wetting episode. If possible, the alarm should be retained by the family for a while in the case of a brief relapse.