OVERVIEW

• Although the characteristic symptoms of restless legs syndrome (RLS) were first reported in the 1600’s, it was not described in the pediatric literature until 1994.
• Epidemiologic studies show a prevalence of RLS at least 4%, affecting over 1.5 million children in the United States.
• Most research has focused on adults, however, symptoms often begin during childhood or adolescence.
• About 35% of patients report onset prior to age 20
• About 10% of patients report that the condition appeared during the first decade of life
• There is significant overlap between RLS and “growing pains”, leading to under diagnosis of this condition in children and adolescents.
DEFINITION OF RLS

- RLS is a neurologic, primarily sensory disorder, characterized by uncomfortable sensations in the extremities that are accompanied by an almost irresistible urge to move.
- These sensations occur primarily in the legs, although the arms can also be involved.
- Timing of symptoms appears to have a circadian rhythm, often peaking in the evening hours.
- Unlike adults, children often complain of sensations during the day.
- Fidgetiness during periods of rest may be the primary presenting symptom.
- RLS is a clinical diagnosis.
DIAGNOSTIC CRITERIA FOR RLS

- An uncomfortable sensation or unexplainable urge to move the legs
- Increasing symptoms with rest or inactivity
- Reduction of symptoms with movement
- Worsening of symptoms in the evening or at night
- Symptoms cannot be explained by any other condition or disorder
DIAGNOSTIC CRITERIA MADE EASY

Urge to move the legs

Rest-induced

Gets better with movement

Evening and night are worse

not Solely from mimics
SPECIAL FEATURES OF RLS IN CHILDREN

Pediatricians should be aware of the typical way young children describe RLS: “boo-boos”, “ants crawling”, “aching feeling”, “too much energy”, “spiders in the legs”, “want to stretch”
Run Run Run Run Run Run Run Run Run
IN THEIR OWN WORDS

• Nayalee, age 5: I have bees crawling on my feet and legs and it itches so much. And in school I can’t stay still. And I am always tired and sleepy, daydreaming. And I cry because teacher and kids are mean to me and laugh about me.

• Joseph, age 9: My drawing shows me fighting with my squirming legs. And I know I can never win!
FEATURES OF RLS IN CHILDREN

• The conditions under which symptoms are most likely to occur are the same conditions that promote sleep initiation (at night, during inactivity and rest periods).
• However, children may have more daytime symptoms than adults.
• Children often present with non-specific sleep problems, particularly insomnia (sleep initiation and/or sleep maintenance).
• Daytime sleepiness is common.
• RLS may significantly impact a child’s sleep, mood, daytime behaviors, and learning abilities.
RLS OR WED??

- Restless Legs Syndrome is the most common disorder that you have never heard of!
- aka Willis-Ekbom disease
- Willis recognized this syndrome and, after being ignored for three centuries, Ekbom in the mid-twentieth century described a case series.
- Shortly thereafter the discipline of sleep medicine gained attention
- It was then appreciated that as Ekbom reported “This condition is so common that every physician is certain to see these patients in their practice”.
- Willis-Ekbom disease (WED) Foundation set up a revised consensus statement on the management of RLS via a Medical Advisory Board of the Willis-Ekbom Disease Foundation in Sept, 2013
PEDS REST STUDY

• Picchietti et al, Pediatrics, August 2007
• First population-based study to use specific pediatric diagnostic criteria for RLS
• Two age groups studied: 8-11 years old and 12-17 years old
• Recruitment was from a large, volunteer research panel in UK and US
• Administration was via internet
• Results stratified by age and gender
PEDS REST STUDY RESULTS

- Data collected from 10,523 families
- 2% of patients met criteria for definite RLS
- No significant gender differences were found
- At least one biological parent reported having RLS symptoms in more than 70% of families
- Both parents affected in 16%
- Sleep disturbance significantly more common in patients with RLS than controls (69% vs. 40%)
- History of growing pains significantly more common in patients with RLS than controls (81% vs. 63%)
- RLS is more common in children and adolescents than epilepsy or diabetes
RLS AND GROWING PAINS

• Features of growing pains in children are similar to RLS.
• A history of growing pains has been reported in 78% to 85% of children and adolescents with RLS.
• A recent study in twins suggests a genetic overlap between RLS and growing pains.
• A consensus for unified criteria for growing pains is in progress by researchers.
Growing Pains

“I have found Wintergreen to be great for my children’s growing pains in their legs. This is a real medical condition that happens when kids grow very fast. I just rub some wintergreen on, and within 5 minutes their pain is gone 75%, according to their testimony. Good for my restless leg syndrome, too.” ~ Joan Wolcott, US

Wintergreen is traditionally used for muscular pain, tendinitis, arthritis, rheumatism, cramps and inflammation

www.facebook.com/ElviesEssentials
RLS versus PLMD

- RLS is a clinical disorder (Wake)
- PLMD is a sleep disorder (N2)
DIAGNOSTIC CRITERIA FOR PERIODIC LIMB MOVEMENT DISORDER (PLMD)

- Specific, repetitive, stereotyped limb movements on polysomnography (sleep study).
- Known as periodic limb movements in sleep (PLMS), current criteria require that the PLMS Index exceeds 5/hr.
- Sleep problems, such as difficulties in sleep initiation and/or sleep maintenance, or impairments in daytime function should also be present.
- PLMD may precede the diagnosis of RLS by many years.
DIAGNOSTIC CRITERIA: PLMD (327.51)

Polysomnography shows highly stereotyped, repetitive limb movements that are:
- 0.5 to 5 seconds in duration
- of amplitude greater than 25% of toe dorsiflexion during calibration
- in a sequence of 4 or more movements
- separated by an interval of more than 5 seconds and less than 90 seconds
PLMD ON POLYSOMNOGRAPHY

PSG Findings:
PREVALENCE

- Several studies in referral populations have found that PLMs occur in 25% of children diagnosed with ADHD.
- PLMs are more prevalent in Caucasian children than in African-American children.
PERIODIC LIMB MOVEMENTS IN SLEEP AND RLS IN CHILDREN WITH A HISTORY OF PREMATURITY

• Study published in Sleep Medicine in 2017
• Ex-preterm infants (500-1250 grams at birth) enrolled in CAPS study were evaluated between 5-12 years of age
• Home PSGs were performed that included bilateral anterior tibial electromyograms for assessing limb movements
• Caregivers completed a questionnaire addressing the ICSD3 criteria for RLS (4 criteria) and the Pediatrics Sleep Questionnaire (PSQ) (22 item survey with questions related to snoring, observed apnea, daytime sleepiness, growth, and attention).
STUDY DEMOGRAPHICS

- 167 children were included in study
- Mean age 9.2 years
- 57% male
- 83% White, 10% Asian, 10% Black
- Mean GA 27.2 weeks
- PLMI> 5 hr 15.6%
- PLMI> 15 hr 4%
RESULTS

• No difference between children treated with caffeine in infancy and non-caffeine treated children
• RLS prevalence of 8.4%
• 27% of subjects with PLMI>5 hr met criteria for RLS
• PLMD (elevated PLMI plus sleep or daytime disturbance) prevalence in cohort was 7.8%
• 50% of subjects with PLMI>5 hr had PLMD
• Authors concluded that there is an increased prevalence of RLS and PLMD in children with a history of prematurity
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PATHOPHYSIOLOGY OF RLS/PLMD

- Genetic factors
- Low iron stores
- Dopamine dysfunction
- Medications (serotonin uptake inhibitors, diphenhydramine, and dopamine antagonists, such as metoclopramide or risperidone) aggravate RLS.
- Sleep deprivation aggravates RLS.
- Nicotine and alcohol precipitate or aggravate RLS.
- Exercise has been shown to improve RLS.
RLS MANAGEMENT IN CHILDREN

- Adopt appropriate bedtime habits (the child should only get into bed and lay in bed when it is time to go to bed)
- Eliminate caffeine (coffee, teas, colas, chocolates) and some medications (such as sedating anti-histamines and anti-depressants that contain serotonin)
- Use local comfort aids for legs (heating pad, cold compress, massage, walking, stretching or other relaxation techniques)
PHARMACOLOGICAL MANAGEMENT IN CHILDREN

• There is no medication currently approved for the treatment of RLS/PLMD in children.

• Studies using dopamine agonists have shown long term improvement. However, side effects have been reported (nausea, vomiting, insomnia, and daytime sleepiness).

• Other medications (clonidine, clonazepam, gabapentin) have limited studies in children with RLS.

• The benefit of Iron therapy in reducing RLS symptoms, particularly when the serum ferritin level has been raised above 50 ng/ml, has been shown.

• Vitamin C has been shown helpful by improving iron absorption.
TREATMENT

• It is important that children on iron be regularly assessed and that serum ferritin levels are closely monitored.
• Repeat sleep studies are recommended in children with PLMD who do not respond to iron before starting other medications.
PHARMACOLOGICAL MANAGEMENT OF RLS/PMLD IN ADOLESCENTS

• If serum ferritin levels are <50-75 micrograms/milliliter or if transferrin saturation is less than 20%, oral iron should be strongly considered.

• If symptoms are severe, consider clonidine, dopamine agonist (pramipexole, ropinerole), anticonvulsant (gabapentin), benzodiazepine (clonazepam)

• Dopaminergic agents (caridopa-levodopa) are associated with augmentation (earlier onset of symptoms in the afternoon, shorter latency to onset of symptoms when at rest, spreading of symptoms to upper limbs and trunk, overall increase in severity of symptoms and a shorter effect of the medication).
PREVENTION OF AUGMENTATION

- Consider intermittent treatment if symptoms are infrequent or as a preventative medication before predictable conditions of immobility (long car or plane trips)
- Use longer acting dopamine agonists
- Intermittently attempt to reduce or discontinue the medication
- Little risk of augmentation is seen with gabapentins
- Guidelines for the first-line treatment of RLS/WED
  Sleep Medicine, 2016
LONG TERM SEQUELAE OF RLS/PLMD

• Recent studies have shown that PLMD can lead to cardiovascular problems, specifically, hypertension, in children. The proposed mechanism relates to autonomic nervous system activation with repeated arousals. Dopamine dysfunction may also play a role in the pathophysiology of hypertension.

• Adverse cognitive consequences of RLS, such as difficulty sitting in the late afternoon or evening, a lack of energy, and an inability to concentrate have been reported.

• Children with RLS/PLMD are at risk for anxiety and depression.
SOMATIC AND NEUROPSYCHIATRIC COMORBIDITIES IN PEDIATRIC RLS

Sleep Medicine Reviews, 2017

- Growing pains
- Kidney disease
- Migraines
- Diabetes
- Epilepsy
- Rheumatologic disorders
- Cardiovascular disease
- Liver and gastrointestinal disorders (small intestinal bacterial overgrowth)
- Neuropsychiatric disorders (ADHD, Depression, Conduct Disorder)
RELATIONSHIP BETWEEN RLS/PLMD AND ADHD

• Increasing evidence shows an association between RLS and ADHD
• At least 45% of children with ADHD have been found to have RLS symptoms
• At least 30% of patients with RLS have ADHD symptoms
• Sleep disruption could lead to inattentiveness, moodiness and paradoxical over activity
• Alternatively, RLS might be co-morbid with ADHD
• Subjects with both RLS and ADHD might share a common dopamine dysfunction
• Iron deficiency may be a shared finding
• Improvement and even resolution of ADHD symptoms has been shown after dopaminergic therapy in children with ADHD and RLS.
EDUCATIONAL RESOURCES

• National Sleep Foundation
• Restless Legs Syndrome Foundation
• International RLS Study Group
CONCLUSIONS

• RLS is a common, under-recognized pediatric neurologic disorder
• PLMD is a common, under-recognized pediatric sleep disorder
• Clinical findings of RLS are now well-described in children and adolescents
• Polysomnographic findings of PLMD are also easy to identify, although we may need to re-examine normal versus abnormal findings
• RLS/PLMD are (easily) treatable conditions in the pediatric population
"You think you have problems? I have restless leg syndrome in all 1000 legs."