

# Movements in Sleep – Restless Leg Syndrome & Periodic Limb Movements of Sleep

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## Definition, Assessment, Diagnosis

### Definition

- Restless leg syndrome (RLS) or Willis-Ekbom disease is a sensorimotor disorder characterized by a strong, nearly irresistible urge to move the legs, often accompanied by uncomfortable and unpleasant sensations.
- It most commonly affects the legs, but can also affect the arms, and torso.
- Moving the affected body part modulates the sensations, providing temporary relief. The urge worsens in the evening or night and gets relief in the morning.
- RLS may be associated with periodic limb movements of sleep (PLMS).
- PLMS are characterized by periodic episodes of repetitive, highly stereotyped, limb movements that occur before or after REM sleep.
- Typically, these movements involve extension of the big toe, often in combination with partial flexion of the ankle, the knee, and sometimes the hip.
- RLS was first identified by Karl Ekbom, a Swedish physician in 1954; however, the symptoms of this disorder were described in the 17th century by Sir Thomas Willis.
- First reports of RLS in children occurred in 1994. Recent prevalence rate in children is about 2% without significant gender differences. There are an estimated 1 million school age children affected with childhood RLS with one third having moderate to severe symptoms.
- Children or adolescents affected with RLS will have primary or idiopathic RLS; however, secondary RLS is seen in adults and begins at an older age.
- RLS has been associated with many underlying conditions ([Table 1](#)). More recently a study by Seidel et al reported higher frequency of RLS in migraine patients suggesting an association between RLS and migraine.
- Primary RLS or familial RLS is inherited in an autosomal dominant fashion with variable

penetrance.

- Specifically 4 genes, MEIS1, BTBD on chromosome 6p21.2, MAP2K5 and PTRPD located on 9p24-p22, were found to be linked to RLS. Furthermore candidate genes for affecting risk of PLMS in sleep included BTBD, GLO, and DNAH8.
- Well-established studies have examined the relationship between iron metabolism and RLS. In addition, a link between iron and dopamine metabolism has been elucidated.
- Medications such as sedating antihistamines, almost all centrally active dopamine receptor antagonists, and most antidepressants precipitate or aggravate RLS.

### Table 1. Conditions with RLS

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Table 1. Conditions with RLS
<b>Secondary RLS</b>
Iron deficiency (underlying cause)
End-stage renal disease
Pregnancy
Peripheral neuropathy
Parkinson disease
B12 and folate deficiencies
Thyroid disease
Diabetes (without neuropathy)
Fibromyalgia
Rheumatoid arthritis
Myelopathy
Multiple Sclerosis

### Assessment

- In children, primary familial RLS appears to be more common than secondary RLS.
- During the assessment, potential mimics of RLS should be considered (Table 2).
- Muscle soreness can be reported by children after physical activity.
  - Nocturnal cramps occur in about 7% of children.
  - Peripheral neuropathy, radiculopathy, and myopathy are not commonly seen in the pediatric population.
- PLMS are also seen in other sleep disorders such as narcolepsy, rapid eye movement (REM) disorder, as well as obstructive sleep apnea (OSA). They can be worsened by medications, especially serotonergic antidepressants.
- Sleep starts or hypnic jerks may be mistaken for PLMS but typically are limited to the transition from wakefulness to sleep, are not periodic and are briefer than PLMS.
- In a pediatric case study, 72% of cases had serum ferritin levels less than median normative values for age and sex.
  - Infants, toddlers, teens, especially female adolescents, are at risk for iron deficiency anemia.
  - Thus, iron deficiency may contribute to a worsening of RLS symptoms.

### Table 2. Differential Diagnosis of Pediatric Restless Legs Syndrome

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<b>Table 2. Differential Diagnosis of Pediatric Restless Legs Syndrome</b>
<b>Common</b>
Transient nerve compression Sore muscles Leg cramps Dermatitis Orthopedic disorders Bruise Ligament sprain/tendon strain Positional discomfort
<b>Less Common</b>
Peripheral neuropathy Radiculopathy Myopathy Myelopathy Sickle cell disease Arthritis Fibromalgia

## Diagnosis

- Criteria for the diagnosis of **definite RLS** in children (2 -12 years old): using the URGE criteria for adults
  - An urge to move the legs
  - The urge to move begins or worsens when sitting or lying down
  - The urge to move is partially or totally relieved by movement
  - The urge to move is worse in the evening or midnight than during the day or only occurs in the evening or night

### AND

- The child uses his/her own words to describe leg discomfort. Examples of age-appropriate descriptors: hurt, tickle, tingle, bugs, ants, static, want to run, and a lot of energy in my legs

### OR

- Two or 3 of the following supportive criteria are met:
  - Sleep disturbance inappropriate for age
  - Biological parent or sibling has definite RLS
  - Child has a sleep study documenting a periodic limb movement index  $\geq 5$  per hour of sleep. An acceptable alternative is an index that exceeds 5/h.
  - The condition is not better explained by another current sleep disorder, medical or neurologic disorder, mental disorder, medication use, or substance use disorder.
- Criteria for the diagnosis of **definite RLS in adolescents** (13 to 18 years old)
  - The 4 essential adult criteria are met as noted above.
  - The condition is not better explained by another current sleep disorder, medical or neurologic disorder, mental disorder, medication use, or substance use disorder.
- Criteria for the diagnosis of **periodic limb movements disorder** (PLMD)
  - Polysomnography shows repetitive, highly stereotyped limb movements that are
    - 0.5 to 10 seconds in duration
    - Minimum amplitude of 8 micro V above resting EMG

In a sequence of 4 or more movements

Separated by an interval of more than 5 seconds (from limb-movement onset to limb-movement onset) and less than 90 seconds (typically, there is an interval of 20-40 seconds).

- The PLMS index exceeds 5/h in pediatric cases and 15/h in most adult cases.
  - There is clinical sleep disturbance or a complaint of daytime fatigue
  - The PLMS are not better explained by another current sleep disorder, medical or neurologic disorder, mental disorder, medication use, or substance use disorder (e.g., PLMS at the termination of cyclically occurring apnea should not be counted as true PLMS or PLMD.)
- Severity of RLS symptoms is measured using P-RLS-SS (Peds RLS Severity Scale). In young adults the IRLS (International RLS) rating scale is used.

## Management

- Behavioral Treatment is first line management with emphasis on sleep hygiene including regular sleep schedule, good environment for sleeping, a healthy age-appropriate diet, regulated intake of caffeinated drinks and daily exercise.
- Currently, there are no Food and Drug Administration-approved medications for children. However, some medical literature supports use of pharmacological treatment including hypnotics such as clonazepam, anticonvulsants such as gabapentin and dopaminergic agents such as ropinirole. Another commonly used medication in children is clonidine.
- In children with low serum ferritin levels supplementation with iron as monotherapy or in combination with other treatments is effective in treating pediatric RLS.
- Most recently the FDA approved the use of a medical device Relaxis for RLS in adults. The device provides vibratory counter stimulation that gradually ramps down and shuts off via a low-profile pad. This may be a viable option for children and adolescents in the future.

## Prevention and Education

- It has been reported that low level of iron stores has been associated with RLS; therefore, monitoring serum ferritin levels in children with risk for deficiency may prevent development of PLMS and RLS.
- Education regarding healthy age-appropriate diet as well as good sleep habits may help with the RLS symptoms in the children.
- Poor sleep has been shown to be associated with cognitive and affective problems including impaired attention and memory as well as emotional regulation in children and adolescents. A recent study found a lower grade point average in adolescents with RLS symptoms. Furthermore an association between attention-deficit/hyperactivity disorder (ADHD), RLS, and PLMD has been reported.
- Routine good sleep habits with parental involvement and supervision are most important in children and adolescents. Typical sleep hours by age are tabulated in [Table 3](#) and are ideal for children at each of the age groups.

### Table 3. Normal Hours for Total Sleep Time by Age

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**Table 3. Normal Hours for Total Sleep Time by Age**

Age	Time
2 years	12 hours with 1 nap
5 years	11 hours
10 years	10 hours
Teenager	9 hours
Adult	7-8 hours

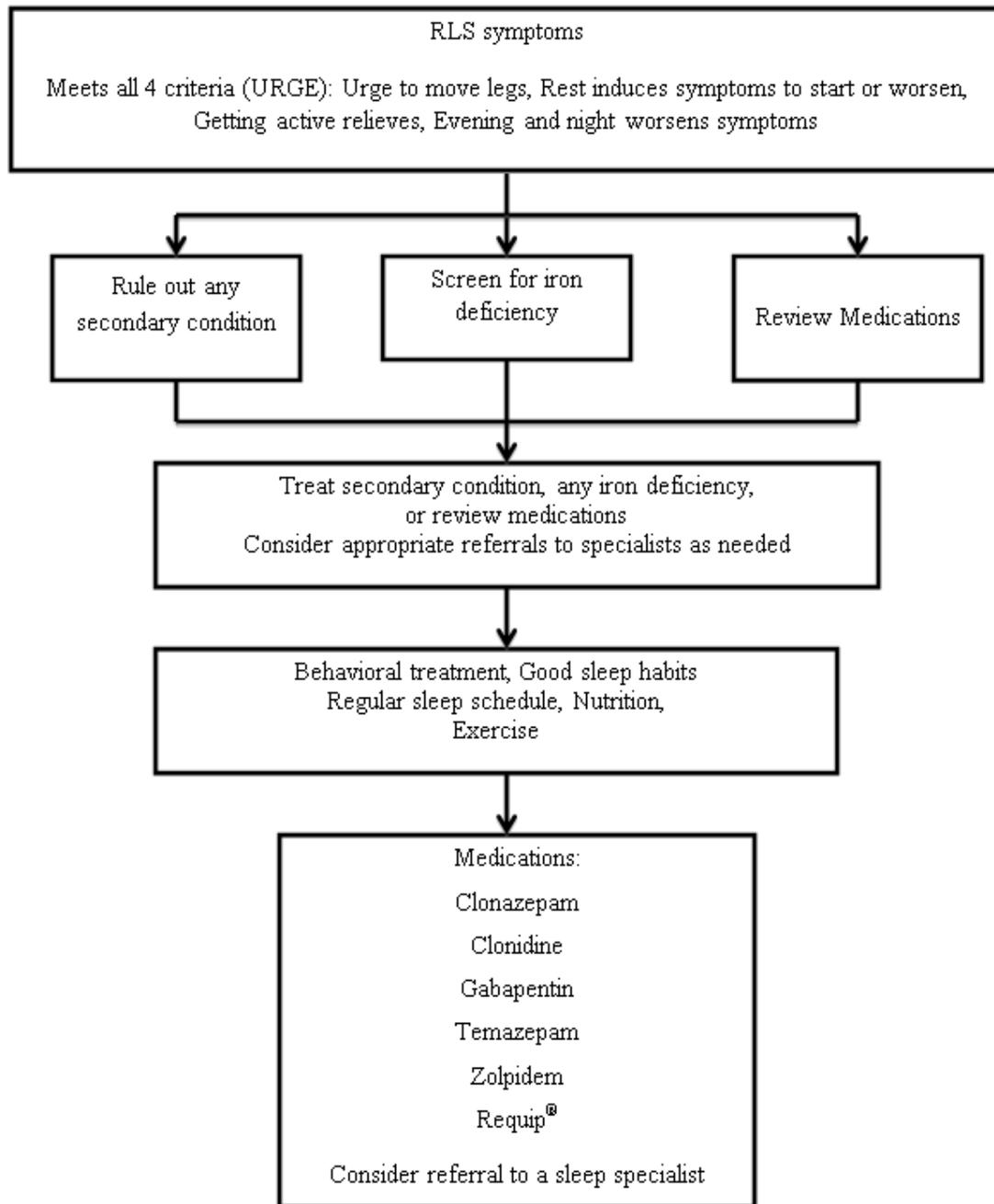
- The Pediatric RLS NEWREST plan presents helpful sleep tips for RLS patients:
  - **Nutritional needs**

A healthy, age-appropriate diet with foods containing caffeine restricted, especially in the late afternoon and evening including chocolate, and drinks such as soda, energy drinks, iced tea, and coffee.

The need for iron supplementation and current dietary iron should be considered.
  - **Environment for sleeping** should be relaxing, quiet, and only for sleeping, and the bedroom should not be used for studying, loud music, TV, and “time out”.
  - **Watch for restlessness, uncomfortable leg sensations, and disturbed sleep**, especially when they impair daytime functioning.
  - **Regular sleep schedule on weekdays and weekends** with a routine bedtime and wakeup time is important.
  - **Exercise daily** as physical activity can decrease RLS sensations and increase sleep time.
  - **Stop substance use** that affects good sleep such as tobacco, alcohol, and recreational drugs.
  - **Take prescribed medication and/or approved iron supplements consistently** to maintain serum ferritin level above 50ng/ml.

**Figure 1. Algorithm for RLS**

To view a larger image on your device, please click or touch the image.



*This guideline was developed to improve health care access in Arkansas and to aid health care providers in making decisions about appropriate patient care. The needs of the individual patient, resources available, and limitations unique to the institution or type of practice may warrant variations.*

## References

## References

1. Allen RA, Picchietti D, Hening WA, Trenkwalder C, et al. Restless legs: diagnostic criteria, special considerations, and epidemiology. A report from the restless legs diagnosis and

- epidemiology workshop at the National Institutes of Health. *Sleep Med* 2003;4:101-19.
2. Amos LB, Grekowicz ML, Kuhn EM, Olstad JD, et al. Treatment of Pediatric Restless Legs Syndrome. *Clin Pediatr (phila)* 2014; 53(4):331-6.
  3. Arbuckle R, Abetz L, Durmer JS, Ivanenko A, et al. Development of the Pediatric Restless Legs Syndrome Severity Scale (P-RLS-SS): a patient-reported outcome measure of pediatric RLS symptoms and impact. *Sleep Med* 2010;11(9):897-906.
  4. Children with RLS: <https://www.rls.org> (Restless Leg Foundation)
  5. Cortese S, Konofal E, Lecendreux M, Arnulf I, et al. Restless legs syndrome and attention-deficit/hyperactivity disorder: a review of the literature. *Sleep* 2005;28:1007-13.
  6. Ekblom K, Ulfberg J. Restless legs syndrome. *J Intern Med* 2009;266:419-31.
  7. FDA Okays First Device for Restless Legs Syndrome. Medscape. May 30, 2014.
  8. Frenette E. Restless legs syndrome in children: A review and update on pharmacological options. *Curr Pharm Des* 2011;17:1436-42.
  9. Lavigne GJ, Montplaisir JY. Restless legs syndrome and sleep bruxism: prevalence and association among Canadians. *Sleep* 1994;17:739-43.
  10. Lewin DS, Di Pinto M. Sleep disorders and ADHD: shared and common phenotypes. *Sleep* 2004; 27:188-9.
  11. National Institute of Neurological Disorders and Stroke : Restless Legs Syndrome Fact Sheet Jul 2015.
  12. Picchietti D, Allen RP, Walters AS, Davidson JE, et al. Restless leg syndrome: prevalence and impact in children and adolescents -The Peds REST study. *Pediatrics* 2007;120:253-66.
  13. Picchietti DL, Stevens HE. Early manifestations of restless legs syndrome in childhood and adolescence. *Sleep Med* 2008;9:770-81.
  14. Picchietti MA, Picchietti DL. Advances in pediatric restless legs syndrome: iron, genetics, diagnosis and treatment. *Sleep Med* 2010;11: 643-51.
  15. Picchietti MA, Picchietti DL. Restless legs syndrome and periodic limb movement disorder in children and adolescents. *Semin Pediatr Neurol* 2008;15:91-9.
  16. Sadeh A, Gruber R, Raviv A. The effects of sleep restriction and extension on school-age children: what a difference an hour makes. *Child Dev* 2003;74:444-55.
  17. Salas RE, Gamaldo CE, Allen RP. Update in restless legs syndrome. *Curr Opin Neurol* 2010;23:401-6.
  18. Schormair B, Kemlink D, Roeske D, Eckstein G, Xiong L, Lichtner P, et al. PTPRD (protein tyrosine phosphatase receptor type delta) is associated with restless legs syndrome. *Nat Genet* 2008; 40: 946-8.
  19. Seidel S, Bock A, Schlegel W et al. Increased RLS prevalence in children and adolescents with migraine: A Case-control study. *Cephalalgia* 2012;32:693-699.
  20. Stefansson H, Rye DB, Hicks A, Petursson H, et al. A genetic risk factor for periodic limb movements in sleep. *N Engl J Med* 2007;357(7):639-47.
  21. Walters AS, LeBrocq C, Dhar A, Hening W, et al. Validation of the International Restless legs Syndrome Study Group rating scale for restless legs syndrome. *Sleep Med* 2003;4(2):121-32.
  22. Owens JA, Rosen CL, Mindell JA. Medication use in the treatment of pediatric insomnia: results of a survey of community-based pediatricians. *Pediatrics* 2003;111: e628-35.