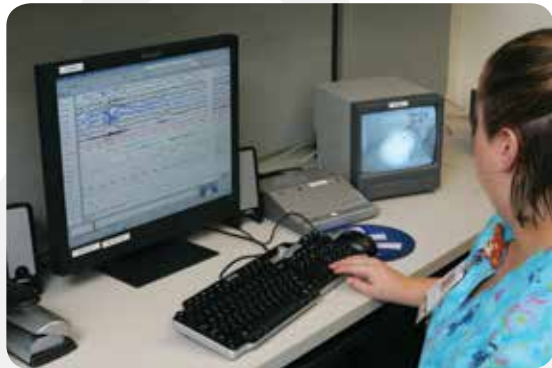


LEG MOVEMENTS DURING SLEEP IN CHILDREN

Identifying the Effects of Age, Gender and Iron Status

Young children often present at the Children's Mercy Kansas City Sleep Center with complaints of snoring, insomnia, daytime sleepiness or just being a restless sleeper. If repeated limb movements are identified during the sleep study, it can help explain poor school performance, hyperactivity or lack of focus.



The sleep medicine team is investigating whether age is an important factor related to LMS and PLMS during sleep in children.

Baha Al-Shawwa, MD, pediatric pulmonologist and sleep medicine specialist at Children's Mercy, set out to investigate age as an important factor related to leg movements (LMS) and periodic limb movements (PLMS) during sleep

in children. In this large study with over 1,000 pediatric patients, the relationship was studied after adjusting many confounding factors such as iron status (ferritin levels), gender and other sleep parameters based on polysomnogram data.

STUDY CRITERIA

Dr. Al-Shawwa and his team performed retrospective data analysis on a large pediatric population who met three criteria:

- Had undergone an overnight sleep study between May 2013 and October 2017
- Had ferritin level tested within 30 days of sleep study
- Patients with obstructive or central sleep apneas were excluded from the sample

In total, 1,070 patients were included in the study, which is the largest cohort of pediatric patients who had iron studies done in conjunction with sleep studies. Sixty percent of the patients were males and patients were divided into six groups based on their age: Group 1 (0-2 years), group 2 (3-4 years), group 3 (5-10 years), group 4 (11-13 years), group 5 (14-15 years) and group 6 (16-17 years).

STUDY FOCUS

Existing normative data for pediatric LMS and PLMS lacks information on ferritin/iron status, despite the fact that it is a major confounding factor. The question central to the new study was: *Will age continue to be a factor for LMS/PLMS in children once we control for ferritin level and gender?* The goal was to uncover additional factors that could help sleep medicine specialists modulate LMS and PLMS in pediatric patients.

RESULTS

At the conclusion of the data analysis, the team discovered two factors associated with increased LMS and PLMS:

- The younger the patient, the more likely they were to experience LMS and PLMS
- Male patients were more likely to have higher rates of limb movements

Although these factors had been noted in existing literature, they were not corrected for underlying ferritin level state. In addition, the Children's Mercy study covered a much larger population, including patients as young as 12 months, whereas most of the existing literature used a cutoff of approximately 5 years of age.

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RESULTS

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Surprisingly, and of great clinical interest to the team, minimal to no relationship between limb movements and ferritin levels was found. The association of ferritin levels with restless leg syndrome (RLS) is well-established in the literature, but this association is more tenuous for PLMS.

The team conducted another analysis on the ferritin data, which included an editorial letter published in the *Journal of Clinical Sleep Medicine*. It found that if the patients were grouped according to age (ages 1-5, 6-11 and 12-19), mean ferritin levels were 24.7 (95th CI: 23.4-26.0, n=535), 31.4 (29.4-33.3, n=411), and 35.0 (29.6-40.4, n=112), respectively. These levels corresponded closely to general population levels found in national surveys.¹

The team then questioned why ferritin levels were not associated with LMS/PLMS. One possibility they mentioned was that serum ferritin does not accurately reflect brain iron stores, and therefore will not reflect the resulting symptoms. This is supported by earlier studies that demonstrated significant differences in CSF ferritin levels but not in serum ferritin levels between adults with or without RLS.

As a result, Dr. Al-Shawwa concluded that age and gender should be considered when interpreting limb movement indices in pediatric sleep patients, regardless of ferritin level.

PRESENTATION OF FINDINGS

Dr. Al-Shawwa's paper on his research and findings has been accepted for publication in the *Journal of Clinical Sleep Medicine*. In addition, he presented his findings at a poster session during SLEEP 2018 in Baltimore.

WHAT COMES NEXT?

Although the study confirmed that age plays a major role in LMS/PLMS in children irrespective of iron status, the reason for this has not yet been identified. Therefore, the next step is to perform in-depth analysis of the normative data. The goal is to determine other factors that may play a role and lead to the development of more effective care protocols in treating restless sleep for pediatric patients, ultimately improving the health of children.

SOURCES

¹ National Report on Biochemical Indicators of Diet and Nutrition in the U.S. Population, Centers for Disease Control and Prevention.

https://www.cdc.gov/nutritionreport/99-02/pdf/nutrition_report.pdf.

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