NEWS

REM sleep disrupted in children with autism

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Sweet dreams: Children with autism spend less time in the rapid eye movement stage of sleep, in which dreaming is most common, than typically developing children do.

Children with autism spend less time in the rapid eye movement (REM) stage of sleep compared with controls and those with developmental delays, according to a November report in the *Archives of Pediatrics & Adolescent Medicine*[1].

Believed to play an important role in learning and memory, REM sleep is usually prolonged in infants and young children, and decreases with age. It is the phase of sleep in which dreaming is most common.

Disturbances in REM sleep in children with autism could be a sign of abnormal neural organization, and may reveal problems with chemical messengers, or neurotransmitters, in the brain, the researchers say.

Several studies have suggested a variety of **sleep problems in children and adolescents with autism**. Questionnaires completed by parents indicate that children with the disorder struggle with falling and staying asleep, bedwetting, repetitive behavior while falling asleep and daytime sleepiness[2]. Many of these problems are similar to those seen in typically developing children, but

are more common in those with autism, occurring in 44 to 83 percent of school-age children with the disorder[3].

The new study delved deeper into the nature of sleep patterns in these children and found that they spend an average of about 15 percent of their sleep in the REM stage, compared with 23 percent or more for the other groups. Children with autism also sleep at least an hour less than other children do on average, the researchers say.

The researchers found no differences between the sleep patterns of developmentally delayed children who do not have autism and those of controls.

"This is compelling evidence that sleep architecture is disturbed in children with autism — and sleep during this period is absolutely crucial to growth and development of the brain," says principal investigator **Susan Swedo**, chief of pediatrics and developmental neuroscience at the National Institute of Mental Health.

The findings confirm anecdotal reports from parents indicating that children with autism **don't sleep as long**, or as peacefully, as other children do, Swedo notes.

Many of the observations from sleep studies are based on actigraphy, which relies on a wristwatch-like device to record movement throughout the night. But actigraphy does not provide details about the quality of sleep, notes **Ruth O'Hara** associate professor of psychiatry and behavioral science at Stanford University, who was not involved in the study.

However, data directly measuring the sleep stages of children with autism are relatively scant. One 2007 study showed that children and adolescents with autism spend less time in bed and asleep, and have a longer time to onset of REM sleep, than typically developing controls do[3].

Challenging studies:

In the new study, the researchers used overnight polysomnography — a more elaborate but reliable method in which researchers measure physiological variables such as brain electrical activity. The technique requires attaching a number of sensors to the participant, something that children with autism sometimes resist, says O'Hara.

Of 88 children in the study, 60 have autism, 15 are typically developing controls, and 13 have developmental delay and were matched for nonverbal intelligence quotient to those with autism. The children ranged in age from 2 to 13 years.

Some children with autism have virtually no REM sleep at all, the new study found. Compared with the control groups, the children with autism spend more time in stage 3, or slow-wave, sleep, in which the deepest sleep occurs.

The new study doesn't indicate whether sleep disturbances in children with autism contribute to deficits seen in the disorder, or are caused by them. However, REM sleep is believed to be important for consolidating memories, which could explain the children's learning difficulties. "If they weren't consolidating memories properly, the things they learned during the day might be forgotten by the next day," Swedo suggests.

A 2009 study found that children with autism who are classified as poor sleepers by various measures — including parental reports, actigraphy and polysomnography — show more inattention, hyperactivity and restricted or repetitive behaviors compared with those classified as good sleepers[4]. Poor sleepers with autism have also been shown to have higher scores related to mood problems on a behavior checklist, and have trouble with reciprocal social interaction[5].

The new study notes the possible roles of several neurotransmitters, including serotonin and glutamate[6,7], in causing the sleep disruptions. "Based on the finding of reduced REM sleep alone, it's likely these neurotransmitter systems are involved because they are so integrally linked to REM," O'Hara says.

Because acetylcholine is the main driver of REM sleep, however, "We [autism researchers] maybe need to look more broadly at the cholinergic system," O'Hara notes.

Acetylcholine, and its interaction with other neurotransmitters, may ultimately yield a treatment target, Swedo adds. Her team is studying whether the Alzheimer's drug donepezil, which inhibits an enzyme that breaks down acetylcholine, can **increase REM sleep** and ease other symptoms in children with autism.

Unfortunately, scientists lack good methods to directly assess neurotransmitter function in the brain, O'Hara says. "Typically we're inferring neurotransmitter function. That's been one of the great limitations of the field, not just in autism but in psychiatry in general."

The researchers plan to continue following the children to determine whether their shorter REM sleep persists into adulthood, says Swedo, and to investigate long-term consequences of their disrupted sleep patterns.

REFERENCES:

1. Buckley A.W. *et al. Arch. Pediatr. Adolesc. Med.* **164**, 1032-1037 (2010) **PubMed**
2. Miano S. *et al. Sleep Med.* **9**, 64-70 (2007) **PubMed**
3. Miano S. and R. Ferri *Paediatr. Drugs* **12**, 75-84 (2010) **PubMed**
4. Goldman S.E. *et al. Dev. Neuropsychol.* **34**, 560-573 (2009) **PubMed**
5. Malow B.A. *et al. Sleep* **29**, 1563-1571 (2006) **PubMed**

6. Pardo C.A. and C.G. Eberhart *Brain Pathol.* **17**, 434-437 (2007) **PubMed**
7. Lam K.S. *et al. Res. Dev. Disabil.* **27**, 254-259 (2006) **PubMed**