

Enuretic sleep: deep, disturbed or just wet?

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Abstract Enuretic children sleep “deeply” in the sense that they are difficult to arouse from sleep, but not in the sense that their sleep is necessarily polysomnographically different from other children. The enuretic children’s arousal difficulties may be due to a disturbance at the brainstem level and/or to frequent arousal stimuli from the bladder. It may be hypothesised that the sleep disturbance of enuretic children may lead not only to the wetting of the sheets but to disturbances of daytime psychological functioning as well.

Keywords Enuresis · Sleep · Arousal · Polysomnography

The present issue of *Pediatric Nephrology* contains an article evaluating the subjective sleep quality of enuretic children [1]. It was found that bedwetters consider their sleep to be bad, compared with that of controls, because they are anxious about the risk of urinating while asleep, and their sleep is interrupted by the enuretic accidents. These findings are not very surprising. More important and controversial questions are (1) is the sleep of enuretic children “deep”? (2) Is the sleep of enuretic children neurophysiologically disturbed? and (3) Does the possible sleep disturbance of enuretic children have consequences other than the mere wetting of the sheets?

The parents of bedwetting children have always considered that their offspring are “deep sleepers”. This is elegantly illustrated by the common observation during the start of enuresis alarm therapy that all the family wakes up at the sound of the alarm *except* the child using it (note that this includes a “control group”, i.e. the rest of the family). Many questionnaire studies of subjective arousal

thresholds corroborate this observation [2–5], and the pioneer study by Wolfish et al., in which enuretic children and controls were subjected to graded arousal stimuli during well-defined sleep stages, showed quite clearly that this holds true for objective arousal thresholds as well [6]. Thus, the first question above can be answered in the positive.

This leads us to the second question. The fact that enuretic children are more difficult to arouse than their peers does not necessarily mean that their sleep is *polysomnographically* deeper. Two people can have exactly the same sleep stage distribution and electroencephalography (EEG) pattern, but differ vastly with regard to how easy they are to arouse from sleep. Most studies on enuretic children show that their polysomnogram findings are within normal limits [7–9]. The few polysomnographic comparisons that have been performed of children that are not enuretic have yielded conflicting results: either no differences have been found [10–12] or the enuretic children have been found to have subtle EEG signs of deeper sleep [13, 14], or the bedwetters have even been found to have a slightly more superficial sleep than control children [15]. None of these studies showed large differences. So, a judicious interim answer to the second question would be that, on the one hand, yes, there *must* be a neurophysiological correlate of the enuretic children’s low arousability, but, on the other hand, no, there are no polysomnographically clear differences between bedwetters and dry children.

The neurophysiological correlate of the low arousability of enuretic children should probably be sought in the brainstem and in the activity of the autonomic nervous system. The central nervous system (CNS) branch of the sympathetic nervous system is needed both for arousal—via the reticular activating system—and for micturition and detrusor contraction—via the pontine micturition centre. Both these mechanisms converge in a small area around the

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locus coeruleus in the upper pons. There is now increasing evidence that enuretic children suffer from subtle malfunction in this area [16–18].

It is well known that the frequent sleep disruptions experienced by children and adults with sleep apnoea due to upper airway obstruction cause numerous daytime problems as well, such as sleepiness and stunted growth. The fact is that these patients are paradoxically difficult to arouse from sleep. It seems that the brain puts such a high priority on the integrity of sleep that the arousal threshold is increased rather than decreased by the constant arousal stimuli from the airways [19]. This is one cause for the observed association between enuresis and upper airway obstruction [20] (another cause is that these children often have nocturnal polyuria).

The situation may be analogous in enuresis without sleep apnoea. We now know that bedwetting children either have nocturnal polyuria, leading to bladder stretch and (over-) filling at night, or nocturnal detrusor overactivity with repeated detrusor contractions. Both mechanisms, especially the latter, can be expected to cause repeated disruption of the sleep pattern [21], with potential daytime consequences.

The observed (minor) association between nocturnal enuresis and psychological problems [22] was originally explained by now discredited theories of enuresis as an expression of regression or other underlying psychopathology. These associations have been attributed to the low self-esteem of the bedwetters [23] and to an over-representation of children suffering from neuropsychiatric conditions such as attention deficit hyperactivity disorder (ADHD) in the enuretic group [24]. These two explanations are certainly valid, but now we might possibly add a third: bedwetting children, especially the usually therapy-resistant children who have nocturnal detrusor overactivity, might suffer from subtle problems with daytime psychosocial function due to poor sleep quality. This gives us yet another reason to consider enuresis a serious problem in need of efficient therapy. The two now available and evidence-based treatments, i.e. the enuresis alarm and desmopressin, can certainly not offer efficient therapy for all bedwetters.

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