



DIAGNOSIS AND TREATMENT OF ENURESIS IN CHILDREN: MODERN APPROACHES

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ABSTRACT

Enuresis in children is a common condition requiring a comprehensive approach to diagnosis and treatment. The article discusses modern diagnostic methods, including clinical examination, voiding diary, ultrasound diagnostics, uroflowmetry, and neurophysiological studies. Indications for treatment, age criteria, and psychosocial aspects are discussed. Treatment methods are presented: non-pharmacological (behavioral therapy, enuresis alarms), pharmacological (desmopressin, anticholinergic drugs), physiotherapeutic, and psychotherapeutic approaches. Particular attention is paid to monitoring effectiveness, complications, relapses, and the impact on quality of life. The main conclusions emphasize the importance of individualized therapy and the need for further research into genetic and neurophysiological aspects. The work is based on data from 20 authoritative sources over the past 5-10 years

Introduction

Enuresis, or nocturnal enuresis, is defined as involuntary urination during sleep in children over 5 years of age when bladder control is expected [2]. This condition occurs in 15-20% of children aged 5 years and in 5-10% of children aged 10 years, making it one of the most common urological problems in childhood [17]. The relevance of enuresis is due not only to its high prevalence but also to its significant impact on the child's psychosocial development, including reduced self-esteem, social isolation, and psychological disorders [14]. In addition, enuresis can cause feelings of shame and guilt in the child, lead to family conflicts, and limit participation in social activities such as sleepovers at friends' houses or school trips.

It is important to note that enuresis is divided into primary enuresis (when the child has never had a prolonged period of nighttime dryness) and secondary enuresis (when urinary incontinence recurs after a period of dryness of at least 6 months). Monosymptomatic enuresis (only nighttime incontinence without daytime symptoms) and non-monosymptomatic enuresis

(a combination of nighttime incontinence with daytime symptoms such as frequent urination, urgency, or daytime urinary incontinence) are also distinguished.

Although enuresis resolves spontaneously in most children, active intervention is required in some cases. Modern approaches to the diagnosis and treatment of enuresis have undergone significant evolution. Along with traditional methods such as behavioral therapy and medication, increasing attention is being paid to an individualized approach that takes into account the type of enuresis, the child's age, comorbidities, and psychosocial factors. Early and accurate diagnosis, including history taking, physical examination, and additional studies if necessary, is a key step in determining the optimal treatment strategy. Currently, new methods and technologies are actively being studied and implemented to improve the effectiveness of treatment and the quality of life of children with enuresis and their families [14].

The aim of this review is to analyze modern approaches to the diagnosis and treatment of enuresis in children based on current scientific data and clinical guidelines.

Etiology and Pathogenesis

Enuresis in children is a multifactorial condition caused by the interaction of physiological, genetic, and psychological mechanisms. Among the physiological factors, a delay in the maturation of the central nervous system (CNS), which regulates bladder control, and a decrease in nocturnal secretion of antidiuretic hormone (ADH), leading to nocturnal polyuria, are distinguished [15]. Detrusor overactivity and reduced functional bladder capacity also play a key role, especially in children with primary enuresis [24].

Genetic predisposition significantly affects the development of enuresis. If one of the parents suffered from enuresis in childhood, the risk for the child increases by 5-7 times [4]. A study by Yener S. et al. (2024) revealed a link between enuresis and polymorphisms in the AQP2 (aquaporin-2) and AVPR2 (vasopressin receptor) genes, which regulate water balance and circadian rhythms. In addition, genetic markers affecting neurotransmitters such as serotonin and dopamine may be associated with impaired arousal and bladder control [11].

Sleep disturbances are an important pathogenetic factor. According to Neveus (2011), children with enuresis often show increased activity in the rapid eye movement (REM) sleep phase and a reduced arousal threshold in the deep sleep phase, which prevents the response to signals of a full bladder. This is confirmed by polysomnography data showing abnormalities in sleep structure in 30-40% of patients with enuresis [7].

Psychological factors also make a significant contribution. Stress caused by family conflicts, school problems, or traumatic events (e.g., loss of a loved one) can initiate or exacerbate enuresis [5]. Studies show that children with enuresis are more likely to experience anxiety disorders and low self-esteem, which emphasizes the role of psychoemotional status in the pathogenesis [14]. Age-related features, such as the immaturity of the nervous regulation of urination up to 7-8 years, further complicate the situation, requiring a comprehensive approach to diagnosis and treatment.

Clinical Presentation

Enuresis in children is characterized by involuntary urination during sleep, most often in the first half of the night, when the deep sleep phase predominates [24]. The frequency of episodes varies from 1-2 times per week to daily occurrences, which allows for the classification of enuresis as mild, moderate, or severe depending on the number of nights with incontinence [17]. In most children, enuresis is primary (without a period of dry nights),

whereas secondary enuresis (occurring after 6 months of continence) is often associated with psychological or medical triggers.

Typical symptoms include nocturnal urinary incontinence without awakening, which distinguishes enuresis from other forms of incontinence. In 10-15% of children, concomitant daytime symptoms are observed, such as daytime urinary incontinence, increased urinary frequency, or urgency, indicating lower urinary tract dysfunction [10]. Constipation, which occurs in 30% of patients, exacerbates enuresis due to the pressure of the enlarged rectum on the bladder, requiring a comprehensive approach to treatment [13].

Enuresis has a pronounced impact on the child's psychological state. Feelings of shame, fear of judgment, and low self-esteem often lead to social isolation: children avoid sleepovers at friends' houses, participation in camps, or family trips [14]. In 20-25% of patients, anxiety disorders or depressive symptoms are noted, especially with a prolonged course of enuresis [13]. Social adaptation deteriorates due to peer ridicule or pressure from the family, which emphasizes the need for early intervention. It is important to note that enuresis is not related to conscious behavior or laziness but is a medical problem requiring support and understanding. The severity of the clinical presentation varies, and the individual characteristics of each case determine the choice of diagnostic and therapeutic strategies.

Modern Diagnostic Methods

The diagnosis of enuresis in children begins with a detailed clinical examination and history taking, including the frequency of incontinence episodes, family history, and the presence of concomitant symptoms [13].

Assessment of neurological status is performed to rule out CNS pathologies, such as minimal brain dysfunction or underlying neurological disorders, which may manifest as enuresis [von Gontard et al., 2011]. The child's psychological state is assessed using standardized questionnaires (e.g., CBCL – Child Behavior Checklist) to identify anxiety, depression, or behavioral problems that often accompany enuresis [1].

A voiding diary, completed by parents for 7 days, remains the gold standard for analyzing voiding patterns, urine volume, and incontinence episodes [22].

Ultrasound diagnostics (USD) of the urinary system helps to rule out anatomical abnormalities, such as ureteral duplication or residual urine, and uroflowmetry reveals lower urinary tract dysfunction by measuring the speed and volume of urination [3].

Laboratory tests (urinalysis, blood glucose level) are necessary to rule out infections, diabetes, or kidney disorders [19].

Modern neurophysiological methods, such as electroencephalography (EEG), are used when epilepsy or sleep abnormalities affecting enuresis are suspected [23]. Magnetic resonance imaging (MRI) of the brain is used in complex cases to assess structural changes in areas responsible for bladder control, such as the hypothalamus, pons, and frontal lobe cortex. A study by Wang M. et al. (2019) showed that children with enuresis have changes in the activation of the prefrontal cortex, which may indicate a disruption in the neural connections regulating arousal and urination [26].

Consultation with a psychologist or psychiatrist plays an important role, especially in secondary enuresis or the presence of psychoemotional problems. This allows for the identification of comorbid disorders, such as attention deficit hyperactivity disorder (ADHD), which occurs in 20-30% of children with enuresis [25].

Differential Diagnosis between primary and secondary enuresis, as well as the exclusion of organic causes (e.g., spinal dysraphism), determine further treatment strategy.

Modern Treatment Methods

Treatment of enuresis in children includes non-pharmacological, pharmacological, and psychotherapeutic approaches, the choice of which depends on age, severity of the condition, and family preferences. Non-pharmacological methods are the first-line therapy.

Behavioral therapy includes fluid management (limiting fluids 2 hours before bedtime), bladder training (delaying urination during the day to increase bladder capacity), and Kegel exercises aimed at strengthening the pelvic floor muscles [6]. These methods are effective in 20-30% of patients and are safe for younger children. Enuresis alarms, based on the development of a conditioned reflex, awaken the child at the first signs of urination and demonstrate success in 60-70% of cases in children over 7 years of age [12].

Pharmacological treatment is used when non-pharmacological methods are insufficiently effective. Desmopressin, a synthetic analogue of ADH, reduces nocturnal diuresis and is effective in 40-60% of cases [11]. Anticholinergic drugs, such as oxybutynin, correct detrusor overactivity [20]. Imipramine, a tricyclic antidepressant, is used in resistant cases, affecting the central nervous system and reducing the frequency of enuresis in 50-60% of patients, although its use is limited due to side effects such as drowsiness and cardiotoxicity. New studies are exploring the effectiveness of drugs modulating serotonin receptors, such as sertraline, but their use is currently experimental [21].

Psychotherapy, including *cognitive-behavioral therapy* (CBT), helps to cope with emotional problems, increasing the child's confidence and adherence to treatment. CBT is particularly effective in secondary enuresis associated with stress and reduces the frequency of relapses by 20-30% [5].

Physiotherapy, such as pelvic floor *electrical stimulation* and biofeedback, is used for bladder dysfunction, improving control in 40% of cases [8]. Combined therapy (e.g., alarms + desmopressin) demonstrates the best results, achieving success in 70-80% of cases [22].

Monitoring of Treatment and Long-Term Outcomes

Monitoring includes regular assessment of the frequency of incontinence episodes, sleep quality, and the child's overall condition. Effectiveness criteria include a 50% reduction in episodes (partial remission) or complete cessation [17]. Complications, such as headache or hyponatremia with desmopressin use, are rare but require monitoring [18]. Relapses occur in 20-40% of cases after stopping treatment, especially with medication, and are corrected by repeated courses [4].

Successful treatment improves quality of life, as confirmed by PedsQL questionnaires: scores increase by 15-20% after remission [9]. Long-term outcomes depend on the age at the start of therapy and adherence to recommendations, emphasizing the importance of early intervention in children older than 7 years.

Conclusion

Modern approaches to the diagnosis and treatment of enuresis in children emphasize the importance of individualized therapy that takes into account etiology, clinical presentation, and psychosocial factors. Non-pharmacological methods, such as behavioral therapy and enuresis alarms, remain the cornerstone of treatment due to their safety and effectiveness, complemented by pharmacotherapy (desmopressin, imipramine) in complex cases.

Psychotherapy and physiotherapy expand the possibilities for correction, especially in the presence of emotional or functional disorders. The success of treatment depends on thorough diagnosis, including neurophysiological and psychological methods, as well as on cooperation between the physician, the child, and the family.

Parents and guardians should play an active role in supporting the child. Avoiding punishment, creating a comfortable atmosphere, and encouraging small successes help to increase motivation and reduce stress [4]. It is recommended to explain to the child that enuresis is a temporary condition that can be corrected, which helps to reduce feelings of guilt. Educating parents on the proper use of enuresis alarms or adherence to fluid management also increases the effectiveness of therapy.

Prospects for further research are related to the study of genetic markers (e.g., AQP2 and AVPR2 genes) and neurophysiological mechanisms, including the role of sleep disorders and brain regulation. The development of targeted methods, such as personalized pharmacotherapy or neuromodulation, may improve treatment outcomes in the future.

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