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Mini Review

Research Progress in the Treatment of Childhood Nocturnal Enuresis

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Abstract

Nocturnal Enuresis (NE) mainly refers to the recurrent involuntary urination during nighttime sleep in children aged 5 years or older, after excluding organic diseases of the nervous system, urinary system, endocrine system, or other systems. It is a common pediatric disease. Persistent NE symptoms not only affect the mental health and quality of life of children but also increase family burden and cause significant social anxiety. This article will elaborate on the latest treatment methods and intervention measures for this disease.

Keywords: Nocturnal Enuresis, Desmopressin (DDVAP), Pathogenesis, Treatment Methods

Introduction

The occurrence of NE is related to multiple factors. Although its pathophysiological mechanism has not been fully elucidated, sleep arousal disorder and abnormal bladder function have been recognized as the core fundamental etiologies of this disease in current medical cognition. This disease is relatively common in children over 5 years old. A cross-sectional study on NE conducted by the Chinese Children's Enuresis Management Collaborative Group in 2017 showed that the overall prevalence of childhood NE in China was 4.8% [1]. According to the recommendations of the International Children's Continence Society (ICCS), nocturnal enuresis can be divided into two types: monosymptomatic nocturnal enuresis (MNE) and non-monosymptomatic nocturnal enuresis (NMNE), distinguished by the presence or absence of lower urinary tract symptoms (LUTS) [2]. MNE refers to children with only involuntary urination during nighttime sleep, without daytime lower urinary tract symptoms such as frequent urination, urgent urination, or urinary incontinence. MNE accounts for a relatively high proportion of nocturnal enuresis cases, with more than 68.5% of cases belonging to this type [3].

Pathogenesis

Increased Nocturnal Urination

In normal individuals, the secretion of antidiuretic hormone increases at night, leading to urine concentration and reduced urine output. However, children with NE usually experience enuresis during sleep due to insufficient secretion of antidiuretic hormone at night, which is also an important cause of this disease. In addition, increased fluid intake before sleep and decreased sensitivity to antidiuretic hormone can also result in nighttime enuresis.

Abnormal Bladder Function

Domestic relevant research results showed that urodynamic tests on children with non-monosymptomatic nocturnal enuresis revealed the following distribution of abnormal bladder function: the detection rate of overactive bladder was 80.30%, and the detection rate of reduced nocturnal functional bladder capacity was 21.21%. Notably, some cases had both of the above two types of abnormal bladder function. These test results suggest that abnormal bladder or urethral function is an important pathological factor contributing to non-monosymptomatic nocturnal enuresis in children [4].

Genetics

NE has a significant genetic predisposition. Studies have shown that the incidence of NE in children is 15% if neither parent nor their immediate relatives have a history of enuresis; it increases to 44% if one parent or their immediate relatives have a history of enuresis; and if both parents have a positive history, the incidence increases to 77% [5].

Constipation

Constipation is a common but crucial secondary cause of NE. Due to their anatomical structure and shared nerve innervation, the bladder, urethra, and rectum are prone to concurrent functional abnormalities. When the rectum is overfilled due to fecal impaction, it exerts a series of negative effects on bladder function through direct physical compression and nerve reflexes, ultimately causing or exacerbating enuresis. Studies have shown that the proportion of NE children with constipation ranges from 36% to 80% [6].

Psychological Factors

Mental and psychological behavioral abnormalities are closely associated with NE. Psychological stress (such as fear, fright, or conflict), parents' responses to their children's behaviors, and incorrect coping styles may lead to the occurrence of NE. The current general consensus is that enuresis often causes a series of psychological problems due to low self-esteem, as well as mental and behavioral developmental disorders such as attention deficit hyperactivity disorder [7].

Treatment Methods

Basic Treatment

The consensus guidelines of the ICCS recommend educational and encouragement therapy, as well as behavioral advice for children, as first-line treatment options [8]. Pediatric nurses should strengthen health education for the parents of children with NE, popularize basic knowledge about NE, and guide parents to assist their children in optimizing lifestyle and establishing good urination and defecation habits. Parents should enhance communication with their children, alleviate the children's psychological stress, and help them build confidence in overcoming enuresis symptoms. Relevant studies have shown that the above intervention measures can improve bedwetting symptoms in 15% to 20% of cases, and these cases do not require further intervention [9].

Behavioral Therapy

Behavioral therapy is usually used as a basic means of behavioral intervention for children and is widely applicable to various patient groups. Especially for children with bad living habits, the joint cooperation and long-term persistence of both parents and children are often required to establish a stable and healthy behavioral pattern. For children who need arousal training due to deep nighttime sleep and difficulty in

being awakened, it is more dependent on parents' continuous participation in the intervention process at night to assist in completing the awakening procedure. Although this process has a positive effect on improving children's difficulty in awakening at night, it may also affect parents' own sleep quality and work-rest routine to a certain extent. Therefore, in practical operation, it is necessary to fully evaluate the feasibility and sustainability of the family and provide corresponding support and guidance.

Enuresis Alarm

The enuresis alarm is a first-line treatment for NE recommended by the ICCS. Its mechanism of action is that when a child has an enuresis episode during nighttime sleep, the moisture-sensing alarm device built into the underwear will trigger an alarm immediately, awakening the child to go to the toilet independently after awakening. Through repeated intensive training, it aims to improve the child's sleep arousal function, enabling them to perceive bladder fullness stimulation and wake up to urinate during sleep. This therapy is recommended for children with good treatment compliance, with a clinical effective rate of 50% to 70%, and most successful cases can achieve disease cure [10]. For children with normal nocturnal urine output but small bladder capacity, the enuresis alarm is the first-choice treatment. Studies have found that for children with poor compliance with the enuresis alarm, combined treatment with the enuresis alarm and desmopressin can still achieve a complete response in approximately 74% of patients [11].

Bladder Function Training

Bladder function training is intended for children with small bladder capacity or poor urination habits. During the day, when the child feels the urge to urinate, encourage him/her to hold it for a few more minutes before going to the toilet. This can gradually stretch the bladder and increase its functional capacity. Parents should encourage the child to try to interrupt urination—during urination, ask the child to try to stop for a few seconds and then continue, which helps to enhance the control of the urethral sphincter. Additionally, record the urine output each time and encourage the child to empty the bladder as much as possible during each urination.

Pharmacotherapy

Desmopressin

Desmopressin is a synthetic analog of arginine vasopressin (AVP) and has been consistently recommended as a first-line therapeutic drug for childhood nocturnal enuresis in multiple domestic and international clinical guidelines or expert consensus [12]. This drug mainly exerts its effect by simulating the mechanism of natural antidiuretic hormone, regulating the secretion of ions such as Na⁺, K⁺, and Ca²⁺ by the kidneys, thereby enhancing the reabsorption of water by the

kidneys and reducing nocturnal urine output. When the effect of basic treatment is not satisfactory, it is recommended to complete a voiding diary and distinguish between non-monosymptomatic nocturnal enuresis (NMNE) and monosymptomatic nocturnal enuresis (MNE) based on the presence or absence of lower urinary tract symptoms (LUTS) and relevant examination results. If MNE is diagnosed, and the voiding diary shows that the child's nocturnal urine output exceeds 130% of the age-expected bladder capacity (i.e., the nocturnal polyuria type) or the maximum urine output is greater than 70% of the age-expected bladder capacity (i.e., the normal bladder capacity type), desmopressin therapy is the first choice [13]. In addition, desmopressin can also be considered for children who have difficulty adhering to enuresis alarm treatment. Summer camps and short-term sleep intervention measures also have a certain effect in the prevention of enuresis.

Anticholinergic Drugs

The role of anticholinergic drugs in the treatment of NE is to "relax the bladder and increase its capacity". Anticholinergic drugs mainly exert their effects by blocking M-type cholinergic receptors on the bladder wall. Such drugs can reduce bladder contractions and alleviate enuresis symptoms. These drugs are important for the treatment of bladder dysfunction-type NE, especially when patients are accompanied by daytime frequent urination and urgent urination symptoms. However, due to their potential side effects and specific indications, they must be used under the guidance of a doctor and are usually considered only after the effects of behavioral therapy and first-line drug treatment are not ideal.

Daily Care Guidance

It is recommended that parents attach importance to helping their children develop regular daily routines and good dietary and drinking habits, including: encouraging children to go to bed early and get up early, trying to go to bed before 9 p.m. and emptying the bladder before going to bed; ensuring that children drink sufficient water during the day, with no need to restrict fluid intake during the day, but appropriately limiting water intake 3 to 4 hours before going to bed. At the same time, pediatric nurses will popularize knowledge about childhood enuresis to parents, explaining that enuresis is relatively common in children to alleviate parents' self-blame and anxiety; informing parents that NE has a certain tendency of spontaneous remission and that there are various existing treatment methods to help them build confidence in cure; emphasizing that enuresis is not intentional by the child, and reminding parents to avoid blaming or punishing the child for this reason.

VR Virtual Reality Scene Simulation Training

VR technology has strong immersion, high interest, can provide real-time biofeedback, and can create a safe and con-

trollable treatment environment. Currently, it is mainly used as an effective supplement and auxiliary means to traditional treatment methods (such as drugs and enuresis alarms), rather than a substitute. It is particularly suitable for children who are not sensitive to traditional treatment methods or are accompanied by obvious psychological problems. The application of VR technology for simulation training can improve children's urine control ability and help increase their participation.

Traditional Chinese Medicine (TCM) Therapy

In TCM, the main location of pediatric enuresis is in the kidney, and it is closely related to the bladder, lung, and spleen. The core pathogenesis is the failure of the bladder to control urination, mostly caused by disorders of visceral functions. Clinically, it can be divided into four syndromes: insufficient kidney qi, deficiency of lung and spleen qi, disharmony between the heart and kidney, and dampness-heat in the liver meridian. For those with insufficient kidney qi, the treatment principle is often to warm and tonify kidney yang and consolidate the bladder; for those with deficiency of lung and spleen qi, the principle is to tonify the lung and spleen and consolidate to stop enuresis; for those with disharmony between the heart and kidney, the method of clearing the heart and nourishing the kidney is used. Moreover, TCM decoctions can also be combined with traditional TCM treatments such as acupuncture, tuina (massage), and TCM application for the treatment of pediatric enuresis, and certain effects have been achieved [14,15].

Conclusion

Pediatric NE is a complex disease, and relevant specialist examinations should be completed before treatment. During the treatment process, the active cooperation among physicians, parents, and children is crucial for achieving ideal therapeutic effects. The enuresis symptoms of most children will improve with age, so intervention plans should be formulated individually, and attention should be paid to psychological counseling and humanistic care for children. In terms of treatment, behavioral therapy, as a basic intervention method, is also applicable to all children, and reasonable behavioral guidance can effectively improve children's symptoms; at the same time, the cure rate of combined treatment with enuresis alarm and drugs is higher than that of drug treatment alone. Desmopressin is the first-choice drug for MNE-related enuresis, and anticholinergic drugs can be considered for a small number of drug-resistant patients. Children with different syndromes can achieve a significantly higher cure rate through syndrome differentiation and treatment with TCM, a traditional medical system; meanwhile, with the development and progress of science and technology, the emerging VR technology can empower the field of disease intervention and effectively improve the cure rate.

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