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Original Research Article

Treatment Outcomes of Functional Urinary Incontinence in Children after Structured Urotherapeutic Training

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Abstract

Background: The goal of this study is to assess the results of Standardized Urinary Incontinence Training (SUIT) for children with FUI based on the guidelines of the German Consensus Group on Continence Training (KgKS) and to identify potential influencing factors that may hinder successful urotherapy.

Materials and Methods: Retrospective enrolment was done for all children aged 5–16 years who had received SUIT because of FUI between 2015 and 2024. MEN-only patients and those with organic or neurogenic causes of incontinence were excluded. The participants were divided into three groups based on their diagnosis and symptoms: dysfunctional voiding (DV) without incontinence, non-monosymptomatic enuresis nocturna (Non-MEN), and daytime urine incontinence (DUI). The International Children's Continence Society (ICCS) criteria were used to assess the results at early and late follow-ups, and statistical analyses were conducted to find important success factors.

Results: A total of 114 patients were recruited. Of the 42 children, in whom long-term response was assessed, 29 were in the non-Men group; among these, with a follow-up of more than 24 months, complete response was achieved in 9 children, and 20.6% had relapse in this group. In the DUI group, 5 children had a complete response, and 1 had a relapse. None of the children had relapse in DV w/IC group.

Conclusion: Results show that SUIT is a successful first-line therapy for pediatric FUI. The results emphasize the value of customized treatments and the possible advantages of multicenter, interdisciplinary research focusing on behavioral aspects of treatment regimens.

Introduction

A physiological disorder that affects children is urinary incontinence, which usually goes away between the ages of three and five [1]. About 20% of five-year-old children suffer from nocturnal enuresis, with males more likely to suffer from it [2]. Ten percent of children between the ages of five and thirteen suffer from persistent daytime urine incontinence (DUI), which can lead to serious psychological problems such as poor self-esteem, family disputes, and social disengagement [3,4].

The International Children's Continence Society (ICCS) states that there are several types of urinary incontinence, such as solitary DUI, non-monosymptomatic (Non-MEN) enuresis nocturna, and monosymptomatic (MEN). In general, there are three main forms of urine incontinence: organic, functional, and physiological [5]. Involuntary pee leaking without a known structural, neurological, or biological cause is known as functional urinary incontinence (FUI) [6]. The organic type is frequently linked to neurogenic, urological, or pediatric nephrological disorders. This categorization is essential for patient stratification and guides the study's treatment choices [5]. According to Nieuwhof-Leppink et al., the storage and voiding phases of the bladder are used to classify lower urinary tract dysfunctions. Urge incontinence (UI), voiding postponement (VPI), dysfunctional voiding (DV), or a mix of these symptoms may be present in children [3].

To choose the best course of action, it is essential to distinguish between the biological and functional causes of incontinence. Von Gontard et al. stress the value of "non-invasive behavioral therapy, which may be supplemented by pharmacotherapy if indicated" [7] for patients with FUI. This suggests

that a uniform, non-invasive strategy should be used for the first treatment of children with FUI [8]. Standard urotherapy (SU) is the first-line treatment for the majority of children's lower urinary tract diseases, using the ICCS criteria. It includes education, lifestyle counseling about fluid intake and bowel activity, promoting proper posture and voiding behavior, tracking symptoms using diaries, and regular follow-up. SU uses behavioral and educational strategies to restore regular bowel and voiding functions. It is a well-established foundation for the conservative treatment of disorders of the lower urinary tract.

This method is based on a biopsychosocial concept of continence development and incorporates cognitive-behavioral elements [9]. Desmopressin and anticholinergic medications (such as propiverine and oxybutynin) may be helpful in some situations [10–12], but using medication can have negative side effects that should be avoided at all costs [13]. Anticholinergic usage, for instance, may result in dry mouth, postvoiding residual urine, or constipation, which may call for the prescription of additional drugs [12,14,15]. Constipation frequently has to be managed with extra medication since it is a common concomitant of incontinence in children that hinders the effectiveness of therapy [14–17]. The Interdisciplinary Consensus Group on Continence training has created organized patient training programs to reduce the need for pharmacological therapy and enhance the results [16]. In response, a standardized urinary incontinence training (SUIT) program was created by the German Consensus Group on Continence Training (KgKS [18]), an analogous national application of this strategy. Standardized therapy techniques of behavior modification, education, and parental participation are combined with diagnostics in SUIT, a child-centered, systematic urotherapeutic intervention. It is a non-invasive therapy that enhances quality of life and prevents needless procedures. The curriculum, which was created utilizing national and international continence standards for children with FUI, is effective. Trained continence specialists teach the program in group or individual sessions.

According to the German KGKS, incontinence is a complicated developmental condition that is impacted by a number of social, emotional, and physical variables. The techniques strongly correspond with national and worldwide programs on pediatric urine incontinence, including those of the German Continence Society, the ICCS, and the European Society for Paediatric Urology Nurses (ESPUN) [19,20]. However, because the available data is based only on expert opinion, neither the efficacy of SUIT nor any possible difficulties have been thoroughly examined in research.

Thus, the purpose of this study is to evaluate the results of urotherapeutic instruction that is standardized based on the German KgKS in patients who have FUI. We speculate that the effectiveness of urotherapeutic procedures may be influenced by patient-specific characteristics, including age, comorbidities, and sex. In order to better customize therapy techniques and enhance long-term results, the study also seeks to identify potential obstacles to effective treatment.

Materials and Methods

Retrospective enrollment was done for all children aged 5–16 years who had received SUIT because of FUI between 2015 and 2024.

MEN-only patients and those with organic or neurogenic causes of incontinence were excluded. Medical records provided information on comorbidities, including constipation, ADHD, PSS, and others. As a result, the relevant medical specialists (such as a psychologist in the instance of ADHD) had made these diagnoses.

Following a previous outpatient visit, the diagnosis of SUIT was made using the patient's medical history, an ultrasound, and 14-day voiding and enuresis protocols. The KgKS survey form for bladder function and continence was used to standardize the follow-up questionnaire. The ICCS recommends a standardized tool called the 14-day voiding and enuresis protocol [20]. Based on their symptoms and diagnoses (DV without incontinence, DUI, or non-MEN), each patient was categorized. Patients with functional DV who did not have incontinence also received training because of the similarity of their symptoms. Patient histories included information on comorbidities such as constipation, attention deficit hyperactivity disorder (ADHD), uroflow pattern DV, age, sex, prior therapies, follow-up duration, and psychosocial stress disorder (PSS).

About 12 weeks (3 months) after instruction, an early follow-up assessment was carried out, and at least 6 months following instruction, a late follow-up was carried out. The ICCS (2016) Report for Standardization of Terminology of Lower Urinary Tract Function in Children and Adolescents was used to categorize the symptoms seen during the initial follow-up examination into three groups: non-response (<50%), partial response (50–99%), and complete response (100%). "Relapse" (recurrence of more than one symptom per month), "Continued Success" (no relapse during F/U 6 to < 24 months), and "Complete Success" (no relapse during F/U ≥ 24 months) are the three different criteria that make up the label "Long-term Success" [6]. To maintain clarity, follow-up intervals indicated in months were used to categorize long-term success.

Standardized urinary incontinence training (SUIT) description: According to the KgKS, the SUIT is given in small, sex-specific groups of one to three patients, with one parent present, in a single, organized, one-and-a-half-hour session that is broken up into five theme portions. Formal, interactive components of the lesson include guided practice in identifying bladder signs, personalized feedback, and active practice by the kids using the skills they have learned. After giving a brief introduction, the urotherapist—a medical professional or nurse with specific training in treating lower urinary tract disorders without surgery or medication—begins with an informative speech in which they share knowledge and describe the anatomy and physiology of the urogenital tract. Furthermore, a kid-friendly explanation of the kidneys' and bladder's functions is provided. The development process of micturition and its intricacy are explained. Potential comorbidities are examined along with the underlying pathophysiology of bladder dysfunction. The training program's second portion covers the best micturition practices. The guidelines for micturition are covered, with special attention paid to the significance of prompt and calm micturition and the need to give this procedure enough time. Furthermore, the kids are told to try urinating at particular times of the day. They are counseled to maintain regular bowel motions and are trained to identify the signals from their bladder. Instructions on proper eating and drinking habits, as well as how to utilize protocol systems at home, are given in the sections that follow. These devices are made to playfully record the children's levels of moisture and dryness on particular days, as well as the hours at which micturition took place. Daily continuance of the training materials is encouraged, and the next actions after the training time are described in the last part. Finally, ten to twelve weeks later, a follow-up visit is planned.

Statistical Analysis: Microsoft Excel® 365 (Microsoft Corporation, Washington, USA) and GraphPad Prism® (GraphPad Software Inc., Boston, USA) were used to process and analyze the data. The significance test was conducted using Fisher's exact test. The significance threshold was set at a p-value of less than 0.05.

Results

A total of 114 patients were recruited. The basic demographic data is shown in Table 1.

Table 1: Basic demographics

	n	sex	Mean age	DV	US and/or UI	VP	MS
Non-MEN	69(60.5%)	F=45%	8.3 years	26 (34.2 %)	7 (9.2 %)	17 (22.4 %)	26 (34.2 %)
		M=55%		6 (6.4 %)	22 (23.7 %)	19 (20.4 %)	46 (49.5 %)
DUI	38(33.3%)	F=47.4%	9.1 years	5 (27.8 %)	2 (11.1 %)	9 (50.0 %)	2 (11.1 %)
		M=52.6%		2 (10.0 %)	7 (35.0 %)	5 (25.0 %)	6 (30.0 %)
DV w/IC	7(6.14%)	5=71.4%	11.1 years	5 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)
		2=28.6%		2 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)

DV: Dysfunctional voiding; IC: Incontinence; IQR: Interquartile range; MS: Mixed symptoms; UI: Urge incontinence; US: Urge symptoms; VP: Voiding postponement.

Table 2: Initial and long-term success rates

		Initial response				Long-term response		
	n	No-response	Partial response	Complete response	n	Continued success (F/U 6 to < 24 months)	Complete success (F/U ≥ 24 months)	Relapse (total)
Non-MEN	69 (60.5%)	10 (14.4%)	20 (28.9%)	39 (56.5%)	29	9	20 (68.9%)	6 (20.6%)
DUI	38 (33.3%)	3 (7.9 %)	22 (57.9 %)	13 (34.2 %)	6	8	5	1 (16.6%)
DV w/IC	7 (6.14%)	2 (28.6 %)	3 (42.9 %)	2 (28.6 %)	2	1	1	0

Overall initial and long-term success rates of SUIT: In the Non-MEN group on initial assessment, out of 69 children, 39 had achieved a complete response (56.5%), and 28.9% are classified as partial responders. In the DUI group, out of 38, 13 children are classified as complete responders (34.2%), and 22(57.9%) are partial responders. In the DV w/IC group, 28.6% had achieved a complete response and 42.9 % had a partial response. Of the 42 children, in whom long-term response was assessed, 29 were in the non-Men group. Among these, with a follow-up of more than 24 months complete response was achieved in 9 children, and 20.6% had relapse in this group. In

the DUI group, 5 children had a complete response, and 1 had a relapse. None of the children had relapse in DV w/IC group.

Table 3: Number of patients (n) displaying tested symptoms and comorbidities, along with initial and long-term success outcomes. (Fisher's exact test p-values)

			Long term response(n=37)		
	Percentage of the population	**relapsed**	**Continued success**	**Complete success**	**P value**
MS	37.7 %	22.4 %	83.3 %	78.1 %	0.184
VPI	23.4 %	19.4 %	50.0 %	96.0 %	0.036
ADHD	5.8 %)	55.6 %	75.0 %	14.3 %	0.017

Influence of voiding postponement incontinence (VPI) on treatment outcome: The comorbidity analysis results are shown in Table 3. The long-term success rate and VPI were shown to be statistically correlated. VPI's presence greatly increased the chances of success. Even the presence of ADHD showed a significant difference.

Discussion

The approach that FUI in children is still evolving. The relevance of non-pharmacological urotherapeutic therapies is growing, and SUIT offers a non-invasive, cost-effective approach that prioritizes behavioral and educational interventions. This strategy is in accordance with international guidelines that suggest urotherapy as the initial treatment for FUI, saving drugs and certain urotherapies (such as neuromodulation and biofeedback) for situations in which urotherapy is not enough [16,21].

This is the first research to discuss and document SUIT's efficacy. With around 68.9% of the patients experiencing ongoing or total success after 6–24 months, we were able to show that the treatment impact was sustained and discovered a very high initial success rate.

It is challenging to directly compare the findings of urotherapy studies. First off, various treatment programs have distinct components and variable admission requirements [7, 8]. Second, there are significant differences in outcome measures and follow-up times. Shei Dei Yang and Wang [22], for instance, reported success rates of about 100% for uroflow parameter normalization following biofeedback training; nevertheless, a decrease in the weekly frequency of incontinent episodes does not always follow an improvement in these parameters [23]. Our findings are consistent with the few comparable studies [24,25], which revealed success rates of 79.0~83.5% of patients (nighttime wetting) and 53.1~79.0% of patients (daytime wetting) at 2-year follow-up.

Voiding postponement with incontinence (VPI) is a condition in which daytime urine incontinence results from a chronic delay in micturition. Low voiding frequency, urgency, and behavioral issues are frequently linked to VPI, especially when oppositional defiant disorder (ODD) is present. [20] VPI significantly influenced long-term results in our investigation, with greater treatment responses shown in VPI patients. VPI may potentially indicate a transitional stage in the development of bladder control or a decrease in bladder awareness, even though it is frequently seen as maladaptive behavior. Our results demonstrate that behavior-focused treatments, like those utilized in the KgKS SUIT program, are necessary to effectively control VPI [20].

Interestingly, von Gontard et al. found that 65.1% of children with DUI had VPI as their most prevalent diagnosis. Despite being acknowledged by the ICCS, DUI with VPI might not be properly diagnosed at certain institutions [26]. Results may be improved by using cognitive behavioral therapy to manage both ODD and VPI [26]. Notably, KgKS SUIT's organized approach includes cognitive behavioral components.

A substantial correlation was found between ADHD and decreased long-term success rates. Our results are consistent with other studies that highlight the interaction between ADHD and SUIT outcomes. This is in line with the larger body of research that indicates ADHD may hinder the effectiveness of behavioral treatments for LUTS [27]. Therefore, to address ADHD-related difficulties, tailored strategies are required, such as caregiver involvement and organized routines. The effect of PSS on the outcome of both short-term and long-term treatment emphasizes how important psychosocial aspects are in controlling FUI and the necessity of a holistic strategy that includes stress management and psychological support as essential components of therapy [24].

In order to improve overall well-being and continence results, these elements must be addressed. According to Joinson et al., children with a history of DUI had a roughly twice-greater frequency of PSS than children without such a history [28]. The main drawback of the study is its retrospective nature. This could have affected results that were difficult to track, such as patient motivation and adherence. This restriction made it impossible for us to measure how motivation affects results. We also included a small subset of

SUIT-participating children with defective voiding but not incontinence.

The tiny sample size and underlying disease probably made it impossible to establish long-term effectiveness, even if some people showed immediate improvement.

To focus on a more uniform cohort of patients with functional urine incontinence, it is advised that future research exclude this group. To better control for confounding factors, prospective interventional studies are required to validate the effectiveness of SUIT.

Conclusion

Results show that SUIT is a successful first-line therapy for pediatric FUI. The results emphasize the value of customized treatments and the possible advantages of multicenter, interdisciplinary research focusing on behavioral aspects of treatment regimens.

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