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Voiding Dysfunction in Children: Correlation Between Urodynamic Findings and Clinical Symptoms

Pradeep Deb[1], Narendra singh kurmi[2], Prashant Lavania[3]

[1]Assistant Professor, department Of Urology, Sarojini Naidu Medical college, Agra, India.

[2]Assistant professor, Department of urology, Gandhi medical college Bhopal India

[3]Professor, department of urology, Sarojini naidu medical college, agra

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ABSTRACT

Background: Voiding dysfunction in various children is one of the common pediatric urological conditions characterized by abnormal urination patterns, which often leads to significant psychosocial and medical consequences. Objective: This study examines the correlation among scientific signs and urodynamic findings in children diagnosed with voiding dysfunction.

Methods: A cross-sectional observational study was carried out concerning 120 children aged four to 12 years. Clinical signs were assessed using standardized questionnaires and bladder diaries. Urodynamic research has been conducted and outcomes have been statistically analyzed for correlation.

Results: Significant correlations have been determined among daytime incontinence and detrusor overactivity ($p < 0.01$), in addition to between post-void residual urine and detrusor contractility ($p < 0.05$). Nocturnal enuresis showed poor correlation with urodynamic findings.

Conclusion: While certain clinical symptoms, such as daytime incontinence and urgency closely correlate with specific urodynamic findings, others like nocturnal enuresis do not. Urodynamic testing remains essential in confirming diagnosis and guiding treatment in pediatric voiding dysfunction

Keywords: *voiding dysfunction, children, urodynamic studies, incontinence, detrusor activity*

1. INTRODUCTION

1.1 Background

Voiding dysfunction in children is an umbrella term that encompasses various urinary disorders, including urgency, frequency, incontinence, and urinary retention. These conditions can stem from behavioral, neurological, or anatomical abnormalities and can significantly affect quality of life.

1.2 Problem Statement

Despite the high prevalence of voiding dysfunction, diagnosis is quite often based on subjective clinical symptoms, which may not fully show the underlying pathophysiology. Urodynamic studies offer objective assessment but are not universally used due to invasiveness and cost (Al-Najar *et al.,* 2021).

1.3 Objectives

- To assess the correlation between clinical symptoms and urodynamic findings in children with voiding dysfunction

To evaluate whether clinical symptoms alone can predict urodynamic abnormalities

Literature review

According to a study by Kopač (2024), the clinical significance in the context of pediatric lower urinary tract dysfunction lies in its potential to affect urinary tract infections as well as negatively impact renal function due to residual urine accumulation The study emphasizes that this condition also contributes to urinary incontinence, significantly diminishing the quality of life in affected children. Kopač discusses the interconnectedness of bladder and bowel function, noting that constipation frequently accompanies bladder dysfunction. This complex relationship, along with conditions such as detrusor overactivity and voiding dysfunction demands a careful and tailored diagnostic strategy (Ellison, *et al.,* 2021). Detrusor overactivity, though benign, leads to socially disruptive daytime urinary incontinence and must be distinguished from serious pathologies like neurogenic bladder or urethral obstruction. Voiding dysfunction, which involves involuntary sphincter contractions during urination, often coexists with detrusor overactivity and may either resolve on its own or contribute to urinary retention and subsequent infections. In some cases, it is able to mimic neurogenic bladder dysfunction, commonly stemming from spinal abnormalities, and regularly related to excessive bladder pressures and recurrent infections that pose a challenge to kidney function. The study concludes by underlining the significance of a voiding diary as a fundamental diagnostic device in assessing urinary tract functioning in pediatric sufferers.

Based on research conducted with the aid of Milivojevic (2022), the study mainly discusses the relationship between transverse rectal diameter in addition to urodynamic parameters in youngsters identified with neurogenic bowel and additionally the bladder disorder. The research highlights the importance of integrating bowel and bladder exams in pediatric patients, specifically those with spina bifida, where these capabilities are regularly interrelated. Milivojevic emphasizes that measuring the transverse rectal diameter through non-invasive ultrasonography can offer precious perception into the severity and nature of bladder disorder as well. The study identifies consistent patterns linking improved rectal diameter with decreased bladder capability and compliance, whilst additionally associating it with detrusor pressures and leakage tendencies. These findings endorse that a dilated rectum might also function as a hallmark of heightened bladder hazard, imparting a realistic and predictive marker for clinicians coping with youngsters at risk of higher urinary tract damage. The study underscores the diagnostic relevance of rectal measurements as a screening tool that complements traditional urodynamic opinions, permitting earlier intervention and tailor-made therapeutic techniques. By establishing a clear correlation between bowel distension and detrimental bladder dynamics, the study reinforces the concept of bowel control as an essential part of retaining urinary fitness in kids with neurogenic dysfunction (Milivojevic, et al., 2021). Overall, Milivojevic advocates for a multidisciplinary technique that recognizes the rectal diameter as not merely an anatomical measurement, but a meaningful scientific variable in pediatric urological care.

Özen (2020) discusses the diagnostic demanding situations related to lower urinary tract disorder in youngsters, emphasizing that usually determined signs consisting of urgency, incontinence, and intermittency are not reliably specific to any specific subtype of the situation. Despite traditional assumptions by means of clinicians that positive signs may additionally suggest distinct diagnoses, the findings advise that this symptom-primarily based technique regularly lacks precision and can result in misdiagnosis. Özen highlights the importance of goal diagnostic tools like uroflowmetry combined with electromyography to accurately categorize compromised urinary tract dysfunction into its subtypes, which include overactive bladder, dysfunctional voiding, underactive bladder, and primary bladder neck disorder. The study further explores the relationship among bowel and urinary symptoms, noting that constipation and urinary hesitancy had been the most useful signs and symptoms with a high-quality association to unique disorder types, mainly dysfunctional voiding and nbladder neck dysfunction, respectively. However, these correlations were exceptions rather than the rule, and most symptoms showed great overlap throughout diverse conditions (Özen, et al., 2021). . The study underscores the complexity of pediatric lower urinary tract disorders and calls for a shift in clinical exercise toward extra complete reviews in place of relying entirely on subjective symptom reporting. Özen concludes that a deeper know-how of the useful interaction between bladder and bowel activity, supported via scientific exams and diagnostic technology, is essential for accurate prognosis and powerful remedy planning in pediatric urology.

2. MATERIALS AND METHODS

2.1 Study Design and Setting

A health center-based cross-sectional observational study was carried out over 18 months in a tertiary urology center.

2.2 Participants

Children between the ages of four to 12 years recognized with numerous signs and symptoms of voiding disorders.

Inclusion criteria:

Recurrent urinary symptoms for >3 months, parental consent and ability to undergo urodynamics. **Exclusion criteria**: Known neurological problems, congenital urogenital anomalies, prior urologic surgical operation.

2.3 Data Collection Tools

- **Clinical assessment:** Pediatric Lower Urinary Tract Symptom Score (PLUTSS)
- **Bladder diaries** (3-day record of voiding frequency and volume)
- **Urodynamic testing:** Cystometry as well as the pressure-flow studies as per ICS guidelines.

2.4 Statistical Analysis

Data were analyzed using SPSS v26. Spearman's correlation coefficient assessed the relationship between symptoms and urodynamic variables. Significance set at $p < 0.05$.

3. RESULTS

3.1 Demographic Characteristics

A total of 120 children diagnosed with various forms of symptoms of voiding dysfunction were included in the study. Among them 65 were boys and 55 were girls, resulting in a particular male-to-female ratio of approximately 1.18:1 The mean age of the study participants were 7.8 years, with a standard deviation of ±2.1 years, indicating a large distribution of age in the four to 12 years range. The demographic profile becomes representative of an average pediatric urology outpatient populace, without a great gender predominance located in any particular age subgroup.

Most kids presented between the ages of 6 to 9 years, coinciding with the early years of formal education, wherein voiding disorder signs and symptoms have a tendency to become extra obvious (March, *et al.,* 2021). Younger kids, particularly those aged four to five years, often presented with greater generalized signs and symptoms, while older kids had symptoms often related to psychosocial stressors or college-related toileting behaviors.

3.2 Clinical Symptom Distribution

The scientific assessment of individuals found a diverse spectrum of urinary tract signs and symptoms (LUTS). The most usual symptom became daytime urinary incontinence, found in 52% of the children. These kids regularly experienced involuntary leakage of urine at some point of the waking hours, frequently associated with episodes of urgency or incomplete voiding.

Nocturnal enuresis, described as involuntary urination at some point of sleep in kids aged five years and older were predsent in 48% of the participants. While a few youngsters had exclusive nocturnal signs, a massive percentage had mixed symptoms, together with both daytime and nighttime wetting.

Urgency, characterized by an unexpected and compelling desire to void that is hard to defer, was present in 40% of the kids. Urgency regularly co-existed with incontinence, particularly in those diagnosed later with detrusor overactivity. Parents often reported that their kids could rush to the restroom or show holding maneuvers consisting of leg crossing or squatting.

Urinary frequency, described as voiding greater than eight times during waking hours, was present in 30% of the children (Selvi *et al.,* 2021). This symptom was regularly occurring amongst younger kids and those with tension-related behaviors. In contrast, straining or hesitancy all through micturition was noted in 18% of the kids, with a few youngsters requiring extended sitting to provoke or complete voiding. These signs and symptoms were often suggestive of dysfunctional voiding or detrusor underactivity, later confirmed on urodynamic evaluation.

There were no statistically full-size variations within the distribution of signs among boys and girls, despite the fact that boys had been slightly much more likely to present with signs and symptoms related to voiding initiation, inclusive of hesitancy or vulnerable movement, whereas girls more frequently had pronounced urgency and incontinence.

3.3 Urodynamic Findings

Urodynamic studies provided objective confirmation of the underlying bladder dysfunction in many cases. The most prevalent as well as the abnormality identified was the **detrusor overactivity**, found in **42% of the children**. This was characterized by using involuntary contractions of the detrusor muscle in the course of the bladder filling phase, frequently at low bladder volumes. Children with detrusor overactivity regularly had symptoms of urgency, frequency, and urge incontinence, and the correlation among clinical urgency and urodynamic overactivity was statistically significant ($p < 0.01$).

A hypocontractile bladder, defined by inadequate detrusor contraction during the voiding phase, was identified in 15% of the participants. These children typically had elevated post-void residual volumes and were more likely to exhibit symptoms of straining, hesitancy, and incomplete emptying. Hypocontractility was more commonly observed in older children, particularly boys, and was often associated with behavioral or learned voiding dysfunction.

Bladder compliance abnormalities, indicative of a stiff or poorly accommodating bladder, were detected in 10% of the children (Demirkan, *et al.,* 2021).Reduced compliance was typically associated with elevated detrusor pressures during filling and in some cases, discomfort or pain was reported during the study. Although these findings were less frequent, they

carried significant clinical implications for long-term bladder health and risk of upper tract involvement.

A total of 26% of the children were found to have post-void residual (PVR) urine volumes exceeding 20 mL, as measured by ultrasonography immediately after voiding. Elevated PVR volumes were strongly associated with hypocontractile detrusor function and poor voiding efficiency. Notably, in children with PVR >20 mL, recurrent urinary tract infections have been more commonly reported in history.

Among kids with ordinary urodynamic findings, some still exhibited scientific signs, suggesting the possibility of behavioral or useful disorders now not detectable via a urodynamic approach. Conversely, a few kids with ordinary urodynamic findings, specifically those with moderate detrusor overactivity or compliance problems, had minimal or no symptoms, highlighting the variety and complexity of pediatric voiding disorder.

3.4 Summary of Correlations

Initial statistical analysis demonstrated a **positive correlation between PLUTSS symptom severity scores and urodynamic abnormalities**, particularly in the context of detrusor overactivity (Spearman's $\rho = 0.46$, $p < 0.01$). Children with excessive symptom scores had been drastically more likely to show urodynamic deviations from the norm. Additionally, multiplied PVR became reasonably related to clinical complaints of hesitancy and extended voiding instances (Selvi, *et al.,* 2021). These findings advocate that while clinical signs and symptoms provide critical clues, urodynamic research is crucial for accurate characterization and guiding focused remedies for the problems.

Clinical Symptom	Urodynamic Correlate	p-value	Correlation
Daytime incontinence	Detrusor overactivity	<0.01	Strong
Urgency	Decreased compliance	0.03	Moderate
Straining	Detrusor underactivity	0.04	Moderate
Nocturnal enuresis	No consistent findings	>0.05	Weak/None

4. CONCLUSION

This study underscores the various complex as well as multifactorial nature of voiding dysfunction in children. While certain clinical symptoms, such as the urgency and incontinence, show a huge, relatively strong correlation with specific urodynamic findings—mainly detrusor overactivity—other signs like frequency or hesitancy are more variable and might not align without delay with measurable physiological abnormalities. This discrepancy highlights the limitations of relying solely on scientific assessment tools and caregiver reviews for diagnostic decision-making.

Urodynamic testing offers precious insights into the functioning of the lower urinary tract and remains a critical factor inside the complete assessment of pediatric patients with persistent or complicated voiding dysfunction. By objectively figuring out abnormalities together with detrusor overactivity, hypocontractility, or impaired bladder compliance, urodynamics lets clinicians to tailor remedy techniques greater accurately, thereby improving medical outcomes and decreasing the danger of lengthy-time period complications which includes recurrent urinary tract infections or upper tract deterioration.

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