

## Mental disorders in children and adolescents with lower urinary tract dysfunction

Transtornos mentais em crianças e adolescentes com disfunção do trato urinário inferior

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### ABSTRACT

Lower urinary tract dysfunction (LUTD) affects about 2-25% of the pediatric population and is associated with the presence of emotional and behavioral disorders. The purpose of this literature review was to identify studies focusing on mental disorders in children and adolescents with LUTD. The prevalence of these disorders is high - ranging from about 20 to 40% - in children with symptoms of LUTD and comorbidities. The presence of emotional and behavioral symptoms impact in the treatment of the dysfunction, self-esteem of patients and caregivers. Despite the association between mental/behavioral disorders and LUTD be well documented in the literature, the investigation of psychiatric symptoms in clinical practice is still not common and should be stimulated.

**Keywords:** adolescent; child; mental disorders; nocturnal enuresis; urinary incontinence.

### RESUMO

A disfunção do trato urinário inferior (DTUI) afeta cerca de 2 a 25% da população pediátrica e se associa à presença de transtornos emocionais e de comportamento. O objetivo dessa revisão bibliográfica foi selecionar estudos que enfoquem os transtornos mentais em crianças e adolescentes com DTUI. A prevalência destes transtornos é elevada - variando de cerca de 20 a 40% nas crianças com sintomas da DTUI e comorbidades. A presença de sintomas emocionais e comportamentais impacta no tratamento da disfunção, na autoestima dos pacientes e também nos cuidadores. Apesar da associação entre transtornos mentais/comportamentais e DTUI estar bem documentada na literatura, a investigação de sintomas psiquiátricos na prática clínica ainda é pouco realizada e deve ser estimulada.

**Palavras-chave:** adolescente; criança; enurese noturna; incontinência urinária; transtornos mentais.

### INTRODUCTION

Lower urinary tract dysfunction (LUTD) is an umbrella term that encompasses a spectrum of disorders affecting bladder filling and/or voiding in the absence of neurologic disease or obstructive uropathy. A lack of consistency in terminology has resulted in a reported prevalence of symptoms of LUTD in children ranging from 2% to 25%.<sup>1,2</sup>

According to the consensus published by the International Children's Continence Society (ICCS), LUTD symptoms are categorized based on whether

they are related to bladder filling or voiding. The following are storage symptoms: increased or decreased voiding frequency; incontinence; urinary urgency; nocturia. Voiding symptoms include: hesitancy; straining; weak stream; intermittent stream; urinary retention; feeling of incomplete voiding; postmicturition dribble; dysuria. The comorbidities usually associated with LUTD are urinary tract infection, asymptomatic bacteriuria, constipation, and/or fecal incontinence, vesicoureteral reflux, emotional disorders, and intellectual disability.<sup>3</sup>

In addition to posing risk to the upper urinary tract, LUTD may cause embarrassment and emotional impact on parents and children due to the frustration inherent to dealing with urinary incontinence. An important association between LUTD and mental disorder has been described in a number of studies.

The prevalence of behavioral disorders in children diagnosed with psychiatric comorbidities is significant: 20-30% of them suffer from nocturnal enuresis; 20-40% have diurnal incontinence; and 30-50% have fecal incontinence.<sup>4,5</sup> In children and adolescents from the general population the prevalence of psychiatric disorders is of approximately 10%.<sup>6</sup>

Despite the increased frequency of psychiatric disorders observed in this population, symptoms are usually not targeted in the care delivered to these patients, in what might be categorized as neglect toward children with LUTD in an important area of their lives.<sup>4</sup>

## OBJECTIVE

This study aimed to review the literature on the topic in order to assess the degree of attention paid to behavioral and emotional symptoms in clinical practice as per the ICSS recommendations.<sup>3</sup>

## METHOD

The following keywords were used in a search for papers published on PubMed: *Mental Disorders - Behavior Disorders, Neuropsychiatric disorders, Depression Attention Deficit Disorder, Urination Disorders - Enuresis, Urinary Incontinence, Urinary Retention, Daytime Wetting, Bedwetting, Bowel problems, Dysfunctional elimination syndrome, Overactive bladder syndrome, Voiding postponement, dysfunctional voiding, Adolescent, Child*. Papers published in English and Portuguese within the last ten years and papers cited in the papers listed in the original search results were included.

## DISCUSSION

In the last decade, the relationship between lower urinary tract dysfunction and psychiatric disorder

has been extensively studied. According to Franco,<sup>7</sup> the central nervous system (CNS) is involved in the etiology of most cases of pediatric LUTD, switching from a longstanding vesicocentric model to understand the disease into a neurocentric one. Changes in CNS function and anatomy have also been associated with psychiatric disorders. The neurocentric model facilitates the comprehension of the amply documented association between depression, enuresis, and encopresis.<sup>7</sup>

Von Gontard and Equit<sup>8</sup> stressed the association between altered CNS activity and different forms of incontinence and psychiatric disorders such as attention deficit and hyperactivity disorder (ADHD). Areas of the brain such as the insula, the anterior cingulate cortex, and the prefrontal cortex are responsible for bladder control and monitoring<sup>9</sup> and have been implicated in ADHD and LUTD.<sup>8</sup>

Hyde *et al.*<sup>10</sup> considered enuresis during childhood a premorbid developmental marker of schizophrenia. In a group of patients with schizophrenia, 21% had enuresis during childhood *versus* 11% of their siblings and 7% of healthy controls. Neuroimaging studies revealed global grey matter volume reductions in schizophrenic and non-schizophrenic individuals with a history of enuresis during childhood.

One might infer that, at least in schizophrenic individuals, the anomalous development of the right superior temporal gyrus was associated with enuresis during childhood. Absence of incontinence in later stages of life suggests functional adaptation. According to Franco,<sup>7</sup> these findings support the idea that the frontal lobes are closely involved in the development and maintenance of bladder control.

In another study, adult patients with urinary urgency had increased anterior cingulate cortex activity levels and decreased activity in the orbitofrontal cortex (OFC).<sup>11</sup> Yang *et al.*<sup>12</sup> compared children with ADHD to children with ADHD and enuresis, and observed the latter had shorter response times in neuropsychological tests devised to assess attentional performance, revealing they had less inhibitory control. Understanding this pathophysiological correlation and the importance of treating psychiatric comorbidities are key steps

in attaining more promising therapies for patients with LUTD.<sup>7</sup>

Most of the studies designed to look into the psychiatric symptoms of patients with LUTD were based on the *Child Behavior Checklist* (CBCL), a questionnaire developed to assess the social skills and behavioral problems of individuals aged 6-18 years.<sup>13</sup> Although the CBCL is not a diagnostic tool, elevated scores in its subscales are highly sensitive and specific in characterizing some mental disorders in children and adolescents.

The CBCL groups behavioral problems into internalizing - the summation of scores related to anxiety/depression, withdrawn-depressed, and somatic complaints - and externalizing - the summation of scores in delinquent behavior and aggressive behavior - problem scales.<sup>14</sup>

Kuhn *et al.*<sup>15</sup> reported superior prevalence of clinical-range scores in the CBCL for children and adolescents with LUTD (41%) when compared to healthy controls (9%). There seems to be a distinct pattern between the occurrence of internalizing and externalizing symptoms in this group of children. The prevalence of the first - depression and anxiety disorder - was 29% in the group with LUTD *versus* 6% in healthy controls. The prevalence of externalizing problems - conduct disorder and attention deficit and hyperactivity disorder - was 35% *versus* 0%, respectively.<sup>15</sup>

Children with LUTD also had higher rates of depressive, aggressive, and inattentive symptoms.<sup>16</sup> The rates of psychiatric comorbidity in a group of 1001 children with bladder and bowel dysfunction were up to six times higher than the rates seen in the general population - 43% had clinical-range scores in the CBCL, 36% with externalizing problems and 33% with internalizing problems.<sup>17</sup> The same author described higher rates of symptoms of oppositional defiant disorder (ODD) in children with incontinence than in healthy controls (19.5% *vs.* 5.2%).<sup>18</sup>

In addition to the elevated prevalence of mental disorders in the population with LUTD, the occurrence of the phenomenon varied depending on the type of

lower urinary tract dysfunction: 56% of the children postponing voiding had clinical-range scores in the CBCL *versus* 24% of the children with urinary incontinence.<sup>15</sup> In a group of preschoolers, Niemczyk *et al.*<sup>19</sup> saw externalizing disorders in 14.5% of the individuals with monosymptomatic nocturnal enuresis, whereas children with diurnal incontinence and continent children had similar prevalence rates (9.5%).

#### ENURESIS

Involuntary urination while asleep is called nocturnal enuresis. Children who wet their beds but have no other urinary tract symptoms have monosymptomatic nocturnal enuresis (MNE). Children who urinate on their beds while asleep and have symptoms of lower urinary tract dysfunction are diagnosed with non-monosymptomatic nocturnal enuresis (NMNE).<sup>20</sup>

Pediatric enuresis appears to be strongly associated with attention deficit and hyperactivity disorder (ADHD), as described by Baeyens *et al.*<sup>21</sup> These authors reported a prevalence of 15% of combined ADHD (inattentive/hyperactive) in a population of children with enuresis and 22.5% of predominantly inattentive ADHD, while in the general pediatric population the prevalence of ADHD ranged between 3-5%.<sup>6</sup>

Shreeram *et al.*<sup>22</sup> looked into the prevalence of enuresis in the United States and found a strong association with ADHD, in which children with enuresis had a 2.88-fold chance of having ADHD when compared to healthy controls. Yang *et al.*<sup>23</sup> reported that boys with elevated scores for symptoms of ADHD tended to have higher scores for LUTD in the *Dysfunctional Voiding Symptom Score* (DVSS). The DVSS is a scale used to assess lower urinary tract symptoms in the general population.<sup>24</sup>

Lower urinary tract symptoms correlated with scores in the *Swanson, Nolan e Pelham-IV* (SNAP-IV), a scale used to assess symptoms of ADHD and ODD.<sup>25</sup>

Another study found that children with MNE had a 2.5-fold chance of presenting emotional disorders than controls.<sup>26</sup> Children with NMNE had even higher scores for behavioral problems when compared to a group of individuals with MNE.<sup>17,26</sup> A prospective study enrolling more than 8,000 children, *The Avon Longitudinal Study of Parents and Children* (ALSPAC) by Joinson *et al.*,<sup>27</sup> reported a positive association between difficult temperament and behavioral problems in early childhood and occurrence of enuresis in school years.

#### DIURNAL ENURESIS

Children with diurnal enuresis seem to be more affected by psychological problems. They had about twice the rate of externalizing disorders than children without diurnal enuresis. The following disorders stood out from the list: ADHD - 24.8%; ODD - 10.9%; conduct disorder - 11.8%.

Twenty-nine percent of the children with diurnal enuresis had internalizing disorders.<sup>28</sup> Another large epidemiologic study with approximately 8,000 children found that individuals suffering from diurnal enuresis (10.4%) had more gastrointestinal, urinary, and psychological symptoms than controls.<sup>29</sup> Kuhn *et al.*<sup>15</sup> reported that 49% of the children with diurnal enuresis met the diagnostic criteria for at least one mental disorder described in the International Classification of Diseases - 10<sup>th</sup> revision (ICD-10).

A study carried out with 138 children diagnosed with urinary incontinence described associations between psychiatric symptoms and worse quality of life (QOL), older age, being non-Caucasian, and female sex. Worsening clinical condition was not associated with decreases in QOL.<sup>30</sup> Joinson *et al.*<sup>31</sup> looked at predictors for poor sphincter control - urinary and fecal incontinence - and described developmental delays, difficult temperament, and maternal depression and anxiety as risk factors.

Von Gontard *et al.*<sup>32</sup> estimated that behavioral disorders, oppositional defiant disorder and attention

deficit and hyperactivity disorder in particular, were twice as prevalent in individuals with LUTD than in the general population. Another study found that children with diurnal enuresis had 4.4-fold risk of ADHD.<sup>33</sup>

#### IMPACT

ADHD negatively affects resolution rates of LUTD; children with ADHD had more trouble complying with LUTD therapy and were less responsive to alarm interventions than controls.<sup>34</sup>

Approximately 65% of the children with enuresis had clinical-range scores in the *Child Behavior Checklist* (CBCL) and higher rates of social and behavioral problems.<sup>32,35</sup> Üçer & Gümüş<sup>36</sup> studied a group of children with monosymptomatic nocturnal enuresis (MNE) and found higher rates of poor quality of life, poor sleep, and depression.

The authors of a prospective study evaluated the presence of psychiatric symptoms before and after LUTD therapy and were unable to find changes in the prevalence of internalizing problems. However, externalizing symptoms and total problems in the CBCL decreased (14% to 7%; and 23% to 8%, respectively) in the group with voiding dysfunction. The behavioral symptoms of the individuals in the group with urinary urgency did not ameliorate significantly.<sup>37</sup>

Treating patients with ADHD and LUTD was more difficult than treating individuals with LUTD alone.<sup>7</sup> Baeyens *et al.*<sup>38</sup> followed a group of patients for two years and reported persistence of enuresis in 72.5% of the patients with ADHD, suggesting that individuals with ADHD had more trouble complying with treatment. Even in cases in which enuresis resolved, ADHD persisted, indicating that the symptoms reflected the existence of a neurodevelopmental disorder independent from enuresis. Therefore, one might infer that ADHD interferes with the treatment and prognosis of enuresis.

However, children offered proper treatment for ADHD and children without ADHD have similar rates of urinary incontinence, implying that the treatment of ADHD might be associated with positive effects on the resolution of incontinence.<sup>39</sup> The best mode of treatment for incontinence associated with ADHD appears to be individualized multimodal therapy, which includes behavior modification combined with drug and/or biofeedback therapy and provides for increased effectiveness when compared to monotherapy.<sup>40</sup>

In a study on stressful events of childhood, nocturnal enuresis was rated as difficult by 36.7% of the children and ranked eighth among stressful life events.<sup>41</sup> The stress experienced by many of the children with LUTD was linked to incontinence and subclinical motional symptoms that compromised the treatment and prognosis of LUTD.<sup>4</sup>

The impacts of the dysfunction appear to be felt by parents and caregivers alike. De Bruyne *et al.*<sup>16</sup> reported increased levels of stress in parents of children with LUTD and behavioral disorders. Mothers of children with enuresis had poorer quality of life and more anxiety symptoms than the mothers of controls. Treatment of enuresis led to significant improvements in the QOL of mothers and children.<sup>42</sup> Table 1 lists the main quantitative studies published since the year 2000 to address the psychosocial involvements seen in pediatric patients with LUTD.

## CONCLUSION

Pediatric patients with LUTD often present with psychiatric disorders. This evident association reinforces the current idea that the central nervous system is involved in the etiology of most urinary tract disorders affecting children, contrary to the thought that the bladder was solely responsible for these disorders.<sup>7</sup>

Similarly to enuresis-free children, pediatric patients with MNE had lower emotional comorbidity rates. In the studies included in this review, the pediatric population with diurnal enuresis seems to have been more affected by psychological problems, whereas children with urinary urgency

and incontinence showed internalizing symptoms; children postponing micturition - who often suffered from fecal retention, encopresis, and ODD - had higher rates of externalizing disorders.<sup>25</sup> Children with diurnal enuresis and fecal incontinence are in greater need for mental health care. The impact of these dysfunctions also appears to spill over and affect parents and caregivers with significant levels of stress.<sup>21</sup>

It should be noted that most of the studies screened patients with LUTD for psychiatric symptoms, which in itself does not constitute diagnosis; only specialized health care professionals may diagnose the occurrence of psychiatric disorders based on the criteria dictated by the DSM or the ICD. Therefore, whenever symptoms of this nature are present, the patient must be referred to specialized care and treatment.<sup>4</sup>

Given the high rate of psychiatric comorbidities in children with LUTD, the search for related symptoms gains relevance and is recommended for every child with diurnal enuresis or other symptoms of LUTD or fecal incontinence. Emotional and behavioral disorders compromise compliance with treatment and lead to poorer prognosis.

Therefore, pediatricians and other health care workers recognizing psychiatric disorders in patients with LUTD should refer them to specialized care in order to mitigate their suffering and improve their prognostic chances. Likewise, mental health care workers must be aware of the possible associations between psychiatric disorders and LUTD.

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**TABLE 1** LIST OF QUANTITATIVE STUDIES ON PSYCHOSOCIAL INVOLVEMENT OF PEDIATRIC PATIENTS WITH LUTD

Study	Design	Materials	Instrument	Results
Erdogan <i>et al.</i> <sup>35</sup> Istanbul	Cross-sectional	53 children with nocturnal enuresis, 303 controls	CBCL	Children with nocturnal enuresis: - Higher rates of social and behavioral problems
Joinson <i>et al.</i> <sup>28</sup> UK	Longitudinal (ALSPAC)	8213 school-age children (7 to 9 years)	DAWBA WISC III	Children with diurnal enuresis: - 6.8% had cognitive delays - 2x more psychological disorders: Externalizing: ADHD (24.8%), ODD (10.9%), conduct disorder (11.8%) Internalizing (29.2%)
Wolfe-Christensen <i>et al.</i> <sup>25</sup> USA	Cross-sectional	600 children and adolescents referred to a urology clinic (375 males, 225 females)	PSC DVSS	- 19% had mental disorders: most common was ADHD - Children at increased risk of having emotional disorders: males, with high body mass indices, and high DVSS scores
Üçer & Gümüş <sup>36</sup> Turkey	Cross-sectional	101 children with MNE (62 males, 39 females), 38 controls	CDI, PedsQL, PSQI	Case group: - Poorer quality of life and quality of sleep - Higher depression rates - Poorer QOL when older
Von Gontard <i>et al.</i> <sup>17</sup> Germany	Cross-sectional	1001 children with LUTD (676 males, 325 females)	CBCL	- 70.1% had nocturnal enuresis - 36.8% had diurnal enuresis - 36.8% had fecal incontinence - About 43% had emotional problems Externalizing: (36%), Internalizing: (33.3%) - Children with fecal incontinence → poorer emotional performance (58.8%) - Children with incontinence had 3 to 6 times more behavioral comorbidities than controls
Zink <i>et al.</i> <sup>26</sup> Germany	Cross-sectional	166 children with LUTD (111 males, 55 females)	CBCL	- 40% had behavioral problems on CBCL - 36% had psychiatric disorders - Externalizing 2X > Internalizing - Higher prevalence of psychiatric disorders in diurnal enuresis - Children with nocturnal enuresis had higher rates of psychiatric comorbidities.
Baeyens <i>et al.</i> <sup>21</sup> Bélgica	Cross-sectional	81 children with MNE and 39 with NMNE	CBCL DBRS	- 15% had ADHD - Poorer bladder control was not related to ADHD
Yang <i>et al.</i> <sup>12</sup> Taiwan	Cross-sectional	130 children with LUTD symptoms (92 males, 38 females)	SNAP IV	- 55 children diagnosed with ADHD - The ADHD group had high scores on the DVSS
Crimmins <i>et al.</i> <sup>34</sup> USA	Cross-sectional	192 children with ADHD and LUTD	Clinical diagnosis	- ADHD had negative effect on dysfunction resolution - Children with ADHD: more trouble complying with treatment and poorer response to alarm intervention

Table 1. Continued

Von Gontard <i>et al.</i> <sup>33</sup> Germany	Cross-sectional	1379 school-age children (734 males, 645 females)	CBCL	- Children with diurnal enuresis had 4.4-fold chance of having ADHD
Hooman <i>et al.</i> <sup>15</sup> Irā	Cross-sectional	135 children with LUTD and 75 controls	CBCL	Group with LUTD: - Higher prevalence of behavioral disorders
Joinson <i>et al.</i> <sup>31</sup> UK	Longitudinal (ALSPAC)	10821 school-age children (4 to 9 years)	DTTS EDS	- Risk factors for voiding disorder: - Developmental delays - Difficult temperament - Maternal anxiety and depression
Von Gontard & Hollmann <sup>32</sup> Alemaha	Cross-sectional	167 children with LUTD	CBCL	- 65% of the children with encopresis and enuresis had clinical-range scores in the CBCL
Kuhn <i>et al.</i> <sup>15</sup> Germany	Cross-sectional	49 children with LUTD (28 males, 21 females), 32 controls	CBCL <i>Raven's progressive matrices</i>	- Both groups had similar mean IQ Group with LUTD: - Higher prevalence of behavioral disorders (41% vs. 9%): - Internalizing (29% vs. 6%) - Externalizing (35% vs. 0%) - Children postponing voiding had worse CBCL scores than children with urinary incontinence (56% vs. 24%)
De Bruyne <i>et al.</i> <sup>16</sup> Belgium	Cross-sectional	78 children with LUTD (47 males, 31 females) and 110 controls	CBCL DBDRS PSI	Group with LUTD: - Higher prevalence of depressive, aggressive, and inattentive symptoms - Parents: higher stress scores - Higher prevalence of behavioral disorders in children associated with higher levels of parental stress
Von Gontard <i>et al.</i> <sup>29</sup> UK	Longitudinal (ALSPAC)	> 8000 children in school age (7 to 9 years)	SDQ	- Higher prevalence of behavioral disorders in children with LUTD (41% vs. 9%): - Children with high urinary frequency had higher rates of conduct, emotional, attention, and relationship disorders - Children with urinary incontinence had more gastrointestinal, urinary, and psychological symptoms than their peers
Von Gontard <i>et al.</i> <sup>18</sup> Germany	Cross-sectional	718 school-age children	CBCL	- higher prevalence of ODD in children with incontinence than in continent children (19.5% vs. 5.2%) - Frequency of enuresis was not related to prevalence of ODD symptoms - No difference in the prevalence of ODD symptoms between types of LUTD
Niemczyk <i>et al.</i> <sup>19</sup> Germany	Cross-sectional	1676 preschoolers	DISYPS-II	Children with incontinence - 16.4% t. externalizing - 10.3% ADHD - 10.3% ODD

Table 1. Continued

Bael <i>et al.</i> <sup>37</sup> Belgium	Longitudinal - prospective	111 children with LUTD	CBCL	- 19% had clinical-range scores in the CBCL: after treatment the prevalence dropped to 11 % - Only children with micturition disorders had significant decreases in the prevalence of externalizing problems and total problems in the CBCL
Joinson <i>et al.</i> <sup>27</sup> UK	Longitudinal (ALSPAC)	8769 school-age children	TTS EAS RRPS	- Behavioral problems and difficult temperament in early childhood were identified as risk factor for nocturnal enuresis in school age

DAWBA: Development and Well-Being Assessment; WISC III: Wechsler Intelligence Scale for Children Third Edition; PSC: Pediatric Symptom Checklist; CDI: Children Depression Inventory; PedsQL: Pediatric Quality of Life Inventory; PSQI: The Pittsburgh Sleep Quality Index; DBRS: Disruptive Behavior Disorder Rating Scale; DTTs: Denver Toddler Temperament Scale; EDS: Edinburg Depression Scale; PSI: Parenting Stress Index; SDQ: Strength and Difficulties Questionnaire; DISYPSI-II: Diagnostik-System für psychische Störungen nach ICD-10 und DSM-IV für Kinder und Jugendliche-II; TTS: Toddler Temperament Scale; EAS: Emotionally Activity Sociability Questionnaire; RRRPS: Revised Rutter Parent Scale. CBCL: Child Behavior Check list; DVSS: Dysfunctional Voiding Symptom Score; IQ: intelligence quotient; QOL: quality of life; ADHD: attention deficit and hyperactivity disorder; ODD: oppositional defiant disorder.

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