

# New Insight In Persistent Primary Nocturnal Enuresis: A Preliminary Report

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## Abstract

**Objective:** We studied flowmetry and measured the sacral ratio in 109 patients with primary nocturnal enuresis (PNE), not responding to the various treatments

**Material and Methods:** One hundred–nine patients with a history of persistent PNE included in this study. The mean age was 9.9 years (range 7 to 18 years). Of the 109 patients, all had normal urologic and neurological findings. All children filled a voiding diary. A urinalysis, urine culture, urinary tract ultrasound, lumbosacral x-ray and uroflowmetry were performed in all patients. Uroflowmetry patterns and lumbosacral abnormalities such as spina bifida occulta (SBO) and sacral ratio (S.R, normal >0.74) were analyzed.

**Results:** Spina bifida occulta was identified in 78.9 per cent. The sacral ratio was very low in 76.1 per cent. Abnormal uroflowmetry was detected in 91 per cent. There was a significant correlation between SBO and low S.R, and also between the SBO and uroflowmetry patterns ( $P=0.004$ ), and also between reduced SR and uroflowmetry pattern ( $P=0.001$ )

**Conclusions:** Our preliminary study showed that the lumbosacral abnormalities (SBO, low sacral ratio) and abnormal uroflowmetry patterns correlate with treatment failure. We recommend to evaluate all children with persistent primary nocturnal enuresis. Urinary tract ultrasound, uroflowmetry and plain lumbosacral x-ray views (PA and lat views) are essential and minimally invasive in all patients with PNE and treatment failure prior to carrying out more invasive investigations.

## INTRODUCTION

Primary nocturnal enuresis is a common disorder in the pediatric population that affects approximately 5-10% of 7-year-old children. (1,2) It is defined as bed-wetting that persists beyond the age of five.(3) This disorder has plagued humans for longer than its first description on the Ebers papyrus in 1500 B.C.(4) However, despite extensive clinical research in primary nocturnal enuresis during the last 3 decades, dilemmas continue regarding its pathogenesis. Abnormal bladder function, especially detrusor instability and small capacity has long been associated with primary nocturnal enuresis. However, the exact role remains controversial and a review of previous studies of the relationship of bladder dysfunction and primary nocturnal enuresis reveals conflicting evidence. (5,6,7,8) While some have reported significantly smaller functional bladder capacity in children with primary nocturnal enuresis than that in age matched normal controls (5,6) Norgaard observed that enuretic episodes were triggered by a full bladder, and

bladder capacity in enuretic children was completely normal.(7) Also in another study,(8) was showed that the uroflowmetry and ultrasonography findings and the incidence of urinary infection were not different between enuretic children and normals. These results have led to the current view, which is generally accepted by most experts, that further evaluation in addition to careful and complete history of the voiding dysfunction might not necessary. On the other hand, in the review of literature we found that occult spinal dysraphism may not be apparent on physical examination but it may be associated with tethering of the spinal cord (short, thickened filum terminale which prevents the ascent of the conus medullaris during development). The presenting signs and symptoms are often insidious, like urinary incontinence or change in voiding pattern. (9) Recent reports have suggested that enuretic children with spina bifida occulta may have a worse clinical outcome that failed to respond to conservative measures, but their incontinence respond to divide the filum terminale. (10,11,12)

We evaluated bladder dysfunction and association of spina bifida occulta with persistent primary nocturnal enuresis and measured the sacral ratio as a useful method to evaluate the sacrum in these patients.

### PATIENTS AND METHODS

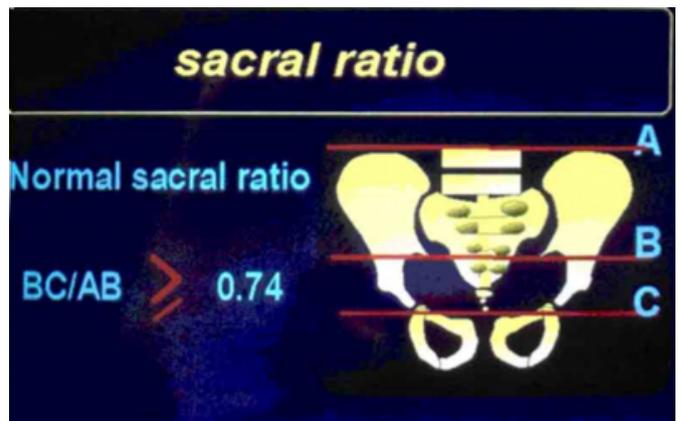
One hundred and nine patients (63% girls, 37% boys, mean age= 9.9 y, range: 7-18 y) were investigated. A stepwise approach was used including a personal and family history, a general urological and neurological investigation, urinalysis, urine culture and ultrasonography of the kidneys, ureters and the bladder. These patients had monosymptomatic primary nocturnal enuresis (more than one wet night weekly) in whom treatment had failed. These patients had been received different treatments like oral desmopressin (200 µg daily) or enuretic alarm and behavioral treatment for at least 3-6 months but failed to achieve an average decrease of 50% or greater in bed-wetting frequency weekly during therapy. The investigations confirmed the absence of any structural organic abnormalities of urinary tract and neurological disorders. In these patients, uroflowmetry was performed on an outpatient basis with micromedics system (M.E.D) [model type: M.E.D 1001 H, model no: DPU-411] using a method described in the references. (13) And also lumbosacral x-ray (P.A) was accomplished to give attention to two points:

Presence of spina bifida occulta (SBO): nonfusion of the spinous processes and the posterior arches of one or more lumbar and sacral vertebrae.

Measurements of sacral ratio: three lines were drawn (Fig.1): line A; extend across the uppermost portion of the iliac crest. Line B; unites the inferior-posterior iliac spines. Line C; runs parallel to line A and B and passes through the lowest sacral point visible on the radiograph. Normal children have an average sacral ratio (BC/AB) of 0.7/0.8 or 0.74.(14)

### Figure 1

Figure 1: Measurements of sacral ratio.



Statistical analysis was performed by  $\chi^2$  test with  $p < 0.05$  considered statistically significant.

### RESULTS

In this study, 109 patients (68 girls, 41 boys) with a mean age of 9.9 years were investigated. Analysis of the uroflowmetric studies revealed 4 patterns. Pattern 1 was the staccato voiding pattern in 60 patients (55%). The second pattern was interrupted voiding that was found in 22 patients (20.2%). Combinations of these two patterns were found in 13 patients (11.9%) and uroflowmetry in 14 patients were normal.

In evaluation of lumbosacral x-ray, we found spina bifida occulta in 78.9% of our patients and sacral ratio in 74% of them was reduced less than 0.74.

We compared the frequency of spina bifida occulta with different patterns of uroflowmetry abnormalities. In our patients with abnormal pattern of uroflowmetry the frequency of spina bifida occulta was significantly increase in comparison with normal pattern ( $p=0.004$ ) (Table 1).

The frequency of reduced sacral ratio was significantly increased in abnormal patterns of uroflowmetry ( $p=0.001$ ) (Table 2).

**Figure 2**

Table 1: Correlation between spinal bifida occulta and uroflowmetry

Uroflowmetry ± Presence of SBO	Staccato Pattern	Interrupted Pattern	Combination of both	Normal	Total
+	19	48	13	6	86
-	3	12	0	8	23
Total	22	60	13	14	109

**Figure 3**

Table 2: Correlation between sacral ratio and uroflowmetry

Uroflowmetry / SR	Min-Max	Mean
Interrupted Pattern	0.38-0.9	0.58
Staccato Pattern	0.37-0.95	0.61
Staccato & Interrupted Pattern	0.2-0.81	0.54
Normal	0.56-0.86	0.77

**DISCUSSION**

Enuresis is considered a benign condition and common in healthy children, with a known rate of spontaneous resolution. (15)

However, as the incidence of non-neuropathic bladder dysfunction is high in this group, as a whole, and maybe the cause in patients who do not respond to first-line treatment. It maybe helpful to have reliable clinical clues to predict its occurrence with an non-invasive method like uroflowmetry. (16) In our study, uroflowmetry abnormalities were found in 91% patients. In previous observation, urodynamic studies, showed the high incidence of detrusor instability in nocturnal enuresis, especially in patients with an increasing number of symptoms. (17)

The exact mechanism involved in the persistent bedwetting is unclear and many questions remain unresolved. The achievement of complete central control of the bladder function is probably a maturation process involving various level of central and peripheral nerves system. For instance; if adequate sensation of bladder filling and the urge for micturition is delayed, incontinence would result. In some cases nocturia, urgency and enuresis may persist until adulthood period due to neurological maturation development. Occult neuropathic defect (spinal bifida occulta) occasionally is responsible for absent bladder

maturation. (18)

Spinal bifida occulta is nonfusion of the spinous processes of the lumbar and sacral vertebrae that are the most common congenital anomalies of the spine. It isn't a normal anatomical variant, because many reports describe increased incidences of spinal bifida occulta in patients with back pain and enuresis.(19,20) Some reports noted a 35 to 60% incidence of spinal bifida occulta in children with enuresis.(20) In this study, 78.9% of patients with persistence PNE had spinal bifida occulta. Several authors have reported that the incidence of spinal bifida occulta is greater in males (21,22) Girls with spinal bifida occulta were predominated in our study (57 girls versus 29 boys).

It has been postulated that spinal bifida occulta represents a developmental delay. (23) With failure of the posterior arch fusing. The posterior arches are usually complete in most children by the age of 5 years (23). Galloway and Tainsh suggested that spinal bifida occulta could be a marker of incomplete neurogenesis of the sacral nerves. (24) Recently, there has been renewed interest in the association of spinal bifida occulta with voiding dysfunction. Galloway and Tainsh reviewed 100 patients with a variety of urological complaints who underwent radiographic evaluation. (24) They found that 43 patients had spinal bifida occulta, of whom 35 underwent urodynamic evaluation, and sacral evoked response measurements. The majority of patients had abnormalities on both examinations. It was concluded that minor abnormalities of the sacrum were associated with significant neurological deficit. In 1989 Fidas et al reviewed 138 adults with varying urological complaints seen at an incontinence clinic who underwent plain abdominal radiograph, of whom 24 had enuresis. (25) In the enuretic group the incidence if spinal bifida occulta was 55% for men and 43% for women, which was greater than the incidence in the control group. All patients underwent urodynamic evaluation but there was no correlation between the urodynamic abnormalities and spinal bifida occulta. Khoury et al reported on the outcome of 31 diurnal enuretic children with spinal bifida occulta. (11) All 31 children had detrusor hyperreflexia that failed to respond to anticholinergic medication.

In conclusion, our data reveals that, the high incidence of spinal bifida occulta in persistent PNE. The measurement of sacral ratio confirmed the high incidence of low SR in children and adolescent with persistent PNE and there was significant correlation between spinal bifida occulta and

reduced sacral ratio. The incidence of abnormal uroflowmetry patterns in persistent PNE and correlation between lumbosacral abnormalities (spinal bifida occulta and reduced sacral ratio) and abnormal uroflowmetry patterns. We highly recommend to perform a a urinary tract ultrasonography a lumbosacral X-ray, and uroflowmetry in each child with PPNE and refractor to the management. The presence of spinal bifida occulta and low SR may be the causes of neuropathic dysfunction of the bladder and sphincter in persistent PNE.

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