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Urodynamic disorders and renal scarring in pediatric patients with nonmonosymptomatic nocturnal enuresis

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Background/aim: In nonmonosymptomatic nocturnal enuresis (NMNE), the incidence of organic abnormality and urodynamic disorder is more frequent than the general population. The aim of this study is to identify urodynamic disorders and renal scarring in children with NMNE.

Materials and methods: This study evaluated the urodynamic disorders and renal scarring of a total of 30 patients who were diagnosed with NMNE. A video-urodynamic test and Tc-99m dimercaptosuccinic acid renal scintigraphy were applied.

Results: Records of 605 patients who had been diagnosed with enuresis were analyzed, and 215 (33.5%) of them had been diagnosed with NMNE. Thirty patients older than 6 years old with NMNE were included in the study. Detrusor overactivity was identified in 10 patients. Bladder capacity was low in 5 patients and bladder compliance was low in 2 patients. Renal scarring was identified in 1 patient. Unilateral vesicoureteral reflux was found in 4 patients.

Conclusion: Bladder function disorder is also a significant risk factor for the development of renal scarring, besides other risk factors. Organic abnormalities are seen more often in patients with NMNE than patients with monosymptomatic nocturnal enuresis, so urodynamic studies should be remembered for patients with NMNE.

Key words: Nonmonosymptomatic nocturnal enuresis, renal scarring, urodynamic disorder

1. Introduction

'Nocturnal enuresis' means wetting in discrete portions while asleep in a child who has passed his or her fifth birthday (1–4). The clinical type in which children are without any other lower urinary tract symptoms (nocturia excluded) and without a history of bladder dysfunction is defined as monosymptomatic nocturnal enuresis (MNE). Similarly, the term nonmonosymptomatic nocturnal enuresis (NMNE) is used to define children with lower urinary tract symptoms (such as daytime incontinence, urgency, holding maneuvers, etc.) and with a history of bladder dysfunction (1–6).

As part of MNE, the necessity of urodynamic trials is a controversial issue. The majority of patients with MNE do not suffer from any urodynamic abnormality or bladder or sphincter function disorders, and their bladder capacity is normal. As abnormality could be detected in a small part of enuretics through urodynamic analyses, patients to be analyzed urodynamically should be carefully chosen.

Urodynamic analyses should be conducted on patients with daytime urinary incontinence, secondary beginning, urinary dysfunction, recurrent urinary tract infection (UTI), perinatal hypoxia, central nervous system trauma, convulsion, bladder trauma, or surgery involved in their history and on patients who fail to respond to treatment. Overactive bladder, detrusor hyperactivity, and flaccid bladder are frequently observed conditions in patients as urodynamic disorders (5,7).

Renal parenchymal damage develops usually on the basis of pyelonephritis and vesicoureteral reflux (VUR) (8–11). In the case that renal parenchymal damage is permanent, renal scarring develops. In recent years, it has been necessary not to neglect the bladder-based factors in the development of renal parenchymal scarring (12–15). The risk factors in terms of development of renal scarring have been defined in studies. Among these risk factors, the combination of VUR and pyelonephritis ranks the first. Bladder function disorders have been also considered

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among the risk factors in terms of development of renal scarring in recent years (16,17). Bladder function disorders are likely to cause renal parenchymal damage without VUR, as well (17–19).

This study was planned to evaluate the relation between urodynamic disorders and renal scarring in pediatric patients with NMNE.

2. Materials and methods

Records of 605 patients who had been diagnosed with enuresis in the pediatric nephrology unit in the last 1-year period were analyzed, and patients older than 6 years old who had been diagnosed with NMNE were included in the study.

A video-urodynamic test was applied to the patients in the urology department. In cases with urinary infection and reflux in which multiinitatives had been applied, the video-urodynamic test was applied following the process along with antibiotics for 24–48 h. All of the urodynamic assessments and analyses were conducted by the same pediatric urologist. Intrablauder pressure monitor, rectal manometer probe, and electromyography electrodes were put on the patients. The bladder was filled with normal saline with a urethral catheter to 10% of bladder capacity, ideally calculated at a temperature close to body temperature.

The detrusor function, neuropathies, capacity of urinary discharge, urinary dysfunction, and urination were analyzed with the video-urodynamic test and the bladder compliance [$V(\text{volume}) / P_{\text{detrusor}}(\text{pressure})$] was assessed. Contractions over 15 cm H₂O in the filling phase in cystometry, detrusor opening pressure over 8 cm H₂O, or detrusor pressure over 100 cm H₂O measured with maximum flow rate were considered as obstruction.

Tc-99m dimercaptosuccinic acid (DMSA) renal scintigraphy was applied in these patients. As part of

DMSA scintigraphy assessment, homogeneous follow-up on distribution of cortical activity and regular contour were interpreted as normal kidneys. Flattened kidney contour, cortical thinning, wedge-style defect, lower volume, and an appearance smaller than the other kidney were regarded as cortical scarring. The reduction in renal cortical uptake was defined as “hypoactive parts”.

Prior to the study, approval was received from the local ethics committee and an approval form was obtained from families.

3. Results

Records of 605 patients who had been diagnosed with enuresis at the pediatric nephrology unit in the last 1-year period were analyzed, and 215 (33.5%) of them had been diagnosed with NMNE. Thirty patients older than 6 years old with NMNE were included in the study. Age and sex distributions of these 30 patients were as follows: 24 girls (80%) and 6 boys (20%), with mean respective ages of 7.85 ± 1.85 years and 7 ± 1.04 years.

Families of 3 patients who had been planned to be urodynamically analyzed rejected the video-urodynamic test. Their uroflowmetry results were normal. Urodynamic analyses were found to be normal in 4 patients (4/27, 14.8%). Urodynamic abnormalities were detected in 23 patients (23/27, 85.2%). Detrusor overactivity was identified in 10 (10/27, 37%) patients. Bladder capacity was lower than optimum in 5 (5/27, 18.5%) patients in terms of age. Bladder compliance was low in 2 patients. Both detrusor overactivity and lower bladder capacity were found in 6 (6/27, 22.2%) patients (Figure 1).

Unilateral VUR was found in 4 out of 30 patients (13.3%). The patients who were diagnosed with VUR were all girls. All of the patients had recurrent (twice or more) UTIs. Among the patients diagnosed with VUR, analysis by DMSA detected normal findings in 1 patient, scarring

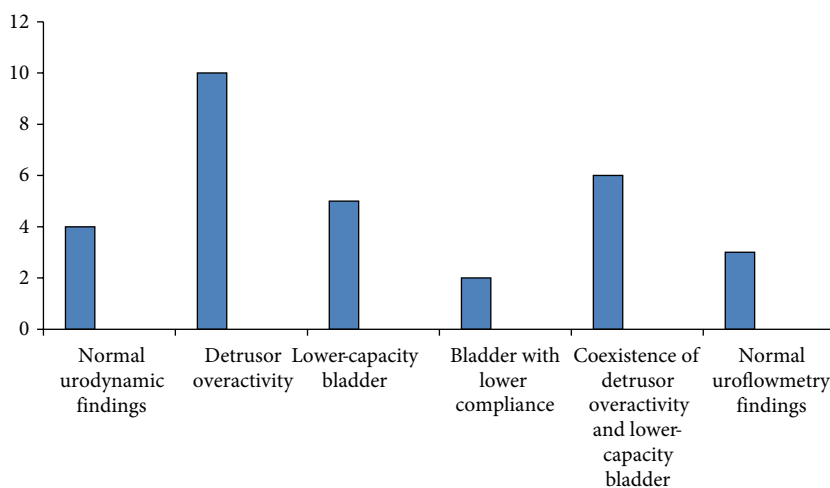


Figure 1. Urodynamic findings.

in 1 patient, and hypoactive parts in 2 patients (on the left kidney in 1 patient and on 2 kidneys in 1 patient). As a result of urodynamic analysis among the patients diagnosed with VUR, detrusor overactivity was found in 2 out of 4 patients.

An analysis of DMSA findings of 30 patients with NMNE showed that the results of Tc-99m DMSA scintigraphy in 12 patients (40%) were normal (Figure 2). Renal scarring was found for 1 of the remaining 18 patients (3.33%). When this patient was analyzed, it was seen that the patient had grade III VUR and recurrent UTI. Hypoactive parts were identified on 2 kidneys of 11 patients (11/18) and only on the left kidney of 6 patients (6/18), which were considered to have developed secondary to previous infections and which were advised to be followed in terms of scar development.

Urodynamic analysis showed abnormality in 17 patients and recurrent UTI history in 12 patients among those diagnosed with pathology by DMSA (n = 18).

4. Discussion

Bladder function disorders have started to be detected increasingly in patients with enuresis in parallel to an increase in use of urodynamic analyses in children. As long as it is not considered to be complicated in MNE, urodynamic analysis is not suggested and development of appropriate technologies is expected, and thus delayed urodynamic analyses were put to use in pediatric enuresis (7).

According to general opinion, the majority of patients with MNE do not have urodynamic abnormality or bladder or sphincter function disorder, and they have normal bladder capacity. Nevertheless, careful action is suggested in the course of making a decision to conduct urodynamic analysis in these patients or not (7,20). In NMNE the incidence of organic abnormality and

urodynamic disorder is more frequent than in the general population (2,5,21,22).

As a result of their urodynamic analysis in 2 groups of patients that they divided as those with MNE (33 patients) and those with complicated primary enuresis (47 patients with complaints of daytime/nocturnal urinary incontinence, urgency, use of urinary continence techniques by the child, UTI, etc.; NMNE in accordance with the new definition), Medel et al. (23) detected detrusor overactivity in 49% of the group with MNE and in 79% of the group with NMNE. Shima et al. (24) found detrusor overactivity in 39.4% of patients with NMNE and 25% of patients with MNE in research that they conducted to study lower urinary system problems in 238 patients with enuresis. In our study, only 4 of 27 patients with NMNE who had been urodynamic analysis were considered normal (7.4%); 2 of these patients had VUR. Detrusor overactivity was detected in 16 patients (16/27, 59.3%).

Naseri et al. (25) detected urodynamic abnormality in 17 of 20 patients with NMNE (85%). Similarly, in our study, urodynamic abnormality was detected in 23 of 27 patients with NMNE (85.2%).

It is considered that the higher urination pressures caused by detrusor overactivity, increased bladder pressure, and detrusor sphincter incontinence (contraction of sphincter, which should become flaccid at the time of detrusor contraction) have an impact on the development of secondary VUR. The functional obstruction deriving from contraction of the sphincter along with undesirable bladder contractions causes intrabladder pressure and development of VUR (14).

Soygür et al. (11) carried out urodynamic analysis on 62 patients who were diagnosed with VUR without any neurological disorders in order to show the relation among urinary disorders, bladder function disorders, VUR, and renal scarring. Unilateral VUR (40.3%) was detected in 25

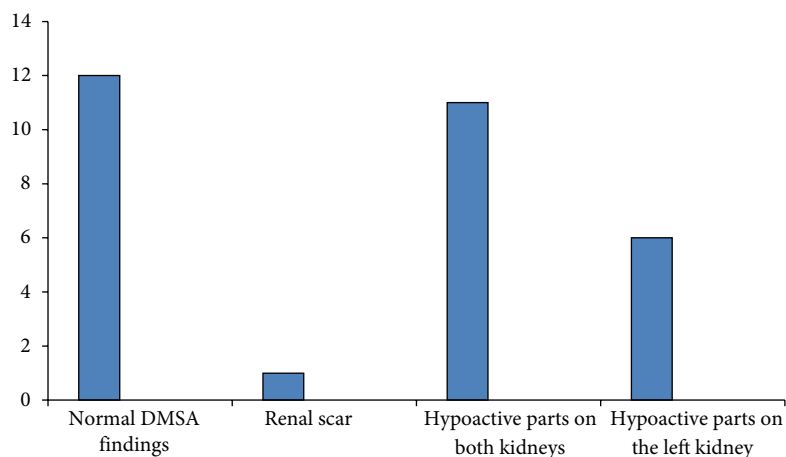


Figure 2. DMSA findings.

patients and bilateral VUR was found in 37 patients (59.7%). Bladder function disorder was found in 28% of patients with unilateral VUR, whereas this rate climbed significantly to 72.9% in patients with bilateral VUR. Soygür et al. indicated higher hospitalization rates particularly in patients with lower bladder function disorders in terms of bilateral VUR.

Karami et al. (12) obtained normal result in 23% of patients as part of the urodynamic analyses they conducted on 139 patients with phase III and above VUR, and they detected overactive bladder in 74%, high-end filling pressure in 72.7%, and bladder with lower compliance in 51%. Although the case numbers are not high enough to argue soundly in our study, detrusor overactivity was detected in 2 out of 4 patients with VUR (2/4, 50%) as well.

In a VUR research study conducted by Tanaka et al. (26) on patients with enuresis, VUR, which is likely to be found in 0%–4.6% of the normal population, was detected in 5.7% of patients with nocturnal enuresis and in 7.4% of patients with NMNE. The urodynamic analysis in patients with VUR showed bladder function disorder by 75%.

Bladder function disorders pave the way for VUR, increased intrablauder pressure, and frequent UTIs, and thus play an important role in the development of renal parenchymal damage.

As a result of an increase in the use of urodynamic analyses in patients with enuresis, it was found that bladder function disorders are a risk factor in terms of the development of renal scarring.

Fifty-two patients who were diagnosed with renal scarring without VUR were reassessed by Vega et al. (19), and only 4 patients (7%) were regarded as normal after the results of urodynamic analyses. In the remaining patients, lower bladder capacity (82%), higher bladder filling pressure (65%), high-pressure irrepressible contractions (62%), and higher urination pressure (60%) were found.

Studies conducted in recent years show that disorders in bladder dynamics also play an important role in development of renal scarring in patients without VUR. Furthermore, it is known that bladder function disorder, which is better understood to be vitally important in the etiology of NMNE, causes VUR or becomes an important risk factor in terms of development of parenchymal damage, irrespective of VUR and other factors, as indicated in some studies. All of the required analyses, including urodynamic studies, should be remembered in patients with NMNE who are at higher risk than patients with MNE in terms of organic pathologies.

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