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SONOGRAPHIC EVALUATION OF DETRUSOR THICKNESS AND PARAMETERS DERIVED FROM ELECTROMYOGRAPHY UROFLOW – DO THEY PROVIDE ADDITIONAL INFORMATION FOR THE DIAGNOSIS OF LUTD IN CHILDREN? A PRELIMINARY REPORT.

Hypothesis / aims of study

The combination of ultrasound evaluation of detrusor thickness and EMG-uroflow may constitute a promising non-invasive diagnostic tool in the evaluation of lower urinary tract symptoms (LUTS) / obstruction in children.

Study design, materials and methods

In this study children with LUTS were enrolled and a few healthy children were included as controls. No children were treated previously.

The ultrasound utilized an electronic 7.5 MHz transducer to measure detrusor thickness of the ventral wall (1) at a bladder volume of 50–100% (2) of the age-adjusted functional bladder capacity (FBC). PVR was measured by using a 3.5 MHz transducer. Patients were grouped according to detrusor thickness, defining 3 groups: 1 mm (D1), 2 mm (D2), and 3 mm and above (D3).

The EMG-uroflowmetry was performed with surface electrodes at defined localisations; in girls close to the level of the external meatus next to the labia majora and in boys perineo-scrotal. Routinely the following parameters were derived: micturition volume, Q_{max} , flow time, micturition time, average flow. Baseline for EMG evaluation was the period prior to voiding compared to the voiding period. EMG activity was categorized either as minor, good, or unchanged relaxation, alternatively as increased or highly increased contraction. Minimal EMG amplitude and its duration, number of pelvic floor contractions and their amplitude, number of flow portions and flow shapes according to ICS and ICI (3) were assessed. Two or three EMG-uroflow recordings were taken, of which the most reliable one was selected for analysis.

Results

104 children were investigated in the first author's unit (48 girls, 56 boys, mean age 8.12 years). The clinical diagnoses comprised healthy children (n=4), children suffering from primary nocturnal enuresis (n=26, out of which 22 showed additional dysfunctional voiding), overactive bladder (n=15), dysfunctional voiding (n=3), reflux (n=1), functional bladder neck obstruction (n=1) and combinations (n=54) of the mentioned diagnostic subgroups, also including encopresis (n=17) and recurrent UTI (n=16). The patient material was subdivided according to measured detrusor thickness (D1 to D3).

In **D1** patients (n=66) sonographic evaluation did not reliably exclude micturition pathologies: In 14/19 patients without PVR, pathological flow parameters were found. All children with dysfunctional voiding showed an increased EMG amplitude during micturition compared to baseline.

Four healthy children all had normal relaxation at uroflow and bell-shaped uroflows without PVR. The same normal findings were recorded in children suffering from monosymptomatic PNE.

In **D2** patients (n=27) 5/7 cases with OAB only had a decreased FBC, Q_{max} was normal. The 3 cases found to have OAB with PVR had an invasive investigation resulting in 2 being classified as neurogenic and in the remaining one a urethral membrane was identified.

In **D3** patients (n=11) the 3 OAB cases had neither PVR nor dysfunctional voiding. FBC was decreased, Q_{max} was elevated and they were older than 9 years. All dysfunctional voiders showed PVR (19-33%) associated with increased pelvic floor activity and FBC was age-adequate.

All children with recurrent UTI showed dysfunctional voiding associated with increased detrusor thickness.

Interpretation of results

Q_{max} was not a reliable variable in cases with dysfunctional voiding or in vesico-ureteral reflux. All patients who showed signs of increasing detrusor hypertrophy (D2, D3) had either dysfunctional voiding (n=29) or OAB only with sufficient pelvic floor relaxation (n=9). The patients with dysfunctional voiding showed an increased or highly increased EMG amplitude during micturition, irrespective of additional diagnoses, e.g. PNE. Therefore, invasive procedures, e. g. cystoscopy and video-urodynamics, might only be advisable in cases with OAB and reflux with regular pelvic floor relaxation and PVR.

Our data make a plea for incorporating EMG as an addition to uroflowmetry to form a standard diagnostic procedure, because uroflowmetry used alone is often misleading.

Concluding message

In cases presenting with an increased detrusor thickness EMG-uroflows can avoid diagnostic pitfalls.

Dysfunctional voiding may cause other LUTS and should therefore be treated prior to the other clinical entities. The correlation between clinical findings and the measured variables are highly improved with the minimal diagnostic approach of ultrasound in combination with EMG-uroflowmetry when compared to the invasive approach with cystoscopy and urodynamics.

None of the presented investigations itself guarantees a correct diagnosis. The combination of ultrasound for assessing detrusor thickness and EMG-uroflow leads to a more precise diagnosis, detects risk factors and avoids invasive procedures and treatment failures.

References

1. Detrusor thickness in healthy children assessed by a standardized ultrasound method. J Urol 2001; 166: 2364-2367
2. Increase in detrusor wall thickness indicates bladder outlet obstruction (BOO) in men W J Urol 2002; 19: 443-452
3. Incontinence 2nd Edition, Health Publication Ltd, Plymouth, 2002; 1086-1089