Dysfunctional Voiding

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04 Jun 2016
International Children’s Continence Society classification of lower urinary tract dysfunction

1. Bladder and bowel dysfunction
2. Overactive bladder
3. Voiding postponement
4. Underactive bladder
5. Dysfunctional voiding
6. Bladder outlet obstruction
7. Stress incontinence
8. Vaginal reflux
9. Giggle incontinence
10. Extraordinary daytime urinary frequency
11. Bladder neck dysfunction
Dysfunctional voiding (DV) in children is defined as

– “habitual contractions of the urethral sphincter during voiding” [1]

Introduction

• Urinary incontinence is present in ~ 7% of children at age 7 years ¹
• Dysfunctional voiding is the underlying cause in ~ 30% of cases ²
• Symp of dysfunctional voiding
  – urinary incontinence
  – recurrent UTI d/t high PVR ³

Introduction

• Bowel dysfunction is strongly a/w dysfunctional voiding
  – 50% of children with dysfunctional voiding present with constipation/ fecal incontinence \(^1\)
  – Tx of dysfunctional voiding is targeted at improving bladder & bowel symp simultaneously

CLINICAL FEATURES
Clinical features

• Majority
  – urinary incontinence a/w urgency,
  – experience only a transient interval between the first desire to void & the necessity of doing so.

• Urinary stream
  – fluctuant or interrupted (‘staccato’ voiding)

• Girls
  – affected almost exclusively
  – 90% recurrent UTI
  – 30% VUR (with or without renal scarring)
In 2000, Farhat and colleagues reported on the creation of the DVSS based on the IPSS.
Dysfunctional Voiding Symptom Score

- 10 quantitative and qualitative urologic parameters translated into age-appropriate Qs for children regarding urinary symp
  - urinary incontinence, voiding habits, urgency, posturing, bowel habits, and stressful life conditions.
  - Scores of 0-3 accd to incidence in the mth before-max possible score of 30
Dysfunctional Voiding Symptom Score Questionnaire

<table>
<thead>
<tr>
<th>Over the last month</th>
<th>Almost never</th>
<th>Less than half the time</th>
<th>About half the time</th>
<th>Almost every time</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I have had wet clothes or wet underwear during the day?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>NA</td>
</tr>
<tr>
<td>2. When I wet myself, my underwear is soaked.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>NA</td>
</tr>
<tr>
<td>3. I miss having a bowel movement every day.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>NA</td>
</tr>
<tr>
<td>4. I have to push or my bowel movements to come out.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>NA</td>
</tr>
<tr>
<td>5. I only go to the bathroom one or two times each day.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>NA</td>
</tr>
<tr>
<td>6. I can hold onto my pee by crossing my legs, squatting or doing the “pee dance”.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>NA</td>
</tr>
<tr>
<td>7. When I have to pee, I cannot wait.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I have to push to pee.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. When I pee it hurts.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Parents to answer. Has your child experienced something stressful like the example below?</td>
<td>NO (0)</td>
<td></td>
<td></td>
<td></td>
<td>YES (3)</td>
</tr>
</tbody>
</table>

TOTAL

- New baby.
- New home.
- New school.
- School problems.
- Abuse (sexual/physical).
- Home problems (divorce/death).
- Special events (birthday).
- Accident/injury.
- Others

Investigations

• Urinalysis
• Urine culture
• Ultrasound
  – minor thickening of the bladder wall,
  – significant residual urine (>10% of expected bladder capacity) is suggestive of dysfunctional voiding
• UDS with EMG

*Bladder capacity
  30 + (age in years x 30)] in mL, or
  (Age+1)x 30
Analysis of uroflow patterns in children with dysfunctional voiding

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Received 30 June 2013; accepted 11 October 2013
Available online 7 November 2013

Results: Of 596 children who underwent a uroflow/EMG examination, 121 had an active pelvic floor EMG during voiding, that is a finding consistent with the diagnosis of DV. The flow patterns identified in those diagnosed with DV were staccato in 70 (58%), interrupted in 22 (19%), mixed in 12 (10%), and a bell-shaped or depressed curve in 17 (14%). Staccato pattern became normal in 96% following successful treatment with biofeedback.
Figure 1  Example of a 10-year-old girl with typical staccato flow pattern, as well as an active pelvic floor electromyography (EMG) during the voiding phase, diagnostic of dysfunctional voiding.
Figure 2  Example of an 8-year-old boy with typical interrupted/fractionated flow pattern, as well as an active pelvic floor electromyography (EMG), diagnostic of dysfunctional voiding.
Figure 3  Example of an 8-year-old girl with mixed flow pattern: flow curve reaches the baseline during the voiding phase, it also meets the criteria for staccato uroflow; pelvic floor electromyography (EMG) during the voiding phase is active, confirming the diagnosis of dysfunctional voiding in this child.
Figure 4  Example of a 9-year-old girl with normal/depressed flow pattern; the pelvic floor electromyography (EMG) is also active in this child, diagnostic of dysfunctional voiding.
MANAGEMENT
Evaluation and Targeted Therapy of Voiding Dysfunction in Children

Lane S. Palmer

Significant strides have been made over the past two decades in more precisely evaluating and managing children with voiding complaints. A thorough history should offer insight into the possible causes for the presenting complaints and this should be supplemented by physical examination, urine studies, and select imaging. Uroflowmetry and external sphincter electromyography with measurement of postvoid residual urine should allow for accurate diagnosis using categories offered by the International Children’s Continence Society. This ability to make an accurate diagnosis should naturally lead to the use of treatment options (urotherapy, pharmacotherapy, biofeedback, and neuromodulation) that specifically target the responsible cause of the complaints rather than simply their symptoms. UROLOGY ■■■: ■■■–■■■, 2016. © 2016 Elsevier Inc.
Figure 1. Schematic flow chart for targeted management of voiding dysfunction in children.
Pelvic floor EMG activity during voiding with relaxed abdominal activity

Dysfunctional Voiding

Biofeedback

Refactory
- Botulinum toxin injection - external sphincter

Incomplete response with high PVR
- Add alpha blocker

Incomplete response with normal PVR, but urgency/frequency
- Add anticholinergic
Biofeedback

• Maizels et al [1] introduced biofeedback, the modulation of a bodily function in response to an auditory or visual representation of that function, in 1979, using urodynamic equipment and successfully retrained 2 of 3 pts.

• Prior to the introduction of animated computer games in 1999, [2] acceptance of biofeedback was slow
  — depended on differences in EMG tracing or its translated sounds coming from patches placed in the area of the external urinary sphincter.

Biofeedback

• Currently, EMG activity is translated into an animated sequence
  – that can be controlled by the pt as he/she contracts or relaxes the external urinary sphincter
• Upon isolating the sphincter, the pt uses the games to learn to modulate the sphincter & then repeat this modulation when voiding.
Biofeedback

• In an analysis of 27 series, Desantis et al [1] reported
  – improvement in UTI (83%)
  – Improvement in daytime incontinence (80%)
  – improvement in
    • constipation (18%-100%)
    • frequency (67%- 100%)
    • urgency (71%-88%)
    • VUR (21%-100%)

Botulinum-A Toxin

• Contraction of the striated muscle of the external sphincter mechanism
  – controlled by acetylcholine
  – can be blocked through the injection of botulinum-A toxin that prevents fusion of neurosecretory vesicles with the surface of the synaptic plasma membrane
Botulinum-A Toxin

• Clinically, in cases of external sphincter contraction that are refractory to tx, including biofeedback
  – injection of botulinum-A toxin holds considerable promise since Steinhardt et al [1] reported the 1\textsuperscript{st} successful case in a 7y/o girl.

Botulinum-A Toxin

• Several subsequent series corroborated botulinum-A toxin’s benefit in refractory cases using higher doses and reporting reliable durability and infrequent complications.
Botulinum-A Toxin

- Radojicic et al [1] injected transperineally (50-100 IU) and restarted behavioral & biofeedback therapy 15 days later.
  - By 6 mths, PVR was significantly reduced and 17/20 patients reestablished normal or improved voiding curves;
  - transient incontinence in 1 pt

Botulinum-A Toxin

• Mokhless et al [1] prospectively injected 50-100 IU cystoscopically at the 3, 6, and 9 o’clock positions in 10 children with repeated monthly according to the response and found that
  – the PVR decreased by 89%,
  – detrusor leak point pressure decreased significantly,
  – a marked increase in maximum urine flow occurred.

Botulinum-A Toxin

- In the only long-term study (20-71 months), Vricella et al [1] reported on 12 children, of which 8 (67%) had significantly improved PVR and mean maximum flow rate.
  - A 2\textsuperscript{nd} injection needed (mean 15 mths) in 50%.
  - Neuropsychiatric prob were present in 3 of 4 non-responders.

THANK YOU