Dysfunctional Voiding Patients: When Do you Give Medication and Why (A Practical approach)

Andrew Combs, PA-C
Director, Pediatric Urodynamics
Division of Pediatric Urology
New York Presbyterian-Weill Cornell Medical Center
Disclosures

- I have no conflicts of interest or financial disclosures to make

- I have no other disclosures to make other than: “the truth shall help you pee”
None of us is as smart as all of us are together

Success is a team effort

CU slogan

• Each of us brings something to the table, none of us has a monopoly on how things should be done
Two Main Objectives

1) Understand how to utilize the uroflow/EMG study to help correctly identify the nature of the child’s LUT Dysfunction particularly in diagnosing the LUT Condition: Dysfunctional Voiding

2) Understand how to identify when conditions exist that warrant the addition of medications to the child’s DV therapy, specifically anticholinergics (antimuscarinics) and/or alpha blockers, to treat associated detrusor overactivity (DO) and secondary bladder neck obstruction (2ºBNO) and how to monitor therapeutic response
First Objective

Understanding how to utilize the uroflow/EMG study to help in more accurately identifying the specific LUT Condition as it relates to disorders of voiding that can underlie the child’s LUT Dysfunction
NORMAL VOIDING
(A staged event)

1\textsuperscript{st} Stage: relaxation of pelvic floor (i.e. EMG)

2\textsuperscript{nd} Stage: within a few seconds:
  • Detrusor voiding contraction
  • Relaxation of bladder base
  • Funneling of bladder neck

3\textsuperscript{rd} Stage: unimpeded urine flow
DEFINITIONS

- **Opening time** – the time interval between the onset of a volitional detrusor voiding contraction and the start of urine flow.

- **PF EMG lag time** – time interval between the start of pelvic floor relaxation of urine flow and the start of urine flow.

Opening time and PF EMG lag time have been shown to be statistically indistinguishable.
Normal Uroflow/EMG

Max Flow Rate: 25.8 ml/s
Average Flow Rate: 16.8 ml/s
Voided Volume: 303 ml
EMG Lag Time: 3 s
PVR: 16 ml
Flow Time: 15 s
Time to Max Flow: 9 s

Uroflowmetry with EMG
Start of pelvic floor relaxation

Start of urinary flow

PF EMG Lag Time: 2 sec
Not every void will have a measurable Lag time if PF muscle recruitment did not occur.
Dysfunctional voiding (DV) is habitual contraction of the urethral sphincter during voiding and supported by a staccato pattern on repeated uroflows or by UDS (while presumed, no EMG evidence of pelvic floor hyperactivity during voiding was required).

This has since changed where now, EMG evidence of pelvic floor hyperactivity during voiding is strongly recommended.
Things are not always what they appear to be

“For crying out loud, I was hibernating! ... Don’t you guys ever take a pulse?”
Can Staccato and Interrupted/Fractionated Uroflow Patterns Alone Correctly Identify the Underlying Lower Urinary Tract Condition?

Sven Wenske, Andrew J. Combs, Jason P. Van Batavia and Kenneth I. Glassberg

From the Division of Pediatric Urology, Morgan Stanley Children’s Hospital of New York and Department of Urology, Columbia University, College of Physicians and Surgeons, New York, New York

THE JOURNAL OF UROLOGY® Vol. 187, 2188-2194, June 2012
Methods

- Database 354 consecutive neurologically and anatomically normal patients with LUTS
- those with either staccato or interrupted urinary flow based on ICCS guidelines were identified
- retrospective review of uroflow data
- simultaneous EMG
- all uroflow and EMG were performed by a single experienced clinician
- Patients with known neurogenic or anatomic abnormalities were excluded
Methods

• EMG units used in our institution:
  • Medtronic Duet system (Mediwatch, USA)
  • Aquarius TT system (Laborie)
  • Both have high sampling rates of 48kHz and 5kHz respectively and a wide spectrum of sensitivities
  • Both units have high quality audio units that can discern between artifact and true motor recruitment
Classic Dysfunctional Voiding
Uroflowmetry

- Standard assessment of pediatric patients with LUTS
- Usually no simultaneous pelvic floor electromyogram (EMG)
- Diagnosis usually based on uroflow pattern alone
## Results

118 of 388 patients (30%): 69 girls (59%), 49 boys (41%)

median age 8 years

<table>
<thead>
<tr>
<th>Flow Type</th>
<th>Count (Percentage)</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Staccato Flow</strong></td>
<td>60 (51%)</td>
<td></td>
</tr>
<tr>
<td>EMG active</td>
<td>20 (33%)</td>
<td>DV</td>
</tr>
<tr>
<td>EMG quiet</td>
<td>40 (67%)</td>
<td>13 IDOD, 16 DUD, 11 PBND</td>
</tr>
<tr>
<td><strong>Intermittent Flow</strong></td>
<td>28 (24%)</td>
<td></td>
</tr>
<tr>
<td>EMG active</td>
<td>13 (46%)</td>
<td>DV</td>
</tr>
<tr>
<td>EMG quiet</td>
<td>15 (54%)</td>
<td>2 IDOD, 1 DUD, 12 PBND</td>
</tr>
<tr>
<td><strong>Mixed</strong></td>
<td>30 (25%)</td>
<td></td>
</tr>
<tr>
<td>EMG active</td>
<td>15 (50%)</td>
<td>DV</td>
</tr>
<tr>
<td>EMG quiet</td>
<td>15 (50%)</td>
<td>4 IDOD, 1 DUD, 10 PBND</td>
</tr>
</tbody>
</table>

118 of 388 patients (30%): 69 girls (59%), 49 boys (41%)

median age 8 years
Conclusions

• Majority of patients with a staccato flow pattern actually had a quiet pelvic floor during voiding which does not support a diagnosis of DV

• Intermittent flow is most commonly associated with DV and PBND, rarely detrusor underactivity

• Had simultaneous EMG not been performed and therapy initiated based on the presumptive diagnoses suggested by flow pattern, the majority might have received unnecessary if not inappropriate therapies

• Uroflow pattern alone can be misleading regarding its underlying pathology

• Performing uroflow with simultaneous EMG is of utmost importance to improve diagnostic accuracy
Not all EMG activity has significance. Note absence of effect of EMG activity on flow rate or detrusor contraction (most likely the effect of urine contact).
Just as a staccato flow pattern is not proof of DV, a relatively normal flow pattern, though less likely, is no guarantee that it is not
Second Objective

Understand how to identify when conditions exist that warrant the addition of medications to the child’s DV therapy, specifically anticholinergics (antimuscarinics) and/or alpha blockers, to treat associated detrusor overactivity (DO) and secondary bladder neck obstruction (2ºBNO) and how to monitor therapeutic response.
Detrusor Overactivity

- Can be identified on uroflow/EMG if DO is present at the time the uroflow study is performed and EMG lag time can be discerned
- We have previously documented that a short lag time (essentially instantaneous flow with PF relaxation) is indicative of UDS proven DO
- The effect of DO on the bladder can be just as damaging as the DV itself
Suggests/consistent with DO
Start of pelvic floor relaxation

Leak

PF Lag Time : 0 sec

Start of voluntary flow

Start of pelvic floor relaxation
Detrusor Overactivity

Start of voluntary flow

Start of PF relaxation

EMG lag time 0sec
Reasons for treating with antimuscarinics

- Significant associated frequency/urgency and wetting
- Significantly diminished capacity
- Documented or suspected elevated storage pressures as evidence by upper tract dilation

- May need to treat concurrently with BF
Study performed 5 hrs after last void and 90 min after start of fluid loading. Urgency reported by the patient (no posturing or wetting noted). Note instantaneous flow with pelvic floor relaxation (PF EMG lag time 0 seconds) and initial max flow spike (both suggestive of DO). Voided volume is only 61% of his ECA of 330ml. On ultrasound bladder wall appears thickened and BN is prominent. The point being that fluid restriction effects frequency, and not all DO results in wetting.
Caveats for treating with antimuscarinics

• Need to aggressively treat any existing constipation and take pre-emptive action for those at risk of developing by dietary changes and consider placing on stool softeners

• Avoid in those with increased PVR and periodically monitor for its development

• Must be paired with timed voiding particularly as capacity improves as DO may continue to occur if the bladder’s limits are exceeded

• Sometimes less is more, as lower doses can be effective with fewer side effects particularly if DO is addressed early
On the other hand not all patients with urgency and a short EMG lag time indicative of DO need medication. Sometimes a good watch is sufficient as the post BF flow study in this 10 yr. old girl illustrates.
Secondary Bladder neck Obstruction (2º BNO)

- First described more than 40 yrs. ago in boys with posterior urethral valve disease

- Obstruction is at the level of the bladder neck as a consequence of muscle hypertrophy that develops in response to infravesical obstruction.

- In DV, obstruction is at the level of the external urethral sphincter (EUS) when there is failure to relax during volitional voiding

- Obstruction also occurs at the level of the EUS during times of detrusor overactivity as the patient attempts to maintain continence
Secondary Bladder neck Obstruction (2º BNO)

- As the detrusor muscle fibers that encircle and comprise the bladder neck become more hypertrophied over time, they impinge on the outlet causing urine flow to decrease and voiding pressures to rise.

- Like any other obstructive model - increased voiding pressures can result in progressive bladder injury and ultimately place the upper tracts at risk.

- If unrecognized and untreated it may play a role in the development of Hinman syndrome.
Secondary Bladder neck Obstruction (2º BNO)

• It should be suspected in patients with marked bladder wall thickening, depressed uroflow rates despite a quiet EMG and elevated PVRs, particularly if not improving on current therapy and when there is persistent or new onset upper tract dilation.

• 2º BNO occurs in 8-10% of patients with either DV or IDOD.

• 2º BNO, although a distinct entity from primary bladder neck dysfunction, it too responds well to alpha blocker therapy, is well tolerated and unlike PBND, it is far less likely to require lifelong therapy in our experience.
Uroflow/EMG in a 12 yr. old boy with persistent urgency and nighttime wetting despite being on 20mg oxybutynin ER; Post void bladder ultrasound, PVR 85ml, note bladder wall thickening and prominent BN.
Video UDS image during voiding phase in same patient, note pinched appearance at bladder neck – urethral junction.
2º BNO pre and on alpha blocker therapy

Note that both show evidence of DO (short EMG lag time ≤1sec) consistent with patient’s c/o urgency and wetting

Note also the on Tx study showing improved flow but an even lower functional capacity as outlet resistance is decreased
Repeat Uroflow/EMG study on alpha block therapy after the addition oxybutynin therapy shows return of bladder capacity to pre Tx state and is in agreement with patient’s reported improvement in control and less frequency
Feeling “improved” does not always equal being improved
Need to identify what drives symptoms, sometimes it's not just abnormal behavior
Few Final Thoughts

• LUTS improvement should be paired with objective measures of improvement (i.e. voiding/wetting diary; uroflow/EMG; ultrasound; urodynamics) - Particularly in more severe cases

• Look for residual DO and/or 2ºBNO in children who are not improving or whose clinical picture is worsening despite receiving appropriate therapy for their primary LUT condition

• Understand that the treatment of LUTD often requires multimodal therapy and that the sequela of LUTD (esp. DV) can take considerable time to resolve
Perspective influences interpretation and response – Hopefully I have influenced yours
Thank You