Patient characteristics at initial visit: Does it predict treatment outcome?

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ICCS Secretary General

Disclosures

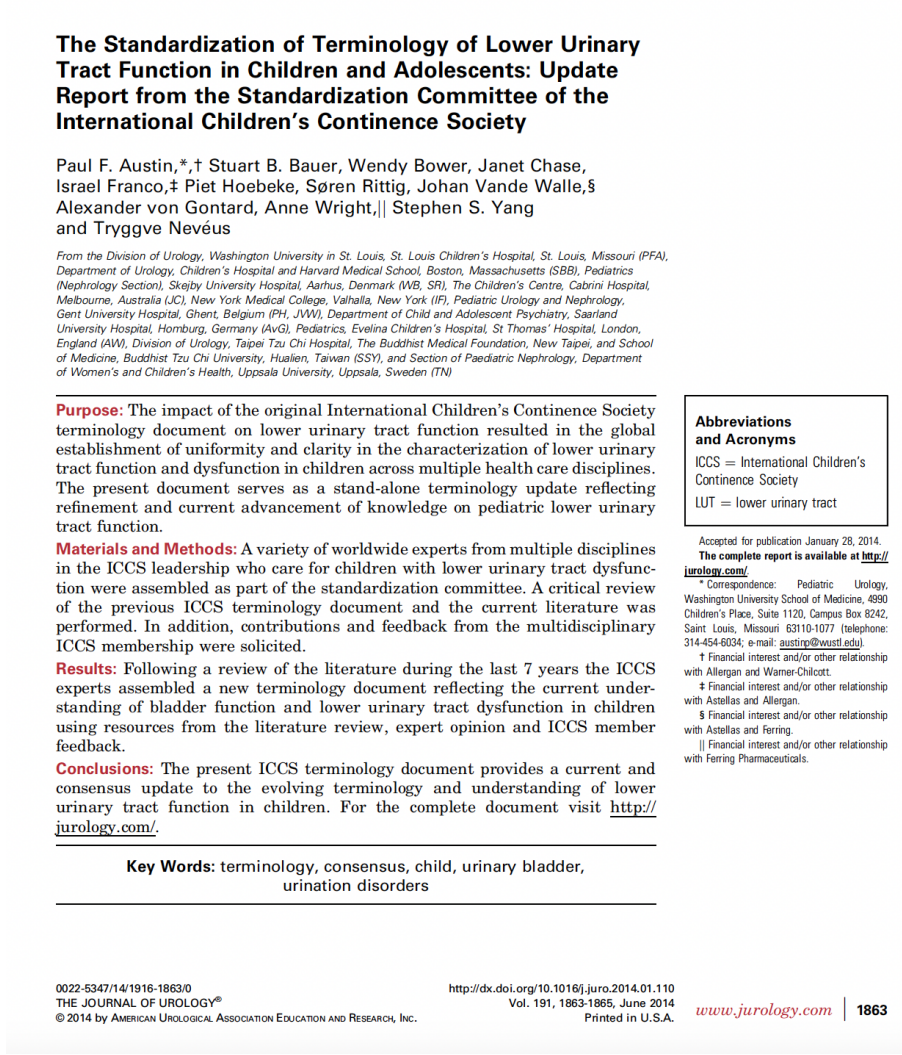
- We have no relevant financial relationships with the manufacturer(s) of commercial services discussed in this presentation
- We do not intent to discuss an unapproved/investigative use of a commercial product/device in my presentation

Outline

- Initial signs and symptoms: Do they offer hints?
- Three pitfalls not to miss
- Uroflow curves: How reliable are they?
- Non-invasive imaging: When to consider renal/bladder ultrasound
- Invasive urodynamics: Can we predict who will benefit?
- Future: AI? Urine biomarkers?

ICCS Standardization of Terminology

- First published in 1998
(Norgaard et al, Br J Urol)
- Updated in 2006
(Neveus et al, J Urol)
- Third edition in 2014
(Austin et al, J Urol)



The Standardization of Terminology of Lower Urinary Tract Function in Children and Adolescents: Update Report from the Standardization Committee of the International Children's Continence Society

Paul F. Austin,*,† Stuart B. Bauer, Wendy Bower, Janet Chase, Israel Franco,‡ Piet Hoebeke, Søren Rittig, Johan Vande Walle,§ Alexander von Gontard, Anne Wright,|| Stephen S. Yang and Tryggve Nevéus

From the Division of Urology, Washington University in St. Louis, St. Louis Children's Hospital, St. Louis, Missouri (PFA), Department of Urology, Children's Hospital and Harvard Medical School, Boston, Massachusetts (SBB), Pediatrics (Nephrology Section), Skejby University Hospital, Aarhus, Denmark (WB, SR), The Children's Centre, Cabrini Hospital, Melbourne, Australia (JC), New York Medical College, Valhalla, New York (IF), Pediatric Urology and Nephrology, Gent University Hospital, Ghent, Belgium (PH, JVW), Department of Child and Adolescent Psychiatry, Saarland University Hospital, Homburg, Germany (AvG), Pediatrics, Evelina Children's Hospital, St Thomas' Hospital, London, England (AW), Division of Urology, Taipei Tzu Chi Hospital, The Buddhist Medical Foundation, New Taipei, and School of Medicine, Buddhist Tzu Chi University, Hualien, Taiwan (SSY), and Section of Paediatric Nephrology, Department of Women's and Children's Health, Uppsala University, Uppsala, Sweden (TN)

Purpose: The impact of the original International Children's Continence Society terminology document on lower urinary tract function resulted in the global establishment of uniformity and clarity in the characterization of lower urinary tract function and dysfunction in children across multiple health care disciplines. The present document serves as a stand-alone terminology update reflecting refinement and current advancement of knowledge on pediatric lower urinary tract function.

Materials and Methods: A variety of worldwide experts from multiple disciplines in the ICCS leadership who care for children with lower urinary tract dysfunction were assembled as part of the standardization committee. A critical review of the previous ICCS terminology document and the current literature was performed. In addition, contributions and feedback from the multidisciplinary ICCS membership were solicited.

Results: Following a review of the literature during the last 7 years the ICCS experts assembled a new terminology document reflecting the current understanding of bladder function and lower urinary tract dysfunction in children using resources from the literature review, expert opinion and ICCS member feedback.

Conclusions: The present ICCS terminology document provides a current and consensus update to the evolving terminology and understanding of lower urinary tract function in children. For the complete document visit http://jurology.com/.

Key Words: terminology, consensus, child, urinary bladder, urination disorders

Abbreviations and Acronyms

ICCS = International Children's Continence Society

LUT = lower urinary tract

Accepted for publication January 28, 2014.

The complete report is available at http://jurology.com/

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† Financial interest and/or other relationship with Allergan and Warner-Chilcott.

‡ Financial interest and/or other relationship with Astellas and Allergan.

§ Financial interest and/or other relationship with Astellas and Ferring.

|| Financial interest and/or other relationship with Ferring Pharmaceuticals.

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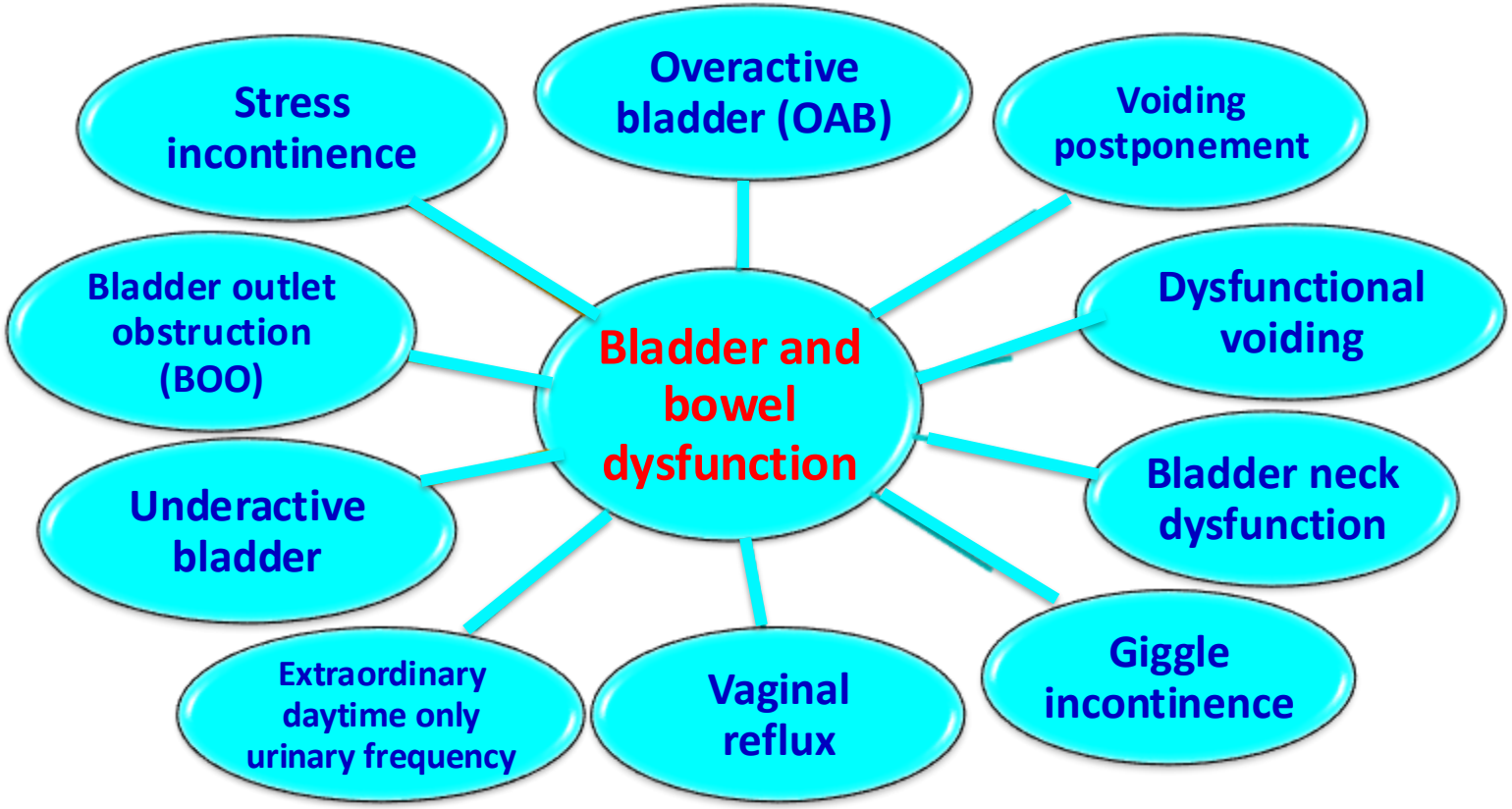
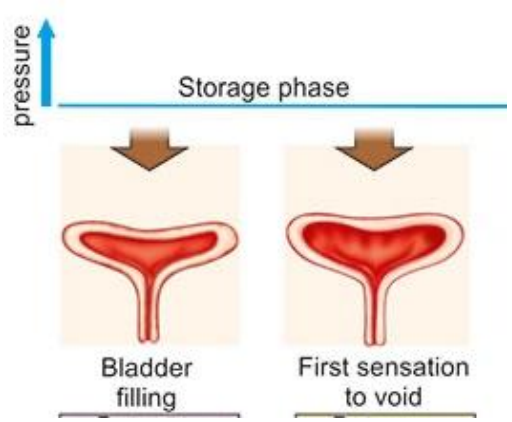
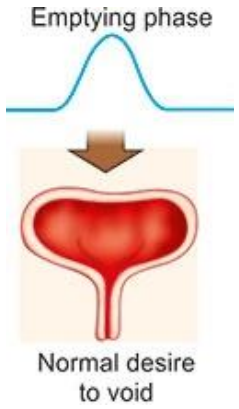
ICCS Recognized LUT Daytime Conditions

(Austin et al, Jurol 2014)



ICCS Recognized Symptoms of LUT Dysfunction (2014)





- **Storage symptoms**
  - Increased or decreased voiding frequency
  - Incontinence
    - Daytime
    - Nighttime (enuresis)
  - Urgency
  - Nocturia

- **Voiding symptoms**
  - Dysuria
  - Straining
  - Intermittency
  - Hesitancy
  - Weak stream

- **Other symptoms:**
  - Holding maneuvers
  - Feeling of incomplete emptying
  - Urinary retention
  - Post-micturition dribbling
  - Spraying/splitting of stream

(figures from Shweta and Swadhin Manual on Urogynecology)

Simplifying the Diagnosis of 4 Common Voiding Conditions Using Uroflow/Electromyography, Electromyography Lag Time and Voiding History

Jason P. Van Batavia, Andrew J. Combs, Grace Hyun, Agnes Bayer, Daisy Medina-Kreppein, Richard N. Schlussel and Kenneth I. Glassberg*

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

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DOI:10.1016/j.juro.2011.04.020

- **Objectives:**
  - To determine the prevalence rates of the different voiding conditions in children presenting with LUTS at a single institution
  - Investigate what additional information was gained by the addition of EMG recordings to uroflow studies
- **Methods:**
  - Review of 100 consecutive children presenting with LUTS
  - All underwent uroflow/EMG at initial visit
  - Diagnosis based on clinical history (LUTS, voiding diary), physical exam, and with support of uroflow/EMG results

Results

Table 1. *Prevalence of NNVD conditions in 100 children and adolescents at a single referral institution and their associated presenting symptoms*

	Dysfunctional Voiding	Overactive bladder (OAB)		Voiding Postponement	Bladder Neck Dysfunction
	No. DV (%)	No. IDOD-A (%)	No. IDOD-B (%)	No. DUD (%)	No. PBND (%)
Overall	20	47	16	7	10
No. gender (% gender):					
M	2 (4)	25 (50)	12 (24)	2 (4)	9 (18)
F	18 (36)	22 (44)	4 (8)	5 (10)	1 (2)
Common LUTS:					
Frequency	5 (25)	33 (70)	15 (94)	2 (29)	8 (80)
Urgency	7 (35)	41 (87)	16 (100)	1 (14)	7 (70)
Daytime incontinence	14 (70)	40 (85)	11 (69)	0	6 (60)
Hesitancy	0	1 (2)	2 (13)	2 (29)	9 (90)
Encopresis	6 (30)	12 (26)	3 (19)	0	0
Constipation	2 (10)	12 (26)	3 (19)	0	2 (20)

Constipation also more common in Dysfunctional Voiding (DV) and Voiding Postponement (DUD)

Table 1. *Bowel dysfunction at initial presentation based on LUT condition*

Diagnosis	No. Pts	No. Constipation (%)	No. Encopresis (%)	No. Constipation + Encopresis (%)
DV	72	28 (39)*,†	4 (6)	3 (4)
IDOD	219	32 (15)*	17 (8)	21 (10)‡
DUD	35	7 (20)	0 (0)	1 (3)
PBND	42	7 (17)†	1 (2)	0 (0)‡
Totals/av	368	74 (20)	22 (6)	25 (7)

Overactive bladder

Voiding Postponement

Combs et al. J Urol 2013

- 48% of children with constipation also had history of UTI

Encopresis + Constipation more common in OAB

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Overactive bladder

Voiding Postponement

(Combs et al. J Urol 2013)

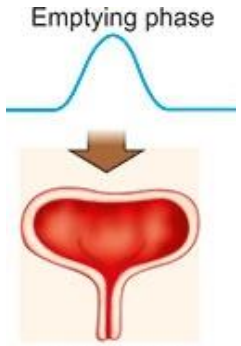
- 48% of children with constipation also had history of UTI

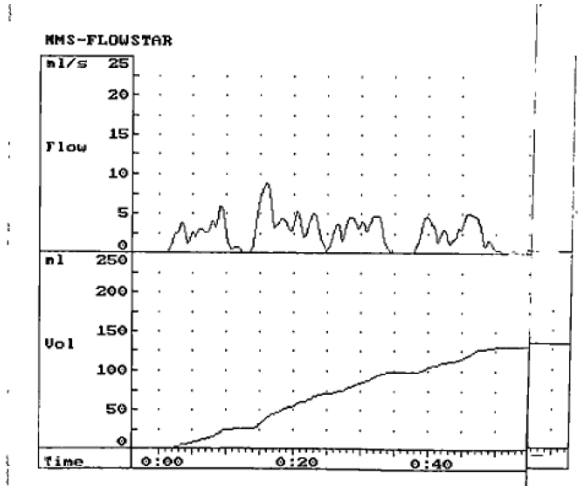
Table 1. *UTI history in 623 children by gender and LUT condition*

LUT Condition	No. Pts	No. UTI History (%)		
		Afebrile	Febrile	Totals
Female:	366	112 (31)	82 (22)	194 (53)
DV	85	27 (32)	22 (26)	49 (58)
PBND	9	1 (11)	1 (11)	2 (22)
Overactive bladder IDOD	195	53 (28)	38 (19)	91 (47)
Voiding Postponement DUD	77	31 (41)	21 (27)	52 (68)
Male:	257	7 (3)	6 (2)	13 (5)
DV	4	0	0	0
PBND	46	1 (2)	0	1 (2)
Overactive bladder IDOD	183	4 (2)	4 (2)	8 (4)
Voiding Postponement DUD	24	2 (8)	2 (8)	4 (17)

(Van Batavia et al. J Urol 2013)

ICCS Recognized Voiding Symptoms (2014)

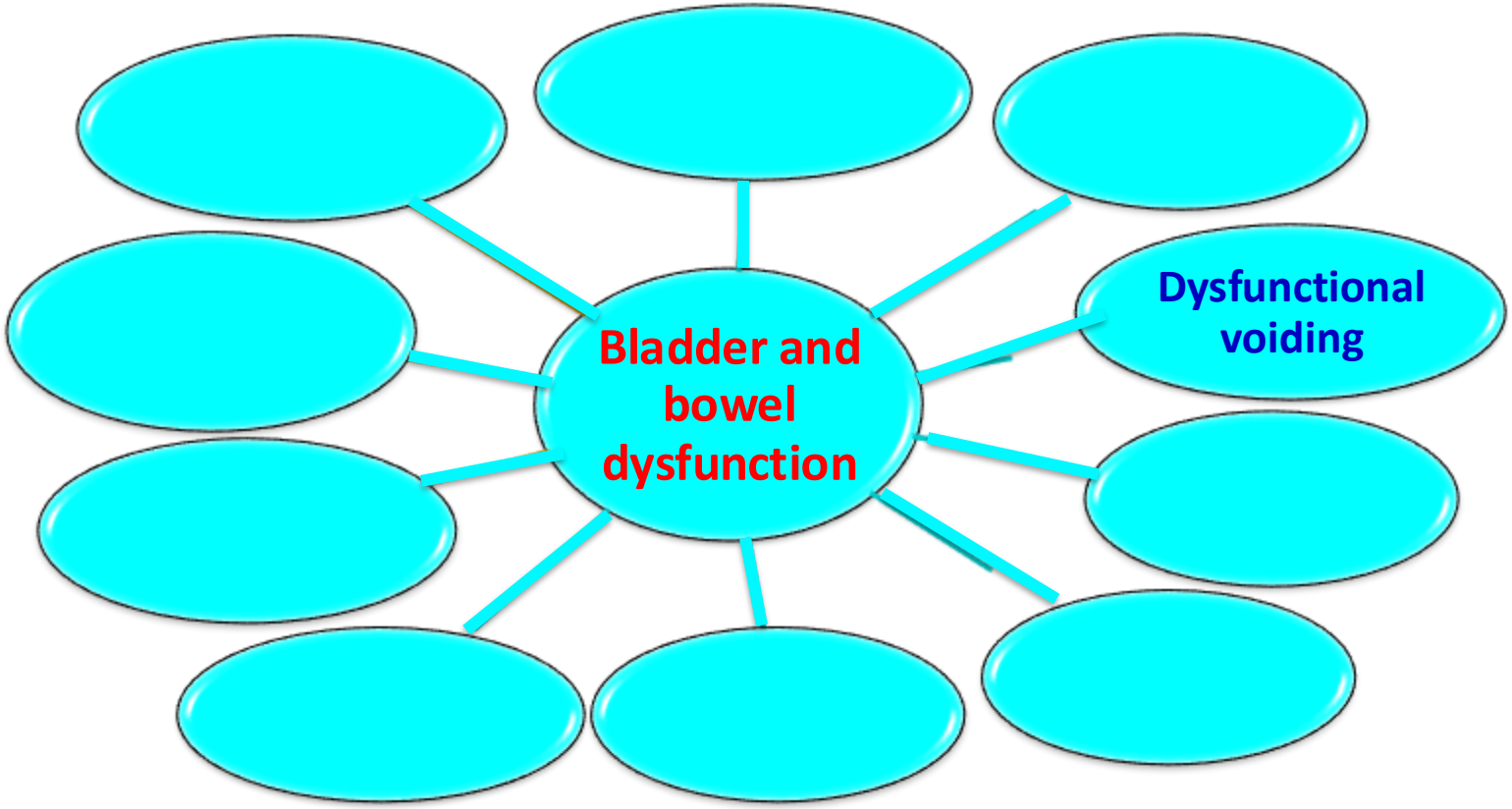




- **Voiding symptoms**
  - Dysuria = burning or discomfort during micturition
    - Start of void – urethral source
    - End of void – bladder source
  - Intermittency
    - Micturition in several discrete stops and starts; not continuous
    - Can suggest: dysfunctional voiding or Valsalva voiding

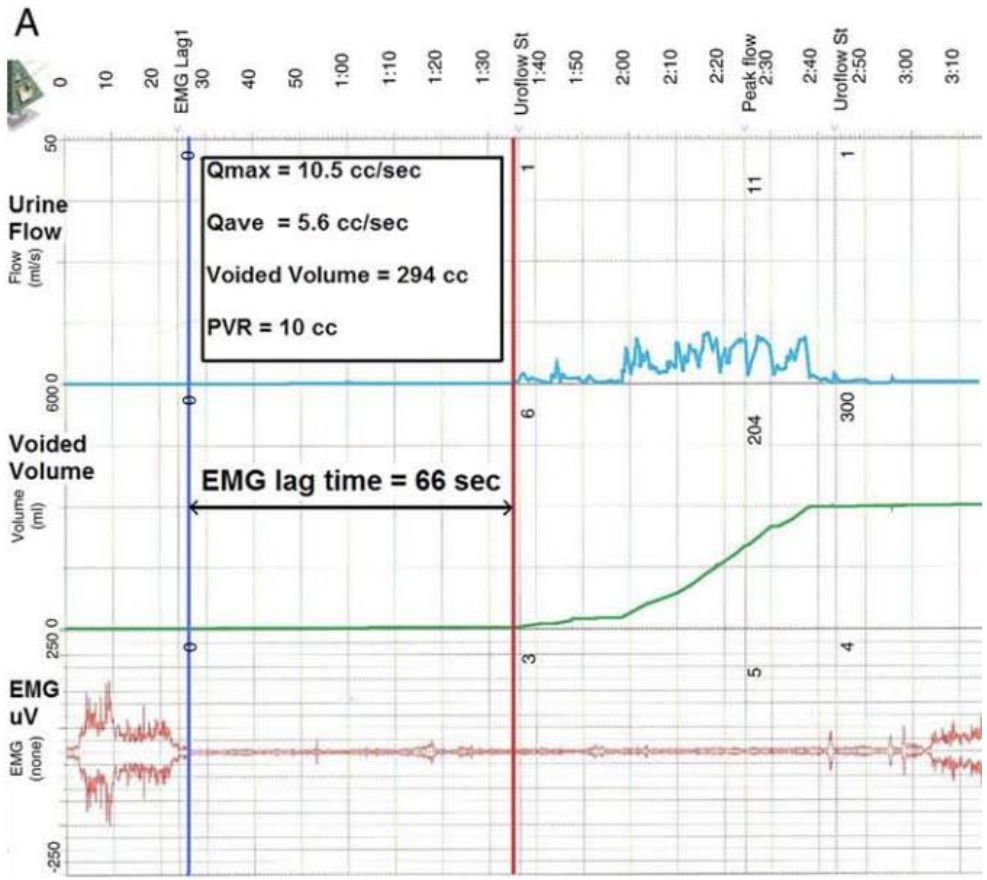
ICCS Recognized LUT Daytime Conditions

(Austin et al, Jurol 2014)



Habitual contraction of urethral sphincter and pelvic floor during voiding; uroflow pattern is often staccato or interrupted with increased EMG activity

ICCS Recognized Voiding Symptoms (2014)



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    - Micturition in several discrete stops and starts; not continuous
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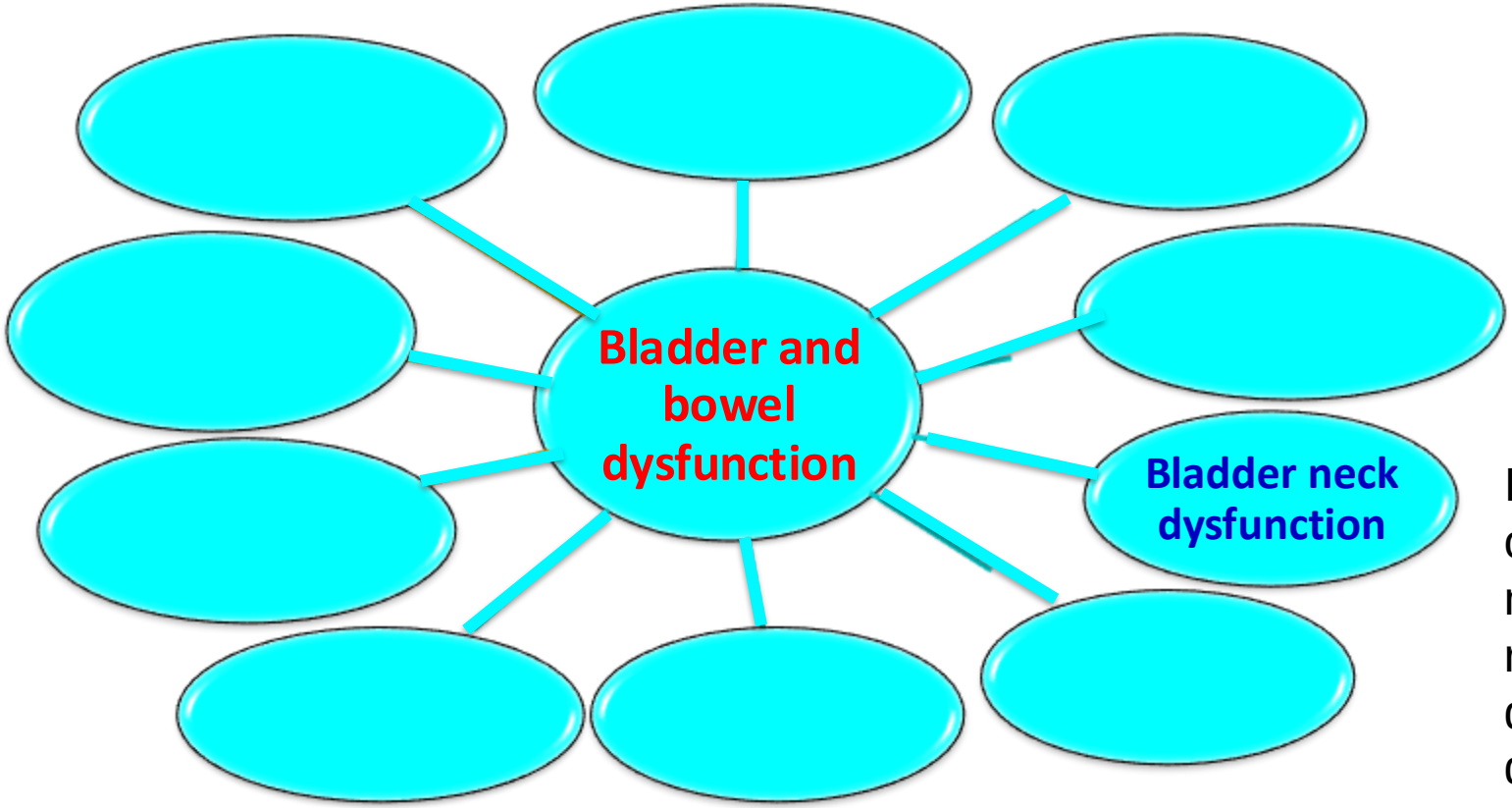
  - Hesitancy
    - Difficulty initiating voiding despite being ready to void
    - Can suggest: bladder neck dysfunction

ICCS Recognized LUT Daytime Conditions
(Austin et al, Jurol 2014)



Impaired or delayed opening of bladder neck results in reduced urinary flow despite adequate detrusor contraction

Results

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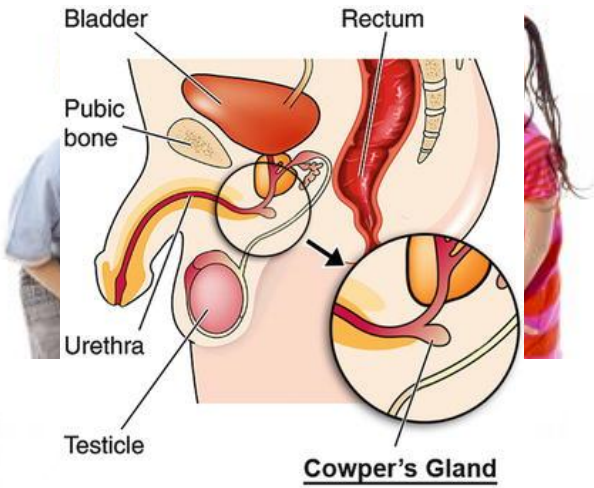
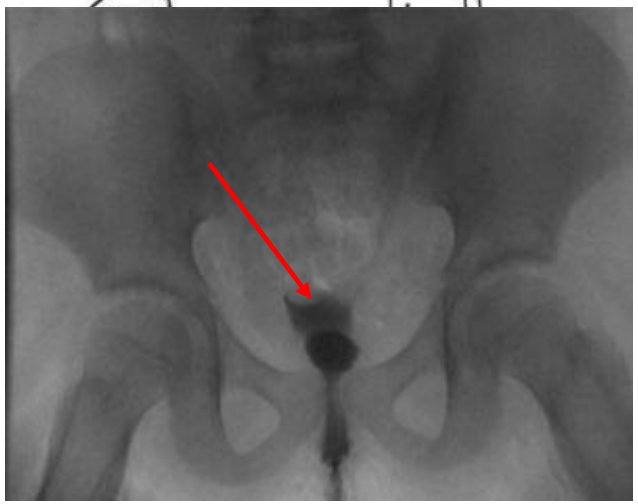
Constipation	2 (10)	12 (26)	3 (19)	0	2 (20)

ICCS Recognized other symptoms (2014)

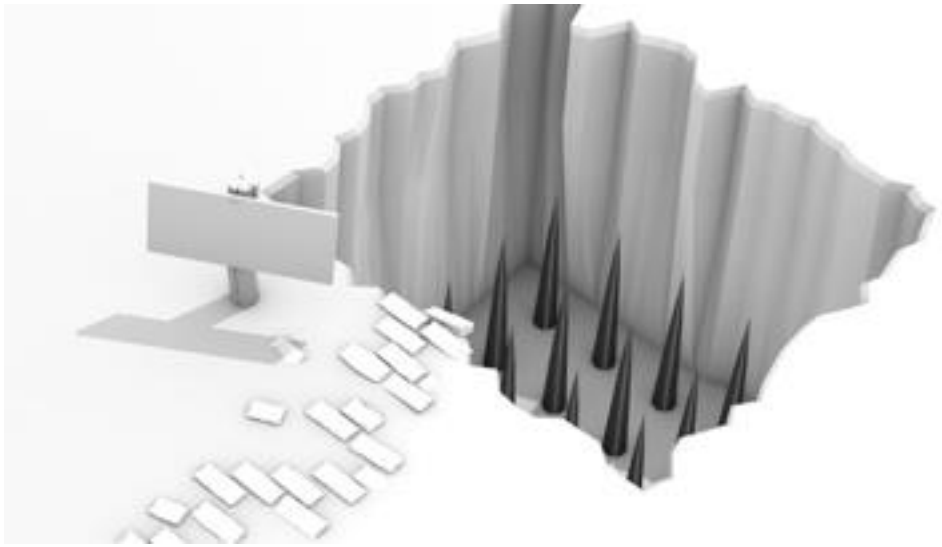
- **Other symptoms:**
  - Post-micturition dribbling
    - Involuntary leakage of urine immediately after finishing void
    - Male = syringocele (Cowper's duct)
    - Female = vaginal voiding
  - Spraying/splitting of stream
    - Consider mechanical obstruction at or below meatus (ie, meatal stenosis)



(https://abdominalkey.com/urethral-syringocele/)


(from Ibieta et al, An Pediatr (Barc) 2015/)

Insert picture of flow from meatal stenosis before and after

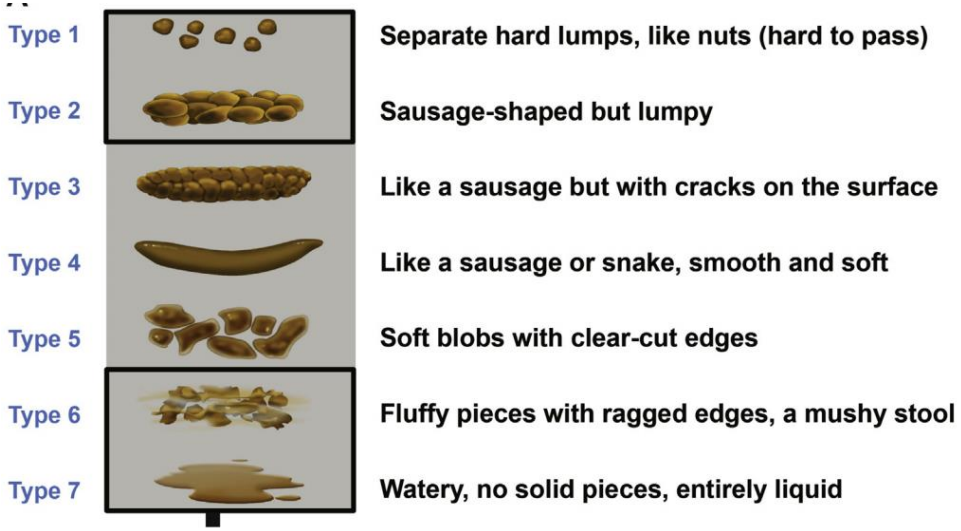


IMPORTANT PITFALLS TO AVOID (3)

BOWEL: THE SECOND PART OF BBD

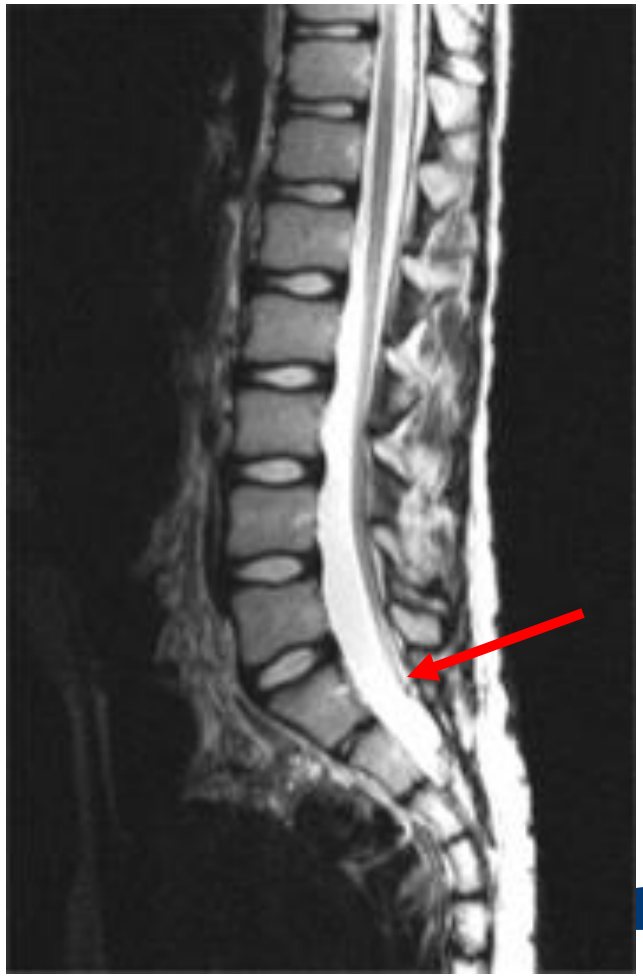
- The coexistence of constipation and bowel dysfunction with LUT dysfunction well documented
- Association between bowel dysfunction and UTIs (especially recurrent UTIs) also well supported in literature

- **<u>Clinical history questions</u>**:
  - How many BMs per week?
  - Use Bristol Stool Chart
  - Do BMs ever clog toilet?
- Physical examination:
  - Stool burden in LLQ



RULE OUT NEUROGENIC CAUSES

- Consider neurogenic bladder
  - Spina bifida, spinal cord injury, tethered cord, cerebral palsy, transverse myelitis, multiple sclerosis (usually older age)
- Sensory issues or muscle weakness?
- Every exam -> look at back and sacrum
- **CONSIDER:**
  - MRI of spine
  - Urodynamic studies



ARE THERE ANY SIGNS OR CONCERNS FOR SEXUAL ABUSE?

- Assess social situation
- Recurrent UTIs and/or LUT dysfunction may be sign of underlying abuse
- Make the call or get assistance if concerned

Comorbidities to consider

- Constipation and fecal incontinence
- Urinary tract infection
- “Asymptomatic” bacteriuria
- Vesicoureteral reflux
- Neuropsychiatric conditions (ADHD, oppositional defiant disorder, etc)
- Intellectual disabilities
- Disorders of sleep
- Obesity

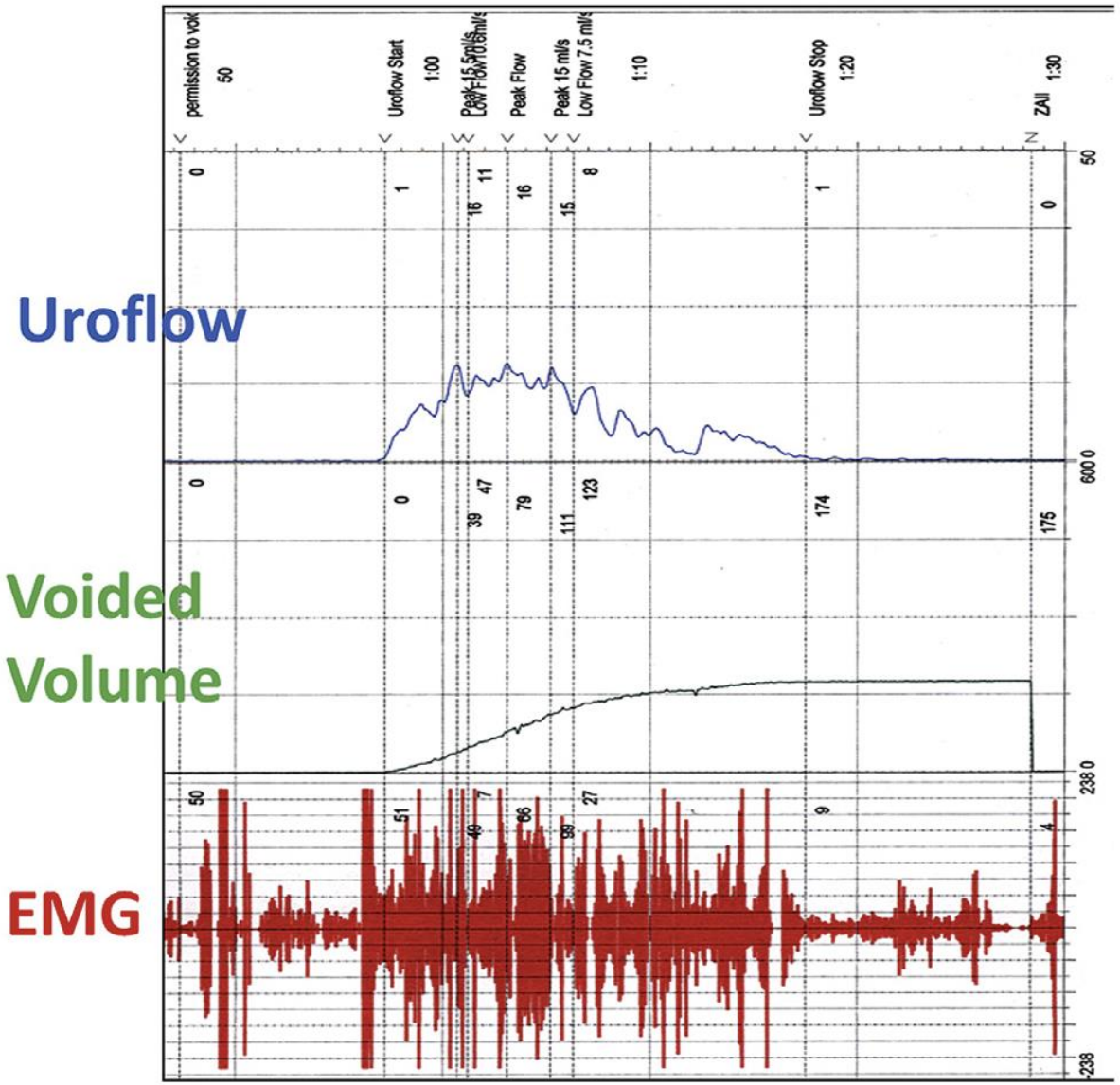
Patient Characteristics at Initial Evaluation

- Initial signs and symptoms: Do they offer hints?
- Three pitfalls not to miss
- Uroflow curves: How reliable are they?
- Non-invasive imaging: When to consider renal/bladder ultrasound
- Invasive urodynamics: Can we predict who will benefit?
- Future: AI? Urine biomarkers?

Why should you include EMG with uroflow?

- Provides additional value that can support or contradict the diagnosis of specific LUT condition:
  - 1) Activity of pelvic floor/sphincter during void
    - Differentiate fractionated uroflow (staccato or interrupted) secondary to active external urethral sphincter or abdominal straining
  - 2) Calculation of EMG lag time
    - Normal 2-6 seconds
    - Prolonged EMG lag time >6 seconds
      - Think: primary bladder neck dysfunction
    - Shortened EMG lag time <2 seconds
      - Think: detrusor overactivity (overactive bladder)

Fractionated uroflow curve with active EMG



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

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- **Methods:** 388 consecutive children with non-neurogenic LUTD
  - Identified those with uroflow curves of staccato, interrupted or mixed
  - Correlated with LUT condition diagnosis
- **Results**: 118 children met inclusion criteria
  - 51% had staccato flow
  - 24% had interrupted flow
  - 25% had mixed flow pattern

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From the Division of Pediatric Urology, Morgan Stanley Children's Hospital of New York and Department of Urology, Columbia University, College of Physicia

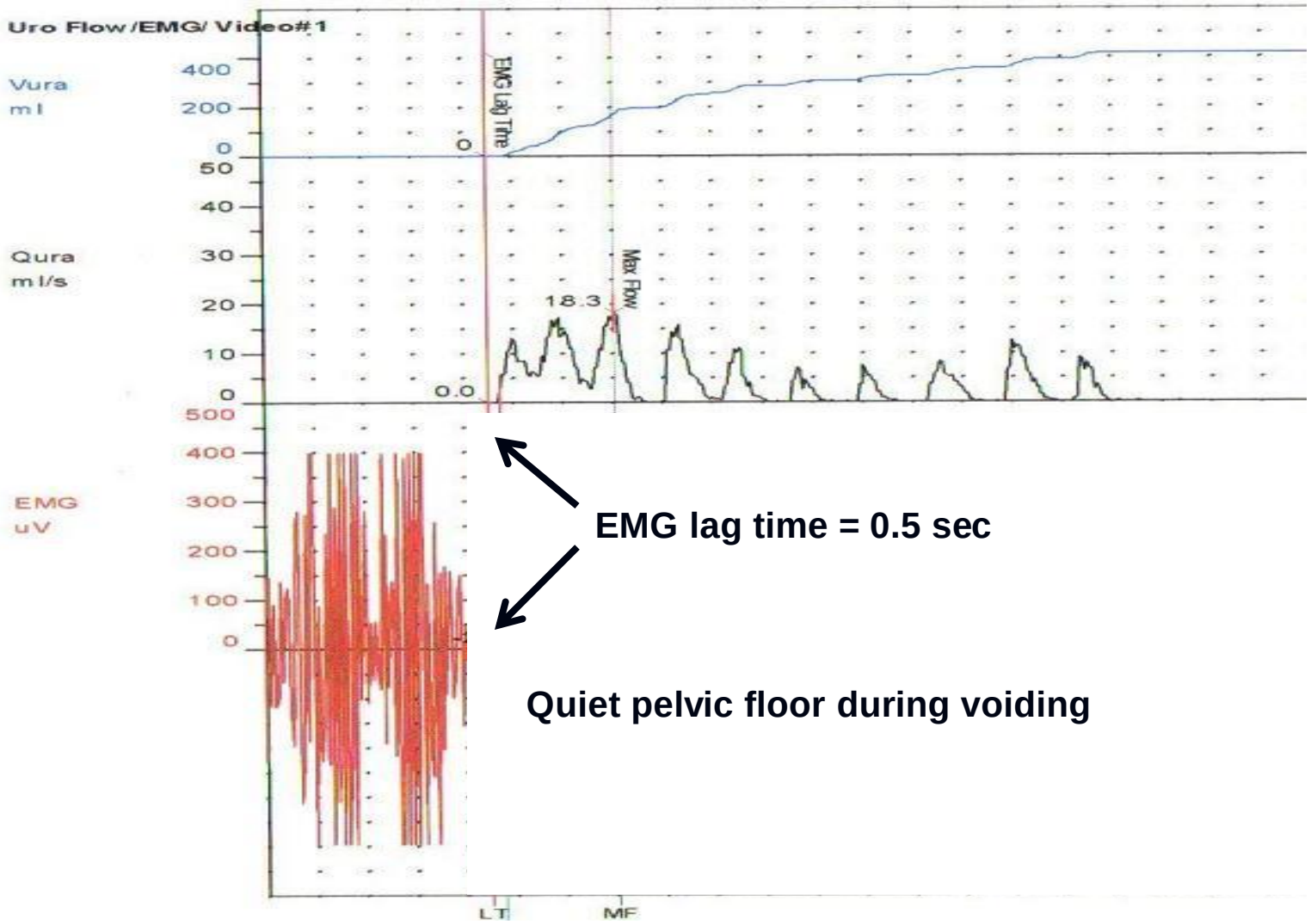
Table 2. *Uroflow/EMG studies in patients stratified by uroflow and final diagnosis*

Diagnosis	No. Staccato (%)	No. Interrupted (%)	No. Mixed (%)
Dysfunctional voiding	20 (41.6)	13 (27.1)	15 (31.3)
Idiopathic detrusor overactivity disorder	13 (5.6)	2 (0.9)	4 (1.7)
Detrusor underutilization disorder	16 (34.0)	1 (2.1)	1 (2.1)
Primary bladder neck dysfunction	11 (18.6)	12 (22.3)	10 (17.0)

Only 33.3% of staccato uroflow curves associated with active pelvic floor EMG during voiding!

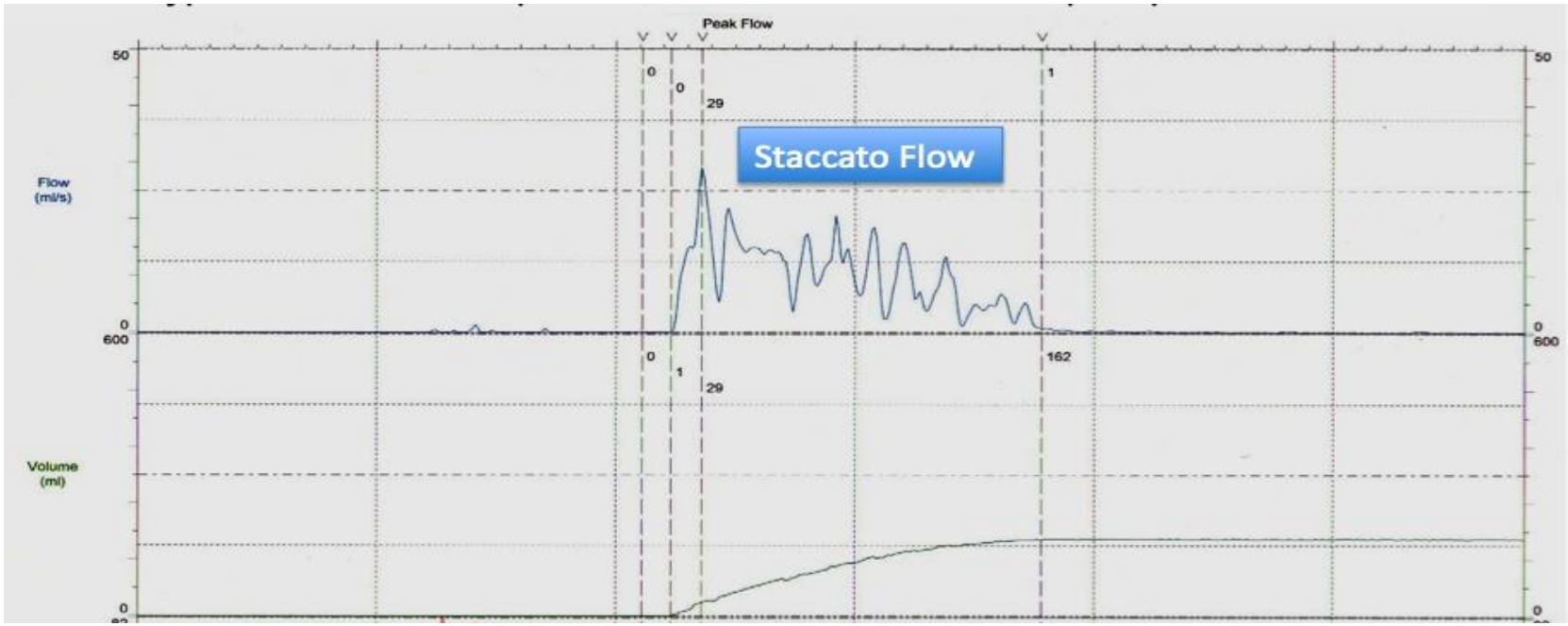
- **Conclusions:**
  - Reliance on uroflow pattern along without simultaneous EMG can be misleading

Interrupted uroflow pattern



EMG lag time = 0.5 sec

Quiet pelvic floor during voiding


Peak Flow
Staccato Flow
Flow (ml/s)
Volume (ml)
50
0
600
0
0
29
1
162
0
1
29

Journal of Pediatric Urology (2014) 10, 250—254

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Analysis of uroflow patterns in children with dysfunctional voiding

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

- 121 children with dysfunctional voiding diagnosed by active EMG during uroflow
- Reviewed uroflow pattern

Journal of Pediatric Urology (2014) 10, 250–254

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Journal of Pediatric urology

Analysis of uroflow patterns in children with dysfunctional voiding

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

Table 1 Patient characteristics, flow patterns, and associated symptoms before initiation of treatment in children diagnosed with dysfunctional voiding.

Variable		*n*	%
Sex	Female	116	97
	Male	5	3
Median age	Total (years/range)	6.5	(2.8–19.0)
	Female (years/range)	6.5	(2.8–19.0)
	Male (years/range)	6.7	(6.0–7.4)
Uroflow pattern	Staccato	70	58
	Interrupted/fractionated	22	19
	Mixed	12	10
	Normal	17	14

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- **Conclusions:**
  - 42% of children with DV have uroflow curve that is not staccato
  - 14% of children with DV had normal bell-shaped curve
  - Simultaneous pelvic floor EMG during uroflow is essential when ruling in or out DV

Ideas

- Tower flow curve and predicting OAB, outcomes when have tower flow from presentation
- Staccato flow and DV?
- Higher DVISS score and more visits for obtaining VUDS
- Specific symptoms and association with conditions -> use 100 diagnoses
- Any AI algorithms for predicting response to antimuscarinics? Maybe only in adults
- Obtaining RBUS for non-neurogenic LUTDu

Patient Characteristics at Initial Evaluation

- Initial signs and symptoms: Do they offer hints?
- Three pitfalls not to miss
- Uroflow curves: How reliable are they?
- Non-invasive imaging: When to consider renal/bladder ultrasound
- Invasive urodynamics: Can we predict who will benefit?
- Future: AI? Urine biomarkers?

Journal of Pediatric Urology (2023) 19, 542.e1–542.e7

Who needs an ultrasound? Using patient symptom questionnaire & UTI history to determine when to obtain an RBUS in children with non-neurogenic lower urinary tract dysfunction

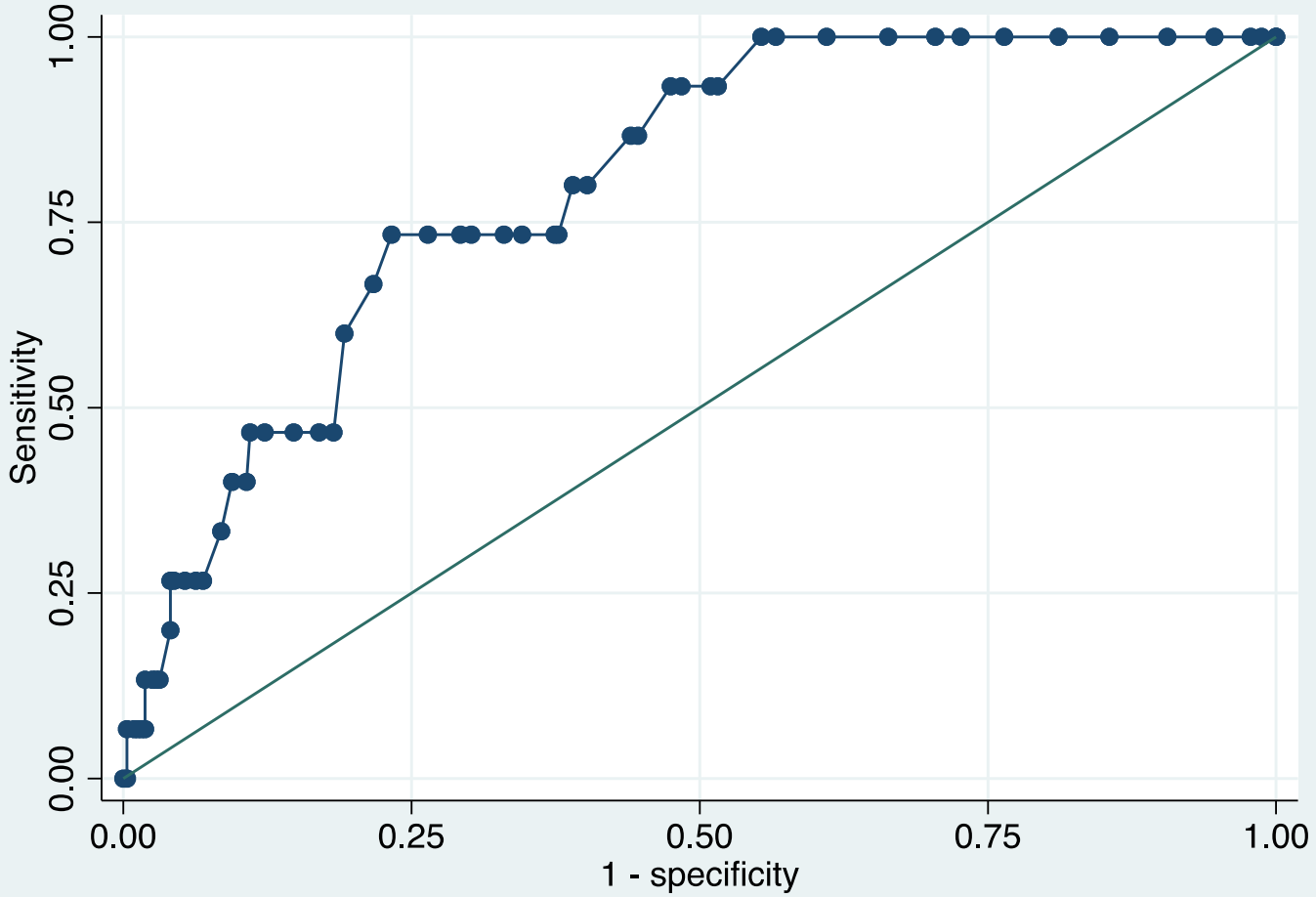
Katherine M. Fischer *, Ethan Samet, Adriana Messina, Amanda Berry, Stephen A. Zderic, Jason P. Van Batavia

- Identified new outpatients with LUTD seen over 1.5 year period who had RBUS as part of work up
- RBUS results categorized as:
  - 1) clinically significant abnormalities
  - 2) normal ultrasounds & insignificant findings
- Matched RBUS results to individual patient characteristics, including DVISS score & UTI history
- Excluded patients with neurogenic bladder or known GU abnormalities (PUV, VUR, hydronephrosis)

Patient Characteristics

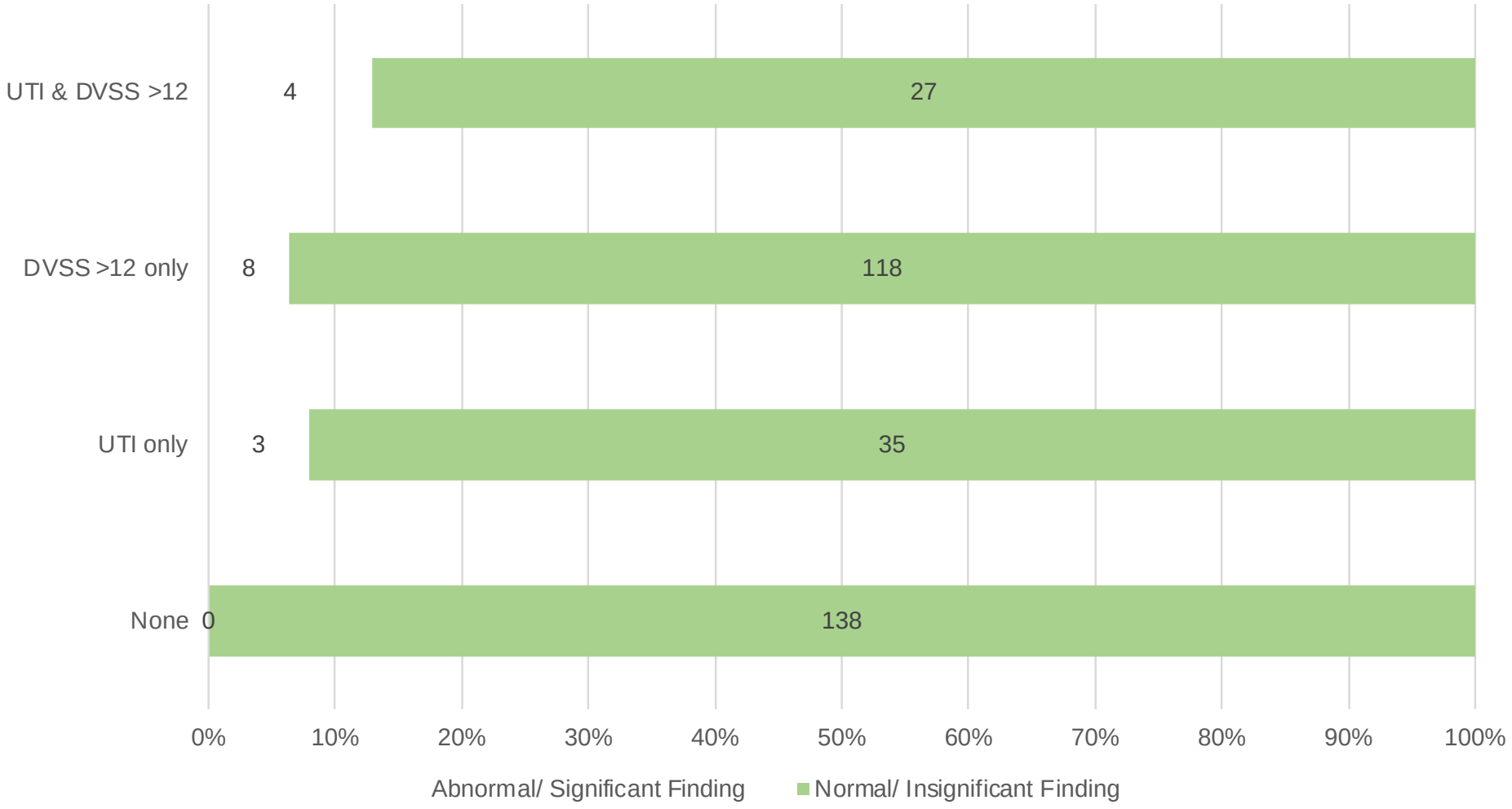
	Normal RBUS (n=318)	Abnormal RBUS (n=15)	p-value
Age (yrs), median	9 (7, 12)	8 (5, 14)	0.41
Race			0.65
Asian	5 (1.6%)	0 (0.0%)	
Black	50 (15.7%)	4 (26.7%)	
Indian	1 (0.3%)	0 (0.0%)	
Other	61 (19.2%)	3 (20.0%)	
Pacific Islander	1 (0.3%)	0 (0.0%)	
Unknown	2 (0.6%)	0 (0.0%)	
White	198 (62.3%)	8 (53.3%)	
Female	178 (56.0%)	11 (73.3%)	0.29
Positive UTI History	62 (19.5%)	7 (46.7%)	**0.019**
DVISS Score, median	11 (6, 17)	17 (13, 25)	**0.002**

Results



- History of UTI & DVISS score were associated with abnormal RBUS on univariate and multivariate analysis
  - Race & gender were not

Results



- DVISS score of 12 was found to be optimal cutoff (80% sensitivity, 57% specificity, AUC=0.68)

Risk Factors	Normal or Insignificant Finding	Abnormal & Significant Finding
None	138 (100%)	0
UTI only	35 (92.1%)	3 (7.9%)
DVSS ≥12 only	118 (93.7%)	8 (6.3%)
UTI & DVSS ≥12	27 (87.1%)	4 (12.9%)

Conclusions

- DVISS score≥12 and UTI history are useful in determining when to obtain an RBUS in the initial evaluation of children with LUTD
- RBUS should rarely be obtained for non-neurogenic LUTD patients without UTI history whose DVISS scores are below 12

Patient Characteristics at Initial Evaluation

- Initial signs and symptoms: Do they offer hints?
- Three pitfalls not to miss
- Uroflow curves: How reliable are they?
- Non-invasive imaging: When to consider renal/bladder ultrasound
- Invasive urodynamics: Can we predict who will benefit?
- Future: AI? Urine biomarkers?

Low yield of ubiquitous use of UDS

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THE USE OF RADIOGRAPHY, URODYNAMIC STUDIES AND CYSTOSCOPY IN THE EVALUATION OF VOIDING DYSFUNCTION

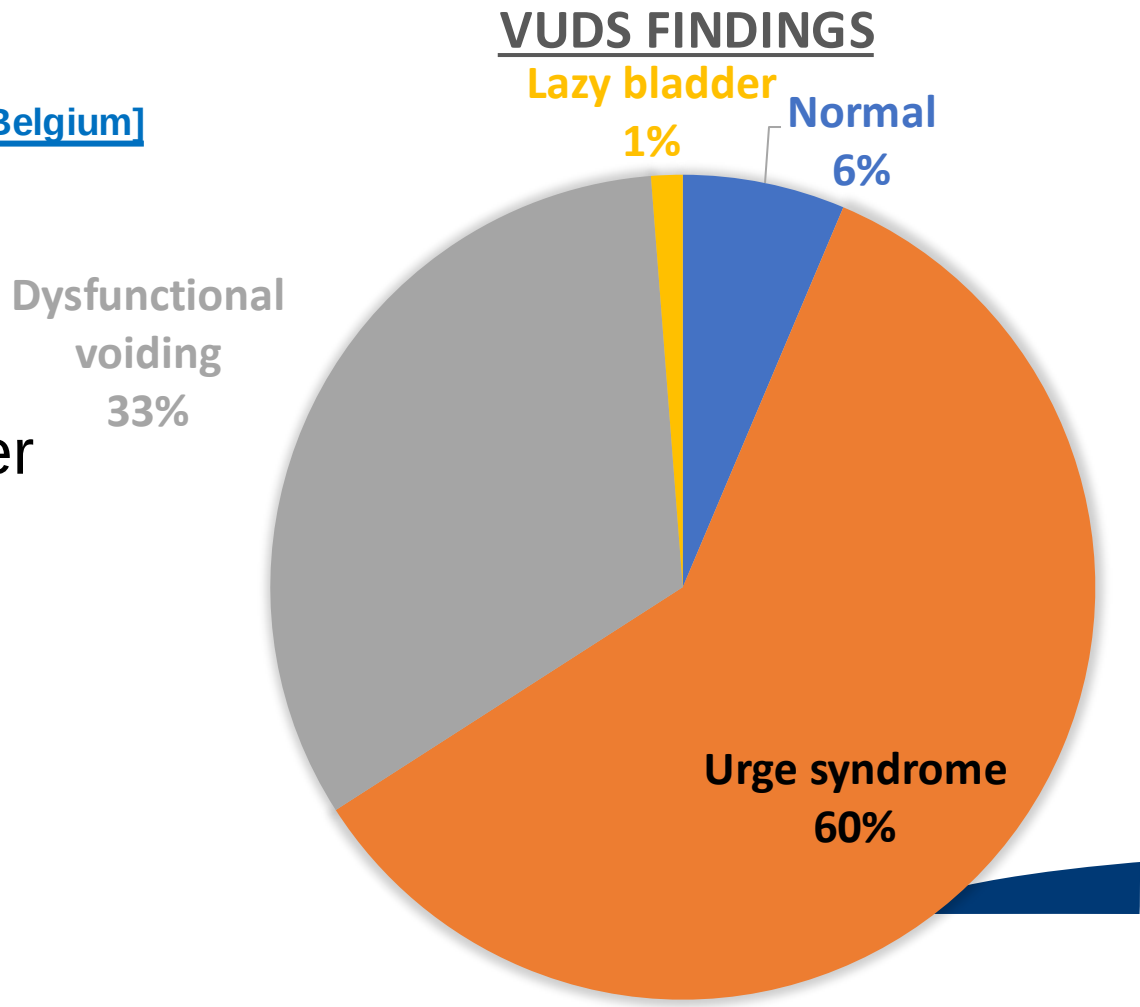
DIPEN J. PAREKH, JOHN C. POPE, IV, MARK C. ADAMS AND JOHN W. BROCK, III

From the Division of Pediatric Urology, Vanderbilt University Medical Center, Nashville, Tennessee

Conclusions: The incidence of upper tract changes and positive anatomical findings in children with voiding dysfunction is too low to justify routine radiological evaluation and cystoscopy. However, in those who present with a nonfebrile urinary tract infection there remains an important role for voiding cystourethrography. We do not recommend routine urodynamics in children with voiding disorder because this study does not change therapy or influence the final outcome. Thorough history and physical examination lead to the correct diagnosis and treatment in the majority of children. A focus on correcting faulty voiding behavior with the judicious administration of antibiotics and anticholinergic therapy leads to a favorable outcome in most cases.

Selective use of UDS for non-neurogenic pediatric LUT dysfunction

- **Hoebeke P et al BJU International 2001** [Ghent, Belgium]
  - 1000 children with “non-neurogenic bladder sphincter dysfunction” underwent videourodynamics (VUDS)
  - Selection criteria = history of UTI, small bladder capacity, dysfunctional uroflow, ultrasound abnormality, or resistance to therapy
  - Risk of UTI higher in girls and those with lazy bladder
  - VUR found in 15% of each group



Journal of Pediatric Urology (2025) 21, 276–282

Can Videourodynamics shape management in refractory pediatric lower urinary tract dysfunction?

Jason P. Van Batavia *, Katherine Fischer, Monica Moran, Joy Kerr, Adriana Messina, Keely McClatchy, Amanda Berry, Dana Weiss, Christopher Long, Stephen A. Zderic

- Retrospectively reviewed all VUDS performed rom 2015 to 2022
- 110 pediatric patients underwent VUDS for non-neurogenic LUTD
- Excluded patients with known neurologic or anatomic lesions and/or developmental delay

Methods

- 9,907 new non-neurogenic LUT dysfunction patients seen during this time in our clinics
- Thus VUDS performed in only 1.1% of non-neurogenic LUT dysfunction patients
- Extracted patient demographics, number of prior visits to our clinic before VUDS obtained, all prior treatments, and patient reported symptoms score (DVISS)
- All VUDS performed with attending physician present throughout study
- Change in management 2/2 to VUDS findings also recorded

(Zderic et al, podium presentation, ICCS Taiwan 2022)

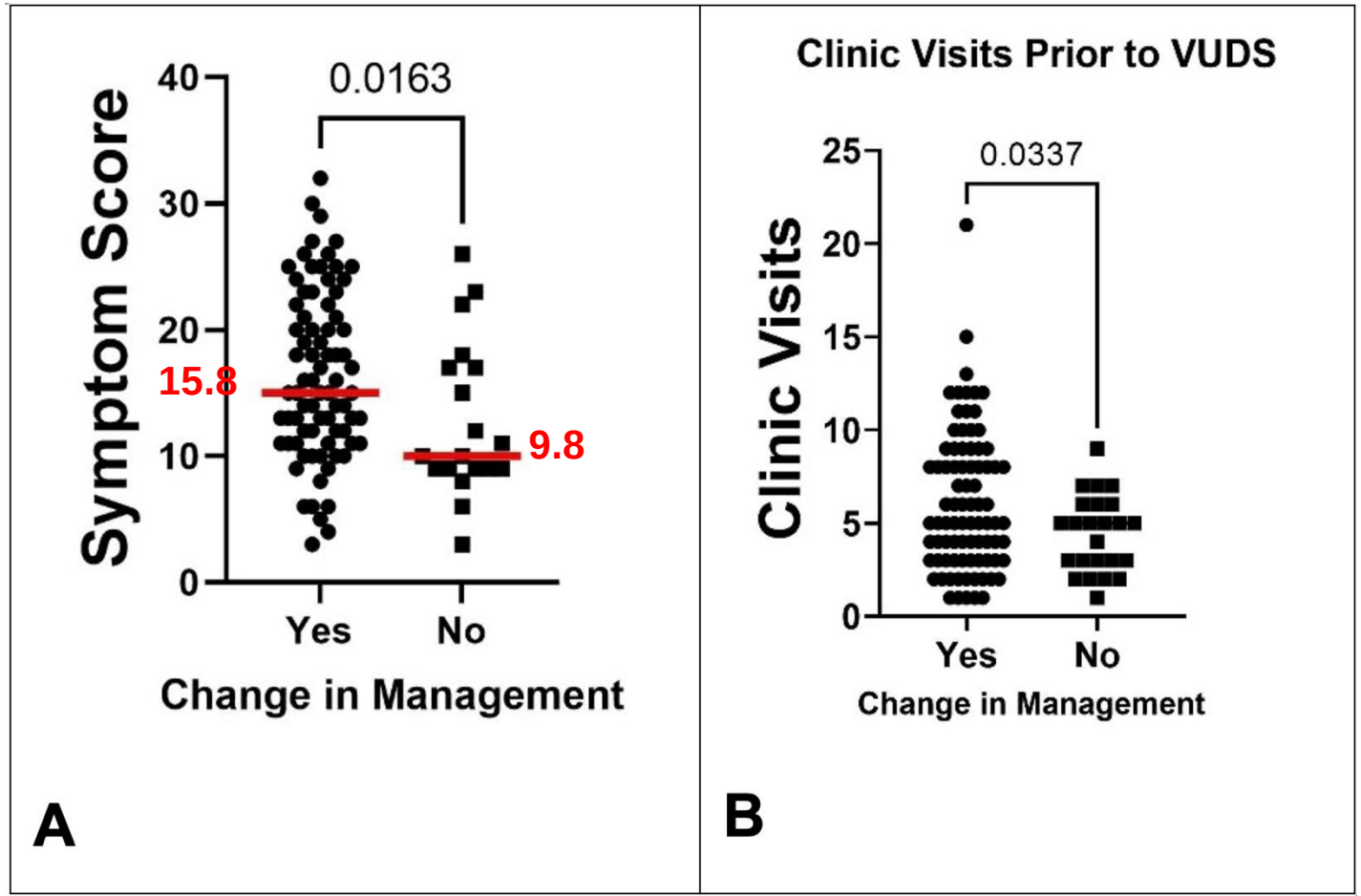
Results

- Mean age 10.5 years
  - 69% female: 34% male
- DVISS score at time of VUDS = 15.6 (vs. 12 for all LUTD patients)
- Mean 5.9 office visits prior to obtaining VUDS

- <u>Management changes noted in 78% of cases (no sex difference)</u>:
  - Change in medication (48%)
  - Start CIC (9.1%)
  - Surgery (13%)
  - Start posterior tibial nerve stimulation (1%)

Factors associated with +VUDS

- **DVISS score and number of prior office visits before VUDS were significantly different between patients who had change in management after VUDS vs. those who did not**



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Can Videourodynamics shape management in refractory pediatric lower urinary tract dysfunction?

Jason P. Van Batavia *, Katherine Fischer, Monica Moran, Joy Kerr, Adriana Messina, Keely McClatchy, Amanda Berry, Dana Weiss, Christopher Long, Stephen A. Zderic

- **Conclusions:**
  - VUDS for non-neurogenic LUTD can be beneficial in select group with refractory symptoms
  - DVISS score of ≥16 and ≥6 prior office visits to the LUT dysfunction clinic can help guide decision making

Patient Characteristics at Initial Evaluation

- Initial signs and symptoms: Do they offer hints?
- Three pitfalls not to miss
- Uroflow curves: How reliable are they?
- Non-invasive imaging: When to consider renal/bladder ultrasound
- Invasive urodynamics: Can we predict who will benefit?
- Future: AI? Urine biomarkers?

Urinary biomarkers

- Biomarkers may be from protein, genetic, metabolite, or carbohydrate
- Any structure that can be measured and used objectively to evaluate physiologic or pathologic process
- Urine is a stable environment for biomarkers
- Many biomarkers (including interleukins, prostaglandins, neutrotrophins, interferons) have been studied in adults

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REVIEW

Neurourology Urodynamics | SUFU Society of Urodynamics, Female Pelvic Medicine & Urogenital Reconstruction | WILEY

Urinary biomarkers in children with neurogenic and non-neurogenic lower urinary tract dysfunction: A systematic review and meta-analysis

Cagri Akin Sekerci MD[1] | Selcuk Yucel MD[1] | Tufan Tarcan MD, PhD[1,2]

- Only 16 studies identified in children with LUT dysfunction
- Most studies level B or C evidence
- Biomarkers evaluated: NGF, BDNF, TIMP-2, NGAL, aquaporin-2
- Meta-analysis only urinary NGF levels in children with non-neurogenic LUTD were significantly higher than healthy controls
- Promising for the future but should only be used in research studies and not in clinical decision making at this time

Received: 14 November 2023 | Accepted: 17 December 2023

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REVIEW

Neurourology Urodynamics | SUFU | WILEY

Urinary biomarkers in children with neurogenic and non-neurogenic lower urinary tract dysfunction: A systematic review and meta-analysis

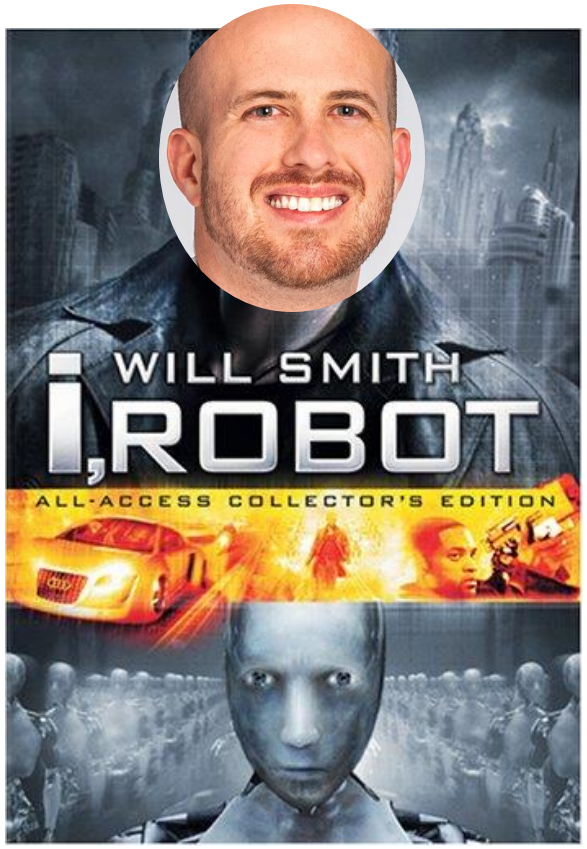
Cagri Akin Sekerci MD[1] | Selcuk Yucel MD[1] | Tufan Tarcan MD, PhD[1,2]

TABLE 4 Typical and atypical urinary biomarkers studied with bladder dysfunction.

Group	Subtypes
Cytokines	IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, MCP-1, MIP-1 INF alpha, INF gamma, TNF alfa, TNF beta
Neurotrophins	NGF*, BDNF*
Growth factors	TGF*, VEGF, EGF
Prostaglandins	PGE_2, PGI_2, PGF2a
Matrix metalloproteinase	MMP-2, TIMP-2*
ATP	
CRP	
NGAL*	
Stem cell factor	
Urinary microbiota	Gardnerella, Lactobacillus, Actinobaculum, Actinomyces, Aerococcus, Arthrobacter, Corynebacterium, Gardnerella, Oligella, Staphylococcus, and Streptococcus
Genomics	Beta 2-adrenoreceptor Gene, mRNAs (NRXN3, BMP7, and UPK1A), miRNAs (miR-103a-3p, miR-10a-5p, and miR- 199a-3p)

Note: Those marked with * have also been studied in children.

Machine Learning and Artificial Intelligence



External Validation Demonstrates Machine Learning Models Outperform Human Experts in Prediction of Objective and Patient-reported Overactive Bladder Treatment Outcomes

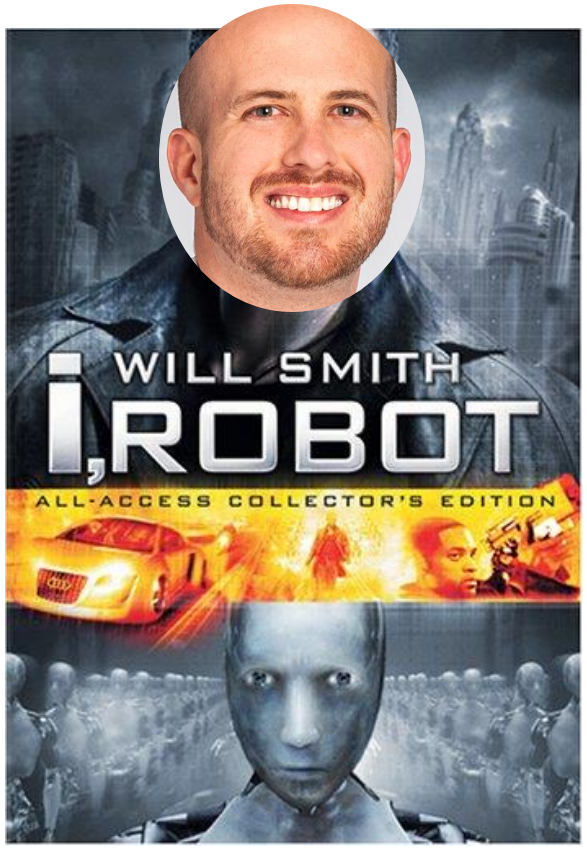
Urology

Werneburg, Glenn T.; Werneburg, Eric A.; Goldman, H...

Vol. 194, pp. 56–63, 2024.

- Developed accurate models using machine learning to predict objective and patient-reported response to intradetrusor botulinum toxin injection for OAB
- The neural network outperformed human experts

Machine Learning: Future is still a way aways



External Validation Demonstrates Machine Learning Models Outperform Human Experts in Prediction of Objective and Patient-reported Overactive Bladder Treatment Outcomes

Urology

Werneburg, Glenn T.; Werneburg, Eric A.; Goldman, H...

Vol. 194, pp. 56–63, 2024.

- Study only in adult women in two large trials
- AUC for the neural network was 0.66
- Only used to predict outcomes of patients refractory to standard therapies
- No model developed for predicting outcomes at initial evaluation

Take Home Messages

- Patient characteristics at initial evaluation including specific lower urinary tract symptoms can suggest a specific underlying LUT diagnosis
- However, these associations should only serve as a guide and not a definitive golden rule as the underlying LUT condition should be based off of the entire clinical picture and workup (ie, diaries, questionnaires, uroflowmetry, etc)
- Do not forgot the 3 pitfalls to avoid when evaluating and treating LUT dysfunction: constipation, neurologic causes, and sexual abuse
- Consider renal bladder ultrasound and urodynamics studies for patients with high symptom scores, UTI history, and/or multiple visits without improvement

THANKS

Questions???

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