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Diagnosis and Management of Bladder Bowel Dysfunction in Children with Urinary Tract Infections

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The association of lower urinary tract dysfunction (LUTD) with functional bowel dysfunction and incidence of urinary tract infections (UTI) among children has been increasingly documented in the past few decades

Recent reports support the relationship between functional bladder bowel dysfunction (BBD) and UTI that predisposes the child to recurrent infection, potentially causing renal scarring

Shaikh N, Hoberman A, Keren R, Gotman N et al (2016) Recurrent urinary tract infections in children with bladder and bowel dysfunction.Pediatrics 137:e20152982

Terminology

The International Children's Continence Society (ICCS):

Dysfunctional elimination syndrome (DES)

Hinman syndrome

Dysfunctional voiding (DV)

BBD :

condition of combined bladder and bowel disturbance that does not explain pathogenesis but rather encompasses the parallel LUT and bowel dysfunction seen in children with neurologic conditions, yet has no neurologic abnormality

Austin PF, Bauer SB, Bower W et al (2016) The standardization of terminology of lower urinary tract function in children and adolescents. Neurourol Urodyn 35:471–481

Causative effect of BBD that leads to UTI

LUTD: Incomplete bladder emptying is an important risk factor for development and recurrence of UTI in children

Rectal distention can compress the adjacent bladder neck and trigonal region leading to detrusor overactivity and possibly bladder outlet obstruction

Effect of BBD on VUR and renal scarring

children diagnose VUR → have BBD in half

BBD → important predictor for spontaneous reflux resolution, susceptibility for pyelonephritis and renal damaging

In another our article → 250 patients with VUR were studied . 54.4% of the patients, VUR was detected during investigation for UTI .

Voiding dysfunction → the most important condition with VUR (15.2%)

Jodal U, Smellie JM, Lax H, Hoyer PF (2006) Ten-year results of randomized treatment of children with severe vesicoureteral reflux. Final report of the international reflux study in children. Pediatr Nephrol 21:785–792 Sadeghi s: Journal of Pediatric Nephrology 5(2) 2017

Evaluation of BBD in infants and children with UTI

*Medical history + physical examination

*Bladder bowel diary, frequency volume chart and 4-h voiding observation in infants

*BBD or LUTD questionnaires

*Bristol Stool Form Scale and Rome IV criteria of constipation

*Ultrasound (kidney, bladder and rectum) and abdominal scout film

*Uroflowmetry and post-void residual (PVR)

*Voiding cystourethrogram (VCUG), urodynamic, and videourodynamic study (VUDS)

Assessment of pediatric BBD with UTI

1. Medical history:
   - Obtain information about UTI occurrence
   - Inquire about co-morbidities and other medical issues
   - Birth history : any signs of perinatal or neonatal insult, perinatal anoxia, congenital infection ,prematurity, prenatal hydronephrosis
   - Voiding patterns, i.e., voiding frequency, timing of any urinary incontinence, associated symptoms of daytime incontinence and enuresis

- Sensory neural or muscle weakness/atrophy involving the lower extremities should be considered as subtle neurologic conditions
- Gastrointestinal parameters, i.e., stool firmness, frequency, pain with defecation and encopresis, functional constipation using ROME IV, nausea, vomiting, weight loss or failure to thrive, appetite decreased
- The school environment and toileting conditions should be explored

2. Physical Examination

- Height/weight
- Blood pressure
- Abdominal palpation(fecal mass)
- Genital examination(meatal anomaly ,labial adhesion)
- Perineal examination(fecal soiling, hemorrhoids, fissure, scars)
- Digital rectal examination, if indicated(large fecal mass, sphincter tone)
- Neurologic examination(sacrum and lower extermities)

3. Bladder diary or 4-h voiding observation:

- 48-h frequency volume chart for toilet trained children
- 4-h voiding observation with the aid of bladder ultrasound for pre-toilet trained children
- weighing diapers before and after each void allows calculation of voided volume

Frequency volume charts are useful to monitor treatment progression and intervention response

Chung JM, Kim KS, Kim SO et al Korean Children's Continence and Enuresis Society (2013) Evaluation of bladder capacity in Korean children younger than 24 months: a nationwide multicenter study. World J Urol 31: 225–228

Tools – Bladder (Voiding) diary

VOIDING CALENDAR

For: _____ Date: From: ____-____-____ to ____-____-____

Times	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	
	Time	Volume	Time	Volume	Time	Volume	Time	Volume	Time	Volume	Time	Volume	Time	Volume
8:00 10:00														
12:00														
2:00														
4:00														
6:00 8:00														
10:00														
Day Wet (+) Day Dry (-)														
Night Wet (+) Night Dry (-)														
BM Comments														

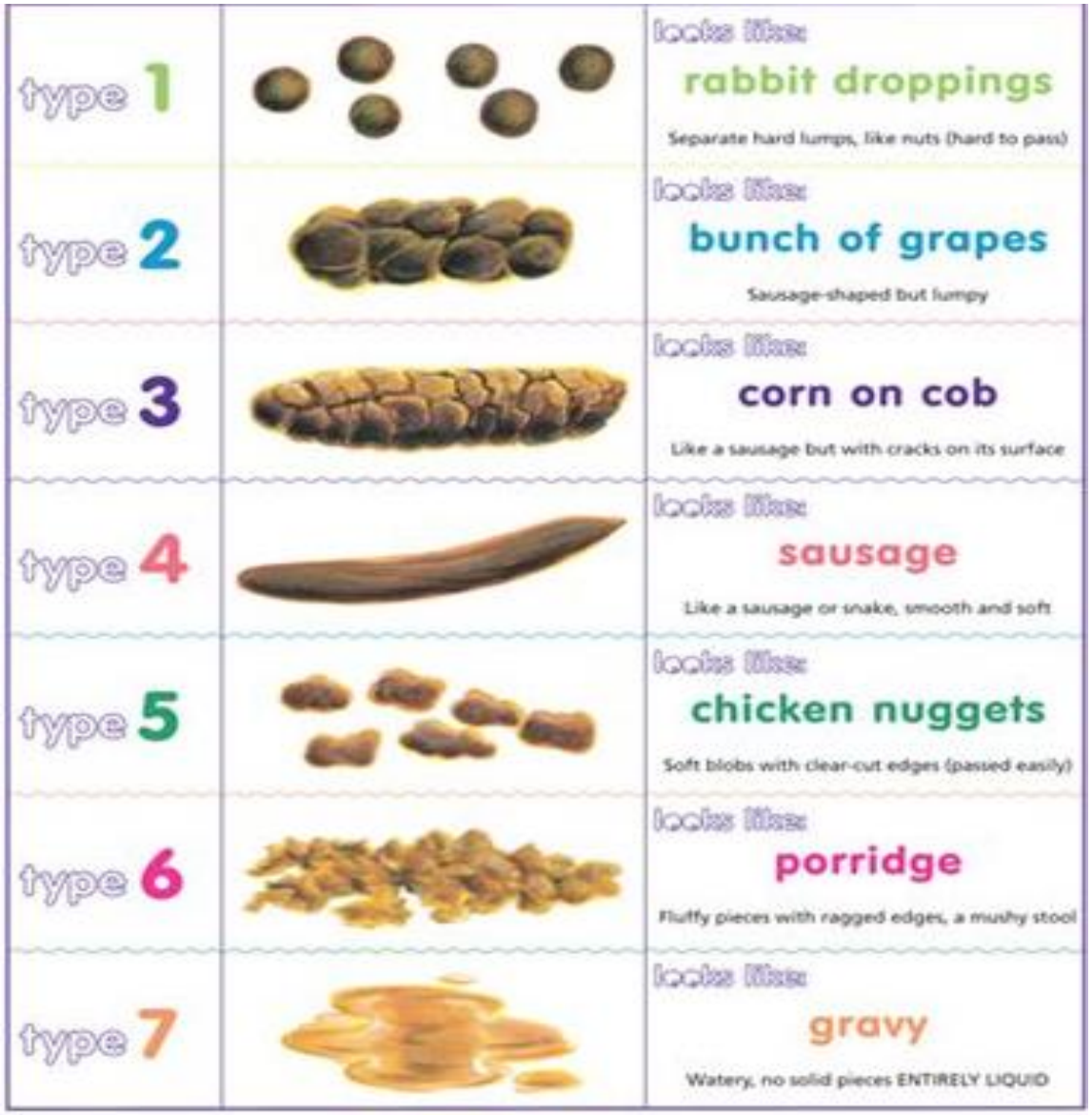
4. BBD or LUTD Questionnaires:

- Several validated questionnaires available for assessment and follow-up of BBD(DVSS,DV and incontinence scoring system) evaluating and monitoring treatment progress

5. Bristol stool form and Rome IV criteria of constipation:

- 7-day bowel diary with description of stool forms

Tools – Bristol Stool form



Imaging

Ultrasound (transabdominal):

- Imaging kidneys and urinary bladder(wall thickness,bladder volume,PVS)
- Transverse rectal diameter(fecal matter behind the bladder)
- Abdominal scout film(KUB):evaluation of radiograph for fecal loading, spinal bony abnormality

Voiding cystourethrogram (VCUG) Indicated for:

- Recurrent febrile UTI ± renal parenchymal abnormalities
- scarring, cortical thinning, increased echogenicity, reduced corticomedullary differentiation, poor renal growth and/or dilatation of renal pelvis, calyces and ureters
- Abnormal bladder contour or spinning top urethra suggestive of DV or other related anomalies
- High grade VUR
- Abnormal ultrasound finding
- Decreased renal Function
- scarring on renal scintigraphy (DMSA)

} prompt specialist referral

Uroflowmetry and PVR

- Uroflowmetry and post-void residual in toilet trained children
- Abnormal uroflow patterns and elevated PVR :
  - PVR>20 ml or 10% bladder capacity in children aged 4–6 years
  - PVR >10 ml or 6% bladder capacity in children aged 7–12 years
  - In infants and younger children: bladder capacity and PVR using a bladder scanner or trans abdominal ultrasound supplementing a 4-h voiding observation

Invasive study

- Voiding cystourethrography for febrile UTI - VUR and dysfunctional voiding
- Urodynamics or videourodynamics (VUDS) are not routinely recommended to diagnose BBD for detailed bladder/sphincter function
- VUDS can show detrusor overactivity, VUR, and dyscoordinated sphincter
- The specific patient population indicated for these invasive diagnostic procedures → patients with recurrent UTI with consideration of reflux, or neurologic conditions that are intended to be ruled out

Treatment of BBD

Address UTI based on guidelines for management in children.(AAP 2011, Stein 2015

↓

Evaluate & rule out congenital urological anomalies relevant to recurrent UTI (AAP 2011) → Manage specific kidney and urinary tract anomalies accordingly

↓

Rule out neurogenic causes of bladder bowel dysfuncon (Ausn 2015) → Treat neurogenic bladder & bowel dysfuncion, according to ICCS standardizaion ocumentaion on neurogenic bladder (Bauer 2013, awashdeh 2012)

↓

Assess for non-neurogenic bowel dysfuncon & manage according to ICCS standardizaon document (Burgers 2013, Koppen 2016)

↓

Evaluate & manage dayme inconnence +/- dysfunconal voiding according to ICCS standardizaon documents (Hoebeke 2010, Chase 2010, Chang 2015)

↓

Evaluate & manage night me inconnence according to ICCS standardizaon documents & guidelines (Neveus 2010, Vande Walle 2012, Franco 2013)

Conservative treatments for BBD

Urotherapy:(All children) first line:

- Education: pediatric subspecialists, urologist, gastroenterologist, and psychology professionals
- Behavioral modification instruction
- Lifestyle advice, oral intake
- Registration of symptoms and voiding habits(Timed and double voiding maneuvers)
- Improvement in elimination habits ,good toileting posture ,good hygiene

- Early toilet training :
  - Parental oriented toilet training method → May be beneficial in infants with elevated PVR
- Bowel management:
  - Education, fecal disimpaction, stool softeners, and fiber → All children with constipation
- Biofeedback relaxation of pelvic floor:
  - Using biological signals to enhance pelvic floor relaxation and facilitate micturition and defecation emptying(83%) → Children with dyscoordinated sphincter and/or pelvic floor muscles during voiding

Bowel management

- four-step approach
  - 1-education regarding bowel physiology and dysfunction
  - 2- fecal disimpaction with enema and laxatives
  - 3-prevention of fecal reaccumulation with stool softeners such as polyethylene glycol,
  - 4- behavioral therapy with follow-up
- Maintenance therapy in treating constipation may be required for months to years afterwards

Constipation(cont.)

234 children treated for chronic constipation, relief occurred in 52% with no UTI in those without urinary tract anomaly

In our study Voiding dysfunctional score based on DVSS before and three months after treatment were compared. Girls with score > 6 and boys with score of 9 were included

Median score of voiding dysfunction revealed significant differences before and after treatment (p=0.001). After treatment, enuresis and encoprosis as well as frequency in defecation showed significant improvement among girls and boys (p=0.003 and 0.001 respectively)

Loening-Baucke V (1997) Urinary incontinence and urinary tract and their resolution with treatment of chronic constipation Of childhood. Pediatrics 100(2 Pt 1):228–232

The Effect of Constipation Treatment on Voiding Dysfunction in Children: Tooran Shahraki, Simin Sadeghi Nov 1, 2010,Zahedan medical research journal

- Electroneurostimulation
  - Involving regulation of the cerebral cortex,spinal pathway and the target organ of pelvic floor muscles → Children refractory to conservative or pharmacological treatments
- Clean intermittent catheterizations:
  - Drain the bladder intermittently with clean urethral catheter → Children who fail conservative management and pharmacologic treatment

Pharmacological treatment of BBD in children with UTI

Types of medication	Indication
Prophylactic antibiotics	Coincidental BBD and VUR, particularly when renal cortical changes were noted and/or high-grade reflux is present
Alpha blockers	Primary bladder neck dysfunction
Anticholinergic agents	Overactive bladder and urinary incontinence
Botulinum toxin A	Detrusor sphincter dyssynergia in patients refractory to conservative and pharmacologic therapies

Surgical treatment of BBD

- Open and endoscopic surgeries for VUR and neonatal circumcision

- Bladder augmentation, appendicovesicostomy (Mitrofanoff procedure), and antegrade continent enema(ACE)

Prognosis in the UTI condition after management of BBD

- Reports of 12-month efficacy for eliminating recurrent UTI using urotherapy in children with BBD vary between 40 and 68%
- Treatment of constipation resolves urinary incontinence and UTI with no sequae on renal function
- Persistence of BBD after correction of VUR raises the risk of postoperative febrile UTI or recurrent UTI, indicating BBD is an important factor of UTI occurrence

Wolfe-Christensen C, Manolis A et al(2013) Bladder and bowel dysfunction: evidence for multidisciplinary care. J Urol 190:1864–1868

Thank you