COMMON PEDIATRIC UROLOGY CONDITIONS

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OBJECTIVES

• Describe common pediatric urologic problems and which problems require further evaluation and which are self-limiting.

• Understand in-office evaluation and management of bladder and bowel dysfunction and urinary tract infections and when to refer for further evaluation.

• Understand nocturnal enuresis and the rationale for the different treatment strategies.

Case

• 7 year old girl with day and night incontinence
  – Damp most days, may sometimes soak underwear
  – Pull up soaked every night
  – Daytime urinary urgency and frequency
  – Squats to prevent leaking
  – “Doesn’t feel the leaking until it’s too late”
  – Diagnosed with two recent afebrile urinary tract infections
Case (continued)

- Bowels hard, infrequently passed.
- Child described as being “lazy”; waiting to the last minute to urinate
- Child hides wet clothing
- Issues regarding school
  - Peer relationships
  - Performance

Day Wetting-Prevalence

- Up to 15% of primary care provider visits are related to urinary function
- 2-5X more common in female patients
- Approximately 15% of 5 – 7 year olds have enuresis
- Strong overlap in nearly 1/3rd of enuretic patients with behavioral conditions
  - Important that both issues are addressed during treatment.

Nervous system control of Lower Urinary Tract

- Continence involves all aspects of the nervous system
  - Autonomic
    - Parasympathetic – storage (pelvic nerve, S2-S4)
    - Sympathetic – emptying (hypogastric nerves, T10-L2)
  - Somatic
    - External sphincter (pudendal nerve S2 – S4)

Function of Lower Urinary Tract

- STORAGE
  - of adequate volumes of urine at low pressure and with no leakage

- EMPTYING that is:
  - Voluntary
  - Efficient
  - Complete
  - Low pressure
As the Child Grows

- Bladder capacity increases & voiding frequency decreases with growth
  - Infants (<2 yo): 7 x weight (kg) = capacity (mL)
  - > 2 yo: capacity in ounces (30mL) = Age (yrs) + 2
- Newborns with frequent, complete, low pressure emptying
  - Newborns void 20 x/day with only a slight decrease during the 1st year of life
- 1-2 yrs: conscious sensation of bladder fullness develops
  - Still immature detrusor-sphincter coordination-frequent voiding (10-15x/day)
- 2-3 yrs: Ability to initiate or inhibit voiding voluntarily develops
  - Inhibit micturition centrally (increasing capacity)
  - Initiate micturition by relaxing sphincter
  - Interrupt voiding by contracting sphincter
- >4 yrs: Voiding comes under reliable voluntary control
  - Adult-like pattern of micturition

Maturation of Voiding

- Initially child has better control over external sphincter than bladder
  - Easier to stop urination than start it
  - Voiding inhibition done by contracting external sphincter rather than inhibiting bladder contraction
  - This pattern may be reinforced during toilet training
  - Persistence of this pattern is bladder sphincter dyssynergia

Usual sequence of bowel & bladder control

- Nighttime bowel continence
- Daytime bowel continence
- Daytime bladder continence
- Nighttime bladder continence
Possible Hypotheses for dysfunctional elimination syndrome (DES)

- Something goes wrong during toilet training
  - Bladder infection
  - Bladder inflammation
  - Constipation
    - Interferes with bladder sensation
    - Impedes emptying → mechanical obstruction at bladder neck
    - Can induce bladder overactivity
- Studies show treatment of bowel issues significantly reduce day and night wetting

Characterization of Dysfunctional Elimination Syndrome (DES)

**Storage problem** vs **Emptying problem**

**Storage problem**
- Failure to store normal volumes of urine at low pressure & without leakage
  - Non compliant bladder
  - Irritable bladder
  - Inadequate sphincter tone during filling

**Emptying problem**
- Failure to empty completely on command, efficiently at low pressures
  - Failure of neurological control of bladder
  - Bladder muscle failure
  - Failure of sphincter relaxation during voiding

ALWAYS ASK ABOUT BOWEL HABITS
Clinical problems from Dysfunctional Elimination Syndrome (DES)

- Increased bladder pressures can result in
  - Secondary vesicoureteral reflux
  - Kidney damage, hydronephrosis
  - Bladder hypertrophy leading to bladder failure
- Residual Urine
  - Urinary tract infection
- Incontinence
  - Social consequences

Description of Types of Incontinence

<table>
<thead>
<tr>
<th>Type</th>
<th>Key Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urgi Incontinence (overactive bladder)</td>
<td>Urge, Frequency – more than 7x/day, Small volume voided</td>
</tr>
<tr>
<td>Voiding postponement</td>
<td>Infrequent micturition – less than 5x/day, Postponement</td>
</tr>
<tr>
<td>Dysfunctional Elimination</td>
<td>Straining to initiate and during micturition, Interrupted stream of urine</td>
</tr>
<tr>
<td>Stress incontinence</td>
<td>Wetting during coughing, sneezing, Small volumes</td>
</tr>
<tr>
<td>Giggle incontinence</td>
<td>Wetting during laughing, Large volumes with apparently complete emptying</td>
</tr>
<tr>
<td>Detrusor underactivity</td>
<td>Interrupted stream, Emptying of bladder possible only by straining</td>
</tr>
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Major Dysfunctional Elimination

- Hinman Syndrome
  - Non-neurogenic neurogenic bladder
  - Acquired process with NO identified neurologic issue.
  - Incontinence, large post void residual, UTI's, upper tract damage
  - Associated with bowel dysfunction as well

Dysfunction Elimination: Key history points

- New or present since infancy?
- Can child remain dry for short periods of time?
- History for UTI
- Voiding pattern (frequency, urgency, staccato stream
- Holding maneuvers
- Bowel function
Physical Examination

- Abdominal palpation
  - Constipation, masses
- Spine examination/Neurological examination
  - Sacral dimple, hairy tuft, skin discoloration
  - Back pain, leg pain/numbness/tingling, change in leg strength/gait
- Inspection of genitalia
  - Erythema
  - Pooling of urine – vaginal voiding
  - Labial adhesions/meatal stenosis

Diagnostic Studies

- Urinalysis, urine culture
- Ultrasound of kidneys AND bladder
  - Pre and post void images
  - Elevated post void if > 2 mL/kg
  - Thickened bladder wall
- KUB, if necessary, for constipation
- Consider voiding cystourethrogram especially if febrile urinary tract infection
- Consider MRI of lumbar spine

Urinalysis – mode of collection

- Mode of collection - important to prevent overtreating contaminated specimens
  - urine bag – least invasive, high false-positive rates (85-99%), only helpful if urine is negative
  - Mid stream clean catch – need to be toilet trained, non-invasive, higher chance of contamination as compared to catheterization
  - Urethral catheterization or suprapubic aspiration — recommended by AAP for children < 24 months

Determining which urine test

Urinalysis/Microscopic
- Rapid screening for UTI
- Considered complementary test for UTI diagnosis for most patients
- AAP guidelines consider urinalysis a necessary diagnostic tool in patients 2-24 months.

Urine Culture
- Standard for diagnosing UTI
### Most useful Urine Dipstick results

#### Leukocyte Esterase
- Released when WBC are broken down
- Marker for pyuria – presence of WBC’s in urine
- False-positive: Other causes of inflammation in urine
- Distinguish asymptomatic bacteriuria from true UTI
- Absence of pyuria in child with a true UTI is rare
- Retrospective study, 2,700 children – 88% and 79% sensitivity and 96% and 97.5% specificity in dilute and concentrated urines respectively in identifying UTI

#### Nitrite
- Urinary nitrite is reduced from dietary nitrates in the presence of gram-negative bacteria
- Gram-positive organisms will give false-negative results
- Frequent urination and dilute urine can provide false negative results
- Sensitivity is poor, specificity is high – positive nitrite test likely true UTI

### Urine Microscopy
- Pyuria is assessed with microscopy from centrifuged urine by using threshold of 5 WBC/hpf (10 WBC’s/hpf more accurate predictor in children < 2 years)
- Urine micro for WBC’s alone not more accurate than dipstick for leukocyte esterase
- Disadvantages – increased expense, need for laboratory to perform, increased time to results
- Value of urine microscopy compared to the urine dipstick remains to be determined.
- Bacteria on microscopy is most reliable and most rapid test for diagnosis of UTI

### Urine Culture
- Positive urine culture is essential in diagnosing UTI
- A UTI on voided sample characterized by 100,000 cfu/mL of a single uropathogen, (based on early-AM voided urine in adult women)
- 2011 AAP guidelines suggested for 2-24 month old children – 50,000 cfu/mL of single organism + pyuria and/or bacteriuria on urinalysis from catheterized sample
- Contamination considered in low colony counts and cultures with heavy mixed growth, & cultures with nonpathogenic organisms-such as lactobacillus, coag-neg staph, alpha-hemolytic strep, candida species

### Urinary tract infection
- Invasion of the urinary tract by an organism that leads to pathologic changes
- Presence of urinary or constitutional symptoms, along with urinalysis findings consistent with inflammation, or bacteria on gram stain, and single bacterial organism on urine culture.
- Upper tract (pyelonephritis) vs lower tract (cystitis)
  - Pyelonephritis: Fever, vomiting, flank pain, lethargy
  - Cystitis:afebrile, dysuria, urgency, frequency
Asymptomatic bacteriuria

- Growth on two consecutive urine cultures of more than 100,000 cfu/mL of the same uropathogen in a patient with no symptoms of infection.
- Unclear as to cause of urinary tract colonization
- No screening needed
- No treatment needed
- Not at increased risk for recurrent UTI's, renal damaged or impaired renal growth.

Radiologic Imaging to do or wait?

- Debate on appropriate imaging after first febrile UTI in a child
  - Historically a renal/bladder ultrasound (US) and voiding cystourethrogram (VCUG) were completed
  - Lack of evidence supporting routine use of imaging in decreasing long term sequelae of pyelonephritis such as renal scarring or renal insufficiency

Renal and Bladder Ultrasound (RBUS)

- Show size, shape and presence of both kidneys
- 15% RBUS done after first UTI in infants will yield abnormal results
  - Undiagnosed congenital abnormalities, urinary tract obstruction, hydronephrosis, stone, fluid collections-renal or perirenal abscesses
- AAP guidelines recommend RBUS in all children < 2 yo who have a febrile UTI.
- If child not responding appropriately to treatment for UTI within 48 hours or is unusually ill, RBUS should be performed during the acute episode

- Additional indications
  - Recurrent febrile or afebrile UTI's
  - Non-E coli UTI
  - Hypertension
- Low sensitivity for detection of vesicoureteral reflux
- Low sensitivity for renal scarring compared to nuclear medicine testing.
**Ultrasound**

- Standard imaging for detection and grading vesicoureteral reflux
- Can also evaluate bladder size and shape, smoothness of bladder wall, urethral abnormalities
- Can also identify constipation or spinal defect
- Obtain after treatment completed and asymptomatic
- Disadvantages include invasive test and radiation exposure

**Voiding Cystourethrogram (VCUG)**

- AAP guidelines do not recommend routine VCUG after first febrile UTI in child < 24 months unless RBUS is abnormal.
- AAP Section on Urology disagree with withholding VCUG after first febrile UTI.
  - Some children do benefit from early detection and treatment to prevent recurrent infection/renal damage
    - May be difficult to determine this is the first febrile UTI
    - Family history for VUR
- VCUG considered in older children with recurrent UTI's especially if family history of VUR

**Voiding Cystourethrogram**

- Voiding Cystourethrogram (VCUG)
  - Reflux
  - Bladder diverticulum
  - Reflux, spinning top
Treatment of Dysfunctional Elimination Syndrome

- Treat constipation aggressively
- Timed voiding schedule
- Treat UTI's with narrow spectrum antibiotics when possible
  - If febrile empirically start antibiotics pending urine culture
  - E. coli most common uropathogen. 80% infections in children
    - Nitrofurantoin or a 1st generation cephalosporin often narrow-spectrum choice
    - Nitrofurantoin with poor tissue penetration — do not use for neonate UTI/pyelonephritis
    - TMP-SMX and amoxicillin used about 50% of time however have high E. coli resistance rates
  - Neonates and young infants cover for Enterococcus as higher rate of enterococci infections
    - Ampicillin or 1st generation cephalosporin
  - Nitrofurantoin with increased risk of hemolytic anemia in < 3 month old infants
  - TMP-SMX contraindicated in < 6 week old infants and preemies
- Afebrile cystitis: 2-4 days is not inferior to a 7-14 day course

Clinical Pearls for Dysfunctional Elimination Syndrome

- 15% of 5 year old with enuresis, 15% have spontaneous resolution each year
- Children with day and night enuresis are treated differently than children with just night wetting
- Children with day and night wetting should have bowel and daytime bladder function addressed prior to treating night wetting.
- Primary interventions are typically conservative with behavioral modifications.

Treatment of Dysfunctional Elimination Syndrome

- Avoid bladder irritants
  - Caffeine, sports drinks, carbonated beverages, chocolate, spicy foods, artificial sweeteners, some fruits and their juices (oranges, lemons, pineapple)
- Advanced therapies
  - Pelvic floor physical therapy & biofeedback – pediatric trained
  - Anticholinergic (Oxybutynin) - reduce bladder contractions, increase capacity
  - α-blockers (Tamsulosin) - antagonize smooth muscle in bladder neck (off label use)
  - β3 receptor agonists (Mirabegron) - bladder wall relaxation (not FDA approved in children)

When to refer Dysfunctional Elimination

- Continuous, primary incontinence that occurs day and night
- Constipation refractory to therapies
- Persistent daytime symptoms despite conservative therapies
- Incontinence that is new after a period of > 6 months of dryness and positive neurological findings
- Meatal stenosis
- Labial adhesions
  - Can try Premarin - side effects of estrogen exposure.
Clinical Pearls for urinary tract infections

- S/S in infant can be vague and non-specific
  - Keep UTI as differential diagnosis for febrile infant
- UTI’s more common in girls except during first year of life when boys are at higher risk
- Uncircumcised boys <6 months of age are 10x more likely to have UTI than circumcised boy
- True UTI requires bacteriuria and symptoms
- Increasing incidence of pyelonephritis and delay in antibiotic treatment can increase risk of renal scarring-early antibiotics in febrile child
- Most of time, pyelonephritis is associated with fever, nausea, vomiting, or flank pain

When to Refer Urinary Tract Infection

- Recurrent afebrile/febrile UTI’s
- UTI’s not responsive to initial antibiotic therapy
- Febrile UTI in an infant
- Abnormal RBUS and/or VCUG
- Prenatally known or postnatally diagnosed congenital genitourinary anomaly
  - Postnatal ultrasound at least 48 hours after birth
- Known or suspected spinal abnormality
- Bowel and bladder dysfunction not improving with treatment

Case 2

- 11 year old male with night wetting since toilet training
- No day urinary symptoms
- Daily, soft bowel movements
- Urine – specific gravity 1.020, otherwise negative
- Refuses to do sleepovers/overnight camp
- Does not want to talk about the issue, parent answers questions in clinic
- Parents have tried to limit fluids, void before bed, parents wake child to urinate about 1-2 hours after bed.
Nocturnal Enuresis

- Incontinence during sleep in a child five years of age or older
- More common in boys
- Self limited, 15% spontaneous cure annually
  - ~15% in 5 yo
  - 10% in 7 yo
  - 5% in 10 yo
  - 2-3% in 12-14 yo
  - 1-2% ≥ 15 yo

Nocturnal Enuresis

- Primary nocturnal enuresis
  - Involuntary incontinence at night by children old enough to be expected to have bladder control
  - Never had bladder control for >6 months at night
- Secondary nocturnal enuresis
  - Involuntary incontinence at night by children old enough to be expected to have bladder control
  - Incontinence reoccurs after at least 6 months of continence.
  - Comorbid behavioral/emotional disorder
  - Stressful life events can cause relapse
    - Separation or divorce of parents
    - Birth of sibling
  - Occasional presentation for GU tract abnormality

Nocturnal Enuresis

- Younger children are more likely to experience spontaneous resolution without therapy
- Children 5-7 years of age may be offered nonpharmacologic treatment if they are motivated
- If child is not bothered by enuresis consider delaying treatment until motivated.

Nocturnal Enuresis Presentation

- Failure to arouse - stress importance to not lay blame on child
  - Child described as deep sleeper
- Increased urine volume at night
- Large wetted volume
- Normal bladder function during the day
Nocturnal Enuresis Evaluation

• Screen for daytime bladder and bowel dysfunction
• Primary vs secondary enuresis
• Typically no physical abnormalities
• Urinalysis evaluating for proteinuria, glucosuria, concentrating defect, infection
• Consider post void residual
• Radiological imaging is not necessary for primary nocturnal enuresis
  – Consider for secondary nocturnal enuresis

Nocturnal Enuresis Treatment

• Moisture Alarm
  – only treatment known to speed up possible cure
• Pharmacologic Therapy
  – Will not speed up cure, take until normally outgrow
  • Desmopressin
  • Oxybutynin
  • Imipramine
• Alternative treatment
  – Hypnosis
  – Acupuncture
  – Chiropractic therapy
  – Herbal therapy

Nocturnal Enuresis treatment

• Moisture alarm
  – 60-80% become dry, 50% long term
  – More effective if used as recommended
• Potty MD - family assistance program-30% discount
  – Provider has to sign up and provide family with code

Nocturnal Enuresis Treatment

• Desmopressin – analogue of antidiuretic hormone
  – Reduces urine production
  – 0.2 mg tablet with max dose 0.6 mg
  – Nasal spray no longer indicated for nocturnal enuresis
  – Taken ONLY right before bed
  – Limited side effects-hyponatremia
    • Overdrinking before bed can lead to hyponatremia
  – Limit fluids to 4-8 ounces starting 2 hours before bed
  – effective in 70% of cases, younger age less effective
  – Can be taken just for social events, if desired
Nocturnal Enuresis Treatment

- Anticholinergic - Oxybutynin
  - reduce bladder contractions, increase capacity
  - Primary side effects – dry mouth, facial flushing, constipation
  - studies have shown not very effective alone for night wetting
- Combination Anticholinergic and Desmopressin
- Tricyclic Antidepressant – Imipramine
  - Anticholinergic relaxing effect on bladder wall, stimulation of the external sphincter, central effect on enuresis which is not well understood
  - Comparison to desmopressin has shown similar effectiveness but significantly more side effects
  - Low doses, 10-25 mg

Nocturnal Enuresis – Alternative Therapies

- Hypnosis, acupuncture, chiropractic therapy, and herbal therapy have weak and inconclusive effectiveness.

Nocturnal Enuresis

- University of Iowa currently has a moisture alarm study.
  - Determine if alternative activation of the alarm would be more effective in eliminating incontinence

QUESTIONS