

Voiding Dysfunction in Children (Without Neurologic Lesions)

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Voiding Dysfunction

- Definitions (Cause for confusion)
- Voiding dysfunction
 - All abnormal patterns of urination
- Dysfunctional voiding
 - Specific abnormal urination where the external urethral sphincter (EUS) is contracted during voiding

Cases

- 4 year old girl with some wetting and history of 2 UTIs.
- Case 1
- Case 2
- Case 3
- Case 4

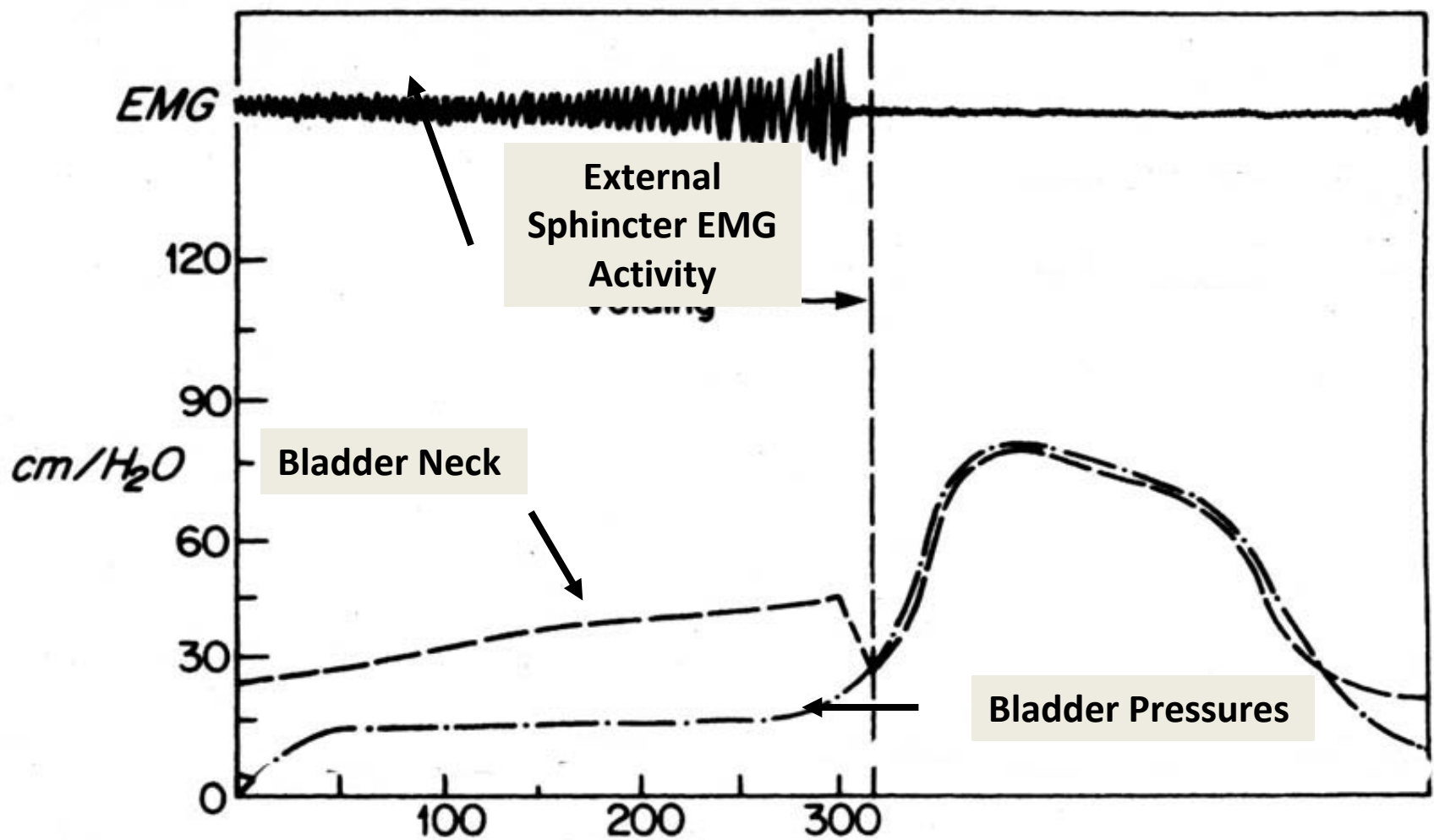
Voiding Cycle

- Infant
 - No cerebral inhibition
 - Newest research shows poorly understood brain bladder interaction even in infants
 - Spinal reflex- responds to increased bladder pressure
 - Spinal reflex mediated thru Pontine micturition center (PMC)
 - Relaxation of external urethral sphincter
 - Bladder neck funneling
 - Detrusor contraction

Voiding Cycle

- “Adult pattern”
 - 3 - 4 years of age and older
 - Able to suppress spinal reflex
 - Can withdraw suppression to allow coordinated voiding
 - Initially cannot void until bladder is full, but over time gains ability to initiate voiding even when not full
 - Dependent on intact and fully developed Pontine cerebral cortex loop

Normal Voiding Study



Storage

Voluntary

Voiding Cycle

- Intermediate phase
 - 18 months to 3 years
 - Awareness of full bladder
 - “I have to pee, Oh, I’m going”
 - Unable to suppress contraction initiated thru PMC
 - Bladder capacity increases significantly thru this period- (very important) thus voiding frequency decreases over this time period, from 12 or more voids to 5 – 6 voids/day
 - Cannot suppress contraction but can control EUS
 - Can be continent by volitional contraction of EUS or occlusion of urethra by direct pressure- “Vincent’s Curtsy”

Holding Maneuvers

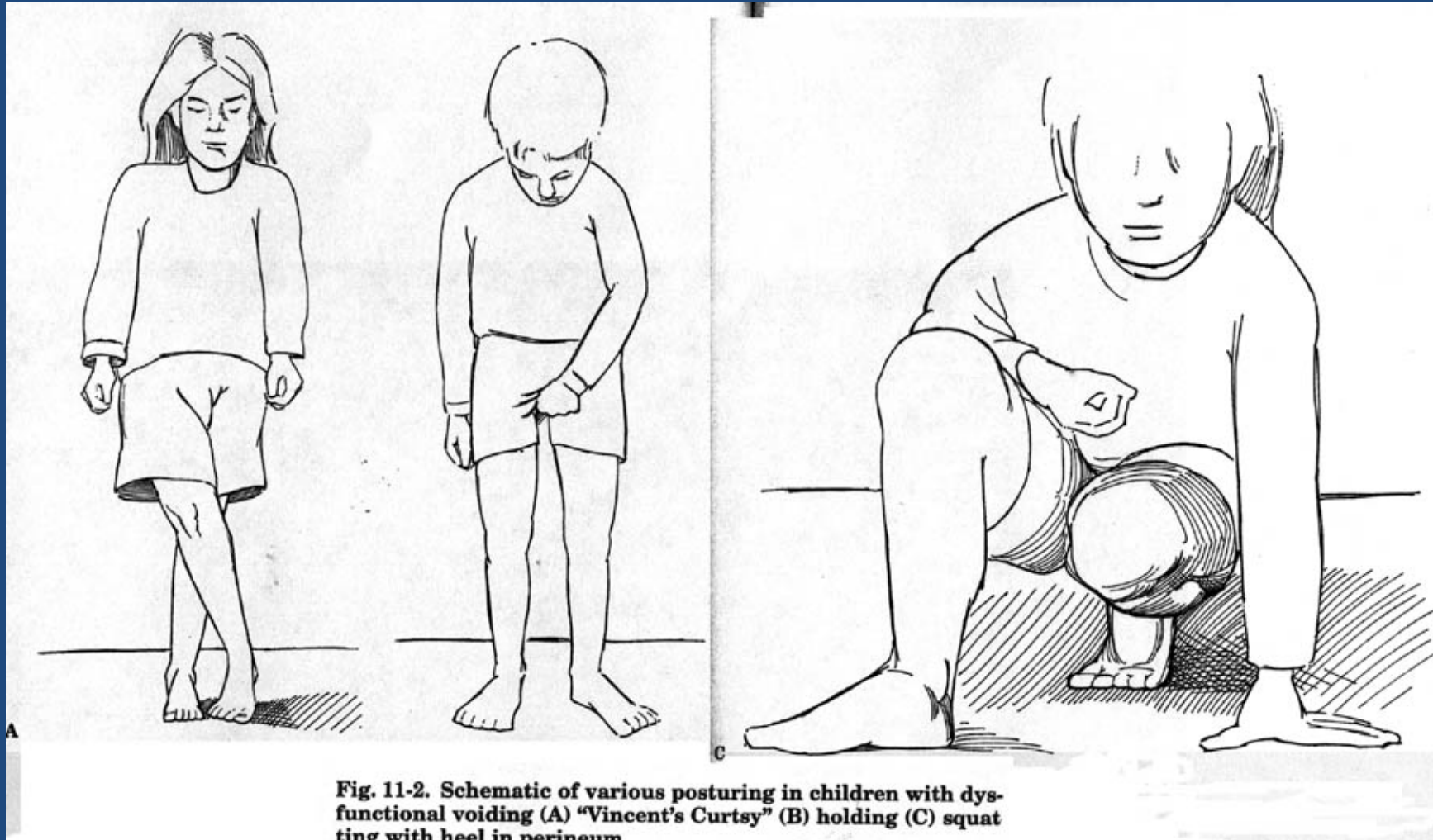


Fig. 11-2. Schematic of various posturing in children with dysfunctional voiding (A) "Vincent's Curtsy" (B) holding (C) squatting with heel in perineum.

Continence

- Passive- Bladder neck (BN), internal sphincter, smooth muscle sphincter- closed
- Active- External urethral sphincter (EUS), external striated sphincter- open or relaxed most of time but closed with increased bladder or abdominal pressure

Development of Dysfunctional Voiding

- Seems to be the persistence of the intermediate phase that every child goes thru as response to sensation of bladder fullness and ensuing contraction
- Normal relaxation of EUS with voiding is overridden
- Pattern of contraction of EUS with bladder contraction becomes the norm even with volitional voiding
- Can result in Lazy bladder and/or OAB and more severe bladder dysfunction or may be result of OAB or both

Types of Dysfunctional Voiding

- Dysfunctional voiding
 - Lazy bladder
 - Over active bladder (OAB)- urge incontinence
- Dysfunctional elimination (dysfunctional voiding & dysfunctional defecation “constipation”)

Lazy Bladder

- Bladder much larger than expected for age and /or weight, age + 2 = capacity (oz)
- Child voids 3X per day or less- infrequent urination hallmark of this entity
- Child may also have incomplete voiding
- Frequent UTIs
- Bladder needs to fill more to generate enough pressure to overcome contracted EUS
- Detrusor decompensation over time

Over Active Bladder (OAB)

Detrusor contractions during filling
Used to be called uninhibited bladder
contractions

Can develop as response to obstruction,
inflammation, contraction against closed EUS,
constipation

Small bladder for age

Frequently associated with urge incontinence

Detrusor hyperreflexive bladder disorder- similar
to OAB but in patients with neurogenic bladder

Types of Dysfunctional Voiding

- Severe
 - Hinman syndrome (non neurogenic neurogenic bladder)- massive bilateral hydronephrosis, severe renal deterioration
 - Ochoa syndrome (urofacial syndrome- peculiar crying type facial expression when smiling)- autosomal recessive on Chromosome 10, 24% renal failure
 - Myogenic detrussor failure (end stage bladder)

Problems associated with Dysfunctional Voiding

- Incontinence
 - Daytime
 - Nighttime
- UTIs
- Hydronephrosis
- Vesico-ureteral Reflux
- Renal failure

Vesico-ureteral Reflux & Dysfunctional Voiding

- OAB most common type of dysfunctional voiding associated with VUR
- Spontaneous resolution of VUR delayed
- Denovo VUR can develop
- Successful TX of dysfunctional voiding results in significant increase in VUR resolution
- Higher risk of surgical failure in anti-VUR surgery in patients with dysfunctional voiding
- Majority of open surgical failure probably due to missed and untreated dysfunctional voiding

Dysfunctional voiding and Urinary Incontinence

- Urge incontinence most common- OAB
- Overflow incontinence- Lazy bladder
- Exacerbated by constipation
- Post void incontinence (vaginal voiding), not type associated with DV

Anatomic Causes of Urinary Incontinence

- NOT TO BE CONFUSED with incontinence associated with dysfunctional voiding
- Ectopic ureter- continuous leaking
- Epispadias/exstrophy- total incontinence
- Fistulas- deflected and double stream, continuous leak, or total incontinence
 - Urethra
 - Bladder
 - ureter
- Common urogenital sinus- continuous leak or total incontinence

Causes of UTIs with Dysfunctional Voiding

- Incomplete emptying
- Turbulent flow
- Hydronephrosis and increased urine transit time
- VUR
- Alteration of vaginal flora- secondary to incontinence or antibiotics for other reasons or previous UTIs

Constipation and Dysfunctional Voiding

- Clear correlation based on many studies
- Pelvic volume theory- direct effect
- Neurologic theory
- Mixed
- Usually treat constipation aggressively first

Canon Paper

- Journal of Pediatric Urology
- Studied 26 children with DV with urodynamics and rectal balloon inflation to simulate a distended rectum
- 40% showed decreased bladder capacity with increased instability
- 40% showed increased bladder capacity with decreased instability
- 33% had persistent pattern even after balloon deflated
- Implies both direct effect as well as mediated thru nervous system

Management of Voiding Dysfunction in Children

- Behavior modification- timed voiding, relax to void exercises, double voiding, change in position for vaginal voiding
- Biofeedback and pelvic floor relaxation
- Neuromodulation (TENS)- difficult in children because of fear of needles
- Bowel management- increased fluids, increased dietary fiber, daily stooling, rectal evacuation, myralax
- Medications-anticholinergics, alpha blockers
- CIC
- Surgery-(Last resort) Botox injection, sphincterotomy, bladder augmentation

Case 1

- 4 year old girl with some wetting and history of 2 UTIs.
- Normal frequency of voiding
- Almost always damp
- No BW
- No constipation

Case 2

- 4 year old girl with some wetting and history of 2 UTIs.
- Voids only 2 – 3 X/d
- Has little warning before wetting
- Normal daily BM

Case 3

- 4 year old girl with some wetting and history of 2 UTIs.
- Normal frequency of urination
- Sudden episodes of wetting
- BM every 3rd day
- Occasional pain with defecation

Case 4

- 4 year old girl with some wetting and history of 2 UTIs.
- Voids 2 – 3 X/ d
- Occasional constipation
- High fever with UTIs

Workup

- History of UTIs
- History of incontinence patterns
- PE
- Voiding diaries
- Imaging
- Urodynamics
- Cystoscopy
- Cystogram and retrograde uretero-pyelogram

When to refer?

- UTIs
- Urinary incontinence past expected age of resolution
- When urinary incontinence bothers patient (as opposed to parent)
- Unusual pattern of incontinence
- Hydronephrosis

Dysfunctional Voiding Clinic

- Run by Amanda Hodges- Pediatric Nurse Practitioner
- Work up time consuming
- Always start with least invasive tests and treatments
 - Voiding diary
 - Uroflow
 - Renal bladder sonogram
 - Behavior modification
- Behavioral issues
- Constipation, constipation, constipation!

Cases

- 4 year old girl with some wetting and history of 2 UTIs.
- Case 1- ectopic ureter
- Case 2- dysfunctional voiding, lazy bladder
- Case 3- dysfunctional voiding and constipation
- Case 4- dysfunctional voiding and VUR



Types of Voiding Dysfunction

- Minor
 - Nocturnal enuresis- decreased bladder capacity, inability to concentrate urine, sleep arousal disturbance
 - Giggle incontinence (enuresis risoria)- complete bladder contraction
 - Stress incontinence (28% of female athletes)- slight leakage
 - Post void dribbling
 - Frequency/urgency syndrome

Work up

- History
 - UTIs
 - Pattern of urination and wetting
 - Frequency of wetting
 - Constipation and defecation history
- PE
 - Lower back, rectal exam
 - Abdominal exam- palpable stool
 - Male- circumcision status, urethral meatus
 - Female- labia, urethral meatus, welling of urine

Work up

- Laboratory tests
 - Urinalysis to rule out: bacteruria, glucosuria, osmolality
 - Rarely obtain BUN & creatinine
- Voiding diaries
 - Very informative if done well!

Work up

- Imaging
 - PVR check
 - Renal bladder sonogram
 - KUB
 - VCUG
 - MRI of spine

Work up

- Studies
 - Uroflow
 - Uroflow with EMG
 - Urodynamics
 - Standard
 - With suprapubic catheter
 - Natural fill
 - Ambulatory
 - Video-urodynamics

Relevant Anatomy

- The detrussor is composed of three layers of smooth muscle but the layers are not distinct and act together. Contractions occur with electromechanical coupling, so that individual cell contractions begin with pulling from adjacent cells, not by direct neuronal excitation. Pathologic changes can therefore occur in alteration of ultra structural changes and thus function.
- Voluntary and autonomic nervous system involved
- Areas of functional difference: detrussor, trigone and bladder neck, and urethral sphincter

Relevant Anatomy

- Autonomic
 - Sympathetic- T11 – L2
 - Hypogastric nerve to bladder, bladder neck, and urethra
 - (Pelvic nerve)

Relevant Anatomy

- Parasympathetic
 - S2 – S4
 - Pelvic nerve to bladder

Relevant Anatomy

- Somatic
 - Voluntary – Onuf's nucleus
 - S2 – S4
 - Pudendal nerve
 - Pelvic muscles
 - External urethral sphincter (EUS)

Filling or Storage Phase

- Sympathetic mediation
 - Relaxation of detrussor
 - Increase tone of trigone to close bladder neck (and EUS)
- Somatic
 - Increase tone to EUS

Voiding Phase

- Somatic
 - Relaxation of EUS
- Parasympathetic
 - Opening or funneling of bladder neck
 - Bladder contraction

Dysfunctional Voiding

- Malfunction during voiding only.
- Term used to describe all abnormal patterns of urination
- Term also used to describe specific abnormal urination where bladder, bladder outlet, and external urethral sphincter are not coordinated thus resulting in urinary tract dysfunction leading to urinary urgency, urinary incontinence, UTIs, hydronephrosis, and acquired VUR not associated with neurologic dysfunction.
- Confusing definitions