Urodynamics Assessment & Urotherapy in Children

APN Ng Wai Hing

Department of Surgery
QEH
Nursing Management in Children with Nocturnal Enuresis

 dak Assessment

 dak Investigations

 dak Urotherapy Program

 dak Support
Urodynamic Study

Cystometry (CMG)

Become synonymous with pressure / flow studies (cystometry or video cystometry)
What is Urodynamics Assessment?

Dynamic functional study of the lower urinary tract
Urodynamic Study

- Comprise of a series of tests
- Diagnostic investigations for patients with urinary incontinence or bothersome LUTS during bladder filling or voiding
- Identify causes of urine storage & voiding dysfunction
Aims of Urodynamics Studies

- To reproduce patient’s symptoms
- To correlate patient’s symptoms with the underlying urodynamic findings
- To define detrusor & urethral function during both filling & voiding
- To establish a precise diagnosis
Types of Assessment

Non-invasive

- History taking
- Frequency-volume chart (FVC) / Bladder diary
- Uroflowmetry
- Bladder scanning
Types of Assessment

Invasive

- Cystometrogram (CMG)
- Video cystometrogram
- Ambulatory urodynamics
- Electromyogram (EMG)
Assessment

History Taking

- Developmental milestone
- Medical, e.g. organic lesion, operation
- Urinary function
- Bowel habit
- Diet habit
- Behavioral / Emotional problems
- Medication
- Family history / problems
Assessment

Physical Examination

❤️ Body weight / height
❤️ Urinalysis & urine culture
❤️ Abdomen palpation
❤️ Inspection of LS Spine
❤️ Neurological assessment
❤️ Genitalia
**FV Chart / Bladder Diary**

- Recording fluid intake & urine output per 24 hrs
- No. of voiding & voided volume
- Distribution of voiding between daytime & nighttime
- Episodes of urgency / leakage / incontinence

### Bladder Diary

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**Note:**
- Water: Includes any drinks, e.g., boiled water, milk, fruit juice, etc.
- Urine: 1 = Little; 2 = Ordinary; 3 = Much
Bladder Diary

- **Urinary frequency**
  - Normal 4–7 times per day

- **Voided volume**
  - Expected volume: \((\text{Age} + 1) \times 30\text{ml}\)
  - Range: 65%–150% of expected volume
Investigations

- KUB
- XR Spine
- USG Urinary tract
- Uroflowmetry
- Bladder scan
- Urodynamic study
- +/- MRI Spine
Uroflowmetry

A non-invasive test used to measure pattern, rate & quality of urine flow
Normal Uroflow Pattern

Bell Shape
Abnormal Uroflow Pattern

- Tower
- Plateau
- Staccato
- Interrupted
Uroflow Rate

- **Maximum flow rate (Qmax):**
  - > square root of voided volume
  - Assess bladder outflow
  - Peak level ≥ 2 sec

- **Average flow rate (Qave):**
  - 50 – 85% of Qmax
Bladder Scanning

A non-invasive portable USG instrument that measures post void residual (PVR)
Bladder Scanning

- Normal PVR < 20ml or < 10% EBC (ICCS, 2006)

- Normal PVR (ICCS, 2014)
  
  *For children 4 – 6 yo*
  - Single PVR < 30ml or < 21% EBC
  - Repetitive PVR < 20ml or < 10% EBC

  *For children ≥ 7 – 12 yo*
  - Single PVR < 20ml or < 15% EBC
  - Repetitive PVR < 10ml or < 6% EBC
Pressure / Flow Cystometry

- Subtraction Cystometry (CMG)
- Videocystometry (VCMG)
- Ambulatory urodynamics
Cystometry (CMG)

- Interpreted findings with comprehensive history & examination
- An objective functional test of bladder & urethral function
- Provides valuable information regarding storing & emptying functions of bladder
Indications

- Neurogenic bladder dysfunction
e.g. Myelomeningocele, occult spinal dysraphism, sacral agenesis

- Non-neurogenic
  e.g. epispadias / exstrophy complex, posterior valves, incontinence, overactive bladder

- Voiding dysfunction associated with significant bladder hypertrophy, VUR or upper urinary tract damage, or detrusor sphincter dyssynergia
Measurements via Cystometry

- Bladder capacity
- Bladder sensation
- Bladder compliance ($\Delta V / \Delta P_{det}$)
- Detrusor stability
Phases of Cystometry

- Filling/storage phase
- Voiding phase

[Graph showing pressure and volume phases]
Pressure Parameters of Cystometry

\( P_{\text{ves}} \) : Intravesical pressure

\( P_{\text{abd}} \) : Intra-abdominal pressure

\( P_{\text{des}} \) : Detrusor pressure \((P_{\text{ves}} - P_{\text{abd}})\)
Electromyogram (EMG)

- To assess the synergy between the bladder & urethral sphincter mechanism during voiding

Types:
- EMG surface patch electrodes placed on pelvic floor
- Fine needle electrodes placed directly into per-urethral striated sphincter to diagnose neuropathy
Conventional CMG
Wireless / Ambulatory UD

- Signals transmission from pressure transducer to computer via Bluetooth connection
- Conventional fill
- Natural fill
Wireless / Ambulatory UD

Child-friendly environment

- ↓ Anxiety
- Allows natural behavior of the child and bladder
Ambulatory UD

Natural Fill

Physiological Fill

Hydration by

- NS infusion through IV line
  @ 10–20 ml/kg/hr over 1 hour
- Drinking fluid
Ambulatory UD

Conventional Fill

- Use artificial filling into bladder
- NS infusion through suprapubic catheter @ 5% of expected bladder capacity/min
CMG Result

Investigation conclusion

Normal bladder compliance
Multiple D.O. especially bladder > 100ml
~30-90cmH2O accompany with urgency sensation until patient cannot hold & void
VV 166ml, emptying efficiency 91%
Qmax 17ml/s, voiding pressure 90-110cmH2O
Tower shape curve

Impression:
PNE with both component of D.O. & nocturnal polyuria

Management: For drug (oxybutynin + minirin) and alarm clock
Urotherapy

Non-Surgical

Non-pharmacological

Cognitive, Behavioral, Physical Therapy

Individualized Treatment Plan
Urotherapy Program

Main goal

- To normalize bladder function by active cooperation of the child & parents (Lane et al, 2002)
- To achieve social continence for these children
- To boost their self-esteem & morale
- To improve their quality of life
Strategies of Urotherapy Program

- Education / counseling / support
- Behavioural Modification
- Motivational Therapy
- Enuresis Alarm
- Bowel Management Program
- Biofeedback Therapy
Parents’ attitude

❤ Be considerate & patience

❤ Reward & encouragement
Education

❤️  Anatomy & Physiology

❤️  Explain on micturation mechanism

❤️  Involve children: age appropriate approach

❤️  Aids with appropriate toys, diagrams, x-rays, pamphlets

❤️  Identify the problem, severity, underlying cause
Behavioral Modifications

- Dietary modification
- Voiding strategies
- Proper voiding posture
Behavioral Modification (1):
Dietary Modification

❤ Adequate fluid intake

Daily intake:
< 10kg child: 100ml/kg
10kg child: ~ 1000ml
20kg child: ~ 1500ml
Behavioral Modification (1): Dietary Modification

♥ Scheduled drinking routine

♥ Avoid fluid intake 2 hours before sleep

♥ Avoid & black-list irritant fluids / food
e.g. caffeine, dairy, citrus, artificial sweeteners, sugars
Behavioral Modification (1):
Dietary Modification

High fiber diet

Daily requirement of fiber
= (age + 5) grams

Well-balanced meals and snacks

× Fast foods & junk foods
× Chocolate
Behavioral Modification (2): Voiding Strategies

 Loving Timed voiding
 - Q2–3H,
 - Before bed time
 - Alarms / watches

DON’T hold the voiding & void at the last moment
Behavioral Modification (2): Voiding Strategies

❤ Double voiding
- Delayed second void
- For improved emptying
Behavioral Modification (2): Voiding Strategies

❤ Urination with relaxation

- “Sigh”, count or sing during urination
- For proper perineal muscle relaxation
Behavioral Modification (3): Proper Voiding Posture

❤️ Put underwear and pants all down to ankles
❤️ Proper straddling, NO tight legged
❤️ Reverse seating if necessary
❤️ Lean forward
❤️ Suitable toilet seat size
❤️ Foot rest
Motivational Therapy

💖 Rewards
  - Not for dry bed only

💖 Star chart

💖 Reassurance & positive reinforcement
Star Chart
月份：_________
月份: ________
Motivational Therapy

♥ Take responsibility to change bed linen
Enuresis (Bedwetting) Alarm

♥ Bedside alarm

♥ Miniature body worn alarm
Enuresis (Bedwetting) Alarm

❤️ Used as 1st line treatment

❤️ Detect wetness (1st drop of urine) & sound alarm

❤️ Conditioning:
   In response to a full bladder & contract pelvic floor muscles

❤️ ↑ nocturnal bladder reservoir function
Enuresis (Bedwetting) Alarm

- Motivated child & parents
- Trial & early follow-up
- Effectiveness
  - Success for 14 consecutive dry nights
- Treatment for 2–3 months
- Vibrating alarm for hearing impairment child
Bowel Management Program

- Fecal disimpaction
- Dietary advice
- Bowel habit
Enema

Microlax  Fleet enema  Saline solution
Fleet Enema

3 – 6ml / kg / dose
No more than 1 tube per day

Alert:
Phosphate intoxication,
Hyperphosphataemia,
Use caution in renal impaired patient
Ideal Position for Fecal Disimpaction

“Buttocks-up & Head-down”
Dietary Advice

High fiber diet
Daily requirement of fiber
  = (age + 5) grams

Fruit juice instead of soft drinks
Drink more fluids, esp. water
Well-balanced meals and snacks
		× Fast foods & junk foods
		× Drinks with caffeine, e.g. cola drinks & tea
		× Chocolate
Toilet Training

AIM

❤️ Regular bowel habit

❤️ Prevent rectal over distension

❤️↑ children’s awareness of the sensation of rectal filling

❤️ Help children accept responsibility & needs for their actions
Toilet Training

- Start from age 2–3
- Sit on the toilet after meal / early morning
- Comfortable toilet environment
- Proper posture for defecation
- DON’T ignore urge sensation
- NO rush!! (enough time: 15 – 20 mins)
- Give reward when defecation in the toilet
Proper posture for defecation

- Back straight
- Lean forward
- Knees higher than hips
- Bulge out abdomen
- Suitable toilet seat size
- Foot rest (to flatten the anorectal angle & aid in stool passage)
Biofeedback

❤ Provides visual or auditory information to patient regarding physiologic event

❤ For dysfunctional voiding / DSD
Biofeedback bird
Biofeedback sea star
Thank you...
Bristol Stool Form Scale

- **Type 1**: Rabbit droppings. Separate hard lumps, like nuts (hard to pass).
- **Type 2**: Bunch of grapes. Sausage-shaped but lumpy.
- **Type 3**: Corn on cob. Like a sausage but with cracks on its surface.
- **Type 4**: Sausage. Like a sausage or snake, smooth and soft.
- **Type 5**: Chicken nuggets. Soft blobs with clear-cut edges (passed easily).
- **Type 6**: Porridge. Fluffy pieces with ragged edges, a mushy stool.
- **Type 7**: Gravy. Watery, no solid pieces ENTIRELY LIQUID.
Hair / Birth Mark

Sacral Dimple