URODYNAMIC STUDIES (UDS) in PEDIATRIC PATIENTS

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PESPOS 2013, Vienna
Topics

- Definition
- Indikation
- How to perform urodynamic studies in pediatric patients?
- Tips and tricks
- Interpretation of UDS
- How does UDS influence our therapeutical decisions?
Definition

By definition of the International Continence Society, any investigation which delivers information about lower urinary tract (dys)function, is a part of urodynamics.

- Voiding & defecation history and charts
- Physical examination
- Uroflowmetry +/- EMG
- Ultrasonography of LUT, pelvic floor

- VCUG
- (Video)cystometry

\{ noninvasive

\{ invasive
Indikations

Invasive UDS are reserved for patients where the noninvasive methods still do not deliver enough information to fell the therapeutical decision.

- functional voiding problems (LUTS)
  - OAB
  - Dysfunctional voiding
  - UAB

- neurogenic bladder
- anatomic anomalies
  - PUV, AUV
  - obstructing ureteroceles
  - anorectal malformations

To ensure safe bladder pressure and to protect the kidney function.

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How to perform urodynamic studies in pediatric patients

- Children need a child friendly environment.

- The presence of the parents is essential.

- You have to have everything ready before you start the study.

- You have only one chance to perform a successful measurement!
Technical equipment

• **Chatheter (vesical)**
  - water filled
  - air charged (not available in small size)
  - small (6-8 Ch.)
  - placed after application of anaesthetic lubricant

• **Chatheter (rectal)**
  - better if ampulla recti is empty

• **EMG-electrodes**

• **Measurement unit**

• **X-ray for fluoroscopy (videourodynamics)**
What do we measure?

- Pressures
  - **vesical**: $P_{ves}$
  - **abdominal**: $P_{abd}$
  - **urethral**: $P_{ura}$
  - *calculated* $P_{det}$

- Muscle activity
  - *mostly surface electrodes*

- Flowrate
Catheter approach

**Suprapubic**

**Pro:**
Seems to be superior to evaluate the filling phase.

**Contra:**
Sedation or anaesthesia, recovery, time-consuming.

**Transurethral**

**Pro:**
Quick and easy to apply

**Contra:**
Challenging in children with sensibility in the urethra.

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Natural filling

**Pro:**
It is physiological and produces less artefacts.

**Contra:**
Time-consuming, need of special equipment.

Slow filling

Filling with saline, water or contrast-medium in room or body temperature.

**Pro:**
faster, no need of special equipment.

**Contra:**
not physiological
Filling cycles/-rate/-volume

How many cycles?
• More than one filling is indicated in case any anomaly is found at the first filling.
• If the your time and the situation allows you to do, try to repeat the filling.

Filling rate:
• 5-10% of expected bladder capacity/min .
• In OAB < 10ml/min .

Filling volume: (no strict guidelines)
Stop filling: by strong desire to void
  if micturation occurs
  if $P_{det}$ >40 cm H2O (continuously)
  if the filling volume eceeds 150% of EBC for age.

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Tips & Tricks
Interpretation

What are we looking for?

- Bladder sensation
- Detrusor function
- Bladder capacity and compliance
- Urethral function and incontinence
- Pressure flow studies
**Bladder sensation**

- Only applicable in older children and adolescents.

- A strong desire to void is the most common sensation that children can express.

  *Try to visualize*

  *Would you wait until you reach the next level in your game? Would you start asking for the next WC in the shopping center?*

- Whenever filling exceeds EBC for age and no sensation is reported, we can use the term reduced bladder sensation.
Detrusor function

- Normal detrusor function allows filling with little or low change in pressure without involuntary phasic contractions.

- Any detrusor activity observed in children and infants before voiding is pathological.

- **Detrusor overactivity** = *involuntary detrusor contractions* that are spontaneous or provoked during the filling phase, involving a *detrusor pressure increase of greater than 15 cm H2O above the baseline.*
Detrusor overactivity
Bladder compliance

- Relationship between the change in bladder volume ($\Delta V$) and change in detrusor pressure ($\Delta P_{det}$)

$$C = \frac{\Delta V}{\Delta P_{det}} \text{ (ml/cmH20)}$$

- Compliance changes according to bladder volume, it varies with age. It should be related to bladder capacity.

- Detrusor pressure can be affected by the filling rate. Prefer slow rates in children and infants.

- There are no reliable reference values in infancy and childhood.

- More important than numerical values, is the shape of the filling curve (linear or nonlinear).

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Urethral function/ incontinence

Is usually assessed in children by pelvic floor EMG, mostly by skin electrodes.

Urethral relaxation incontinence is defined as leakage due to urethral relaxation without increased abdominal pressure or detrusor overactivity.

Urodynamic stress incontinence is defined as involuntary urine leakage by increased abdominal pressure in absence of a detrusor contraction.

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Leak point pressure (LPP)

• Abdominal LPP: intravesical pressure at which urine leakage occurs due to increased abdominal pressure in absence of a detrusor contraction.

• Detrusor LPP: excludes any abdominal component to bladder emptying, such as straining, but it includes voluntary tightening during voiding.

• High LPP indicates that there is a risk of upper urinary tract damage.

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Although pressure flow relationships can be evaluated in infants and children, these measurements are rarely made because of their low clinical relevance in this age group.
How does UDS influence our therapeutical decisions?

- **UDS should be performed or at least interpreted by the person or team who is familiar with the clinical history of the patient, specially if this person is also the one who makes the decision for the further therapy.**

- **UDS is only one important brick in the wall, but it is not the whole truth.**

- **The therapeutical decision making should include all clinical and social aspects of the patient.**