Detrusor Leak Point Pressures (DLPP) in Patients with Relevant Neurological Abnormalities

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Dr. Ahmet Özgür Güçtaş

Background

- McGuire, 1981
  - Observations of videourodynamic studies of children with MMC and UI secondary to impaired bladder compliance
  - DLPP was found to predict the upper urinary tract deterioration (UUTD)*
- Further applied to different etiologies of neurogenic lower urinary tract dysfunction (N-LUTD) in adults

*McGuireMcGuire EJ, Woodside JR, Borden TA. Upper urinary tract deterioration in patients with myelodysplasia and detrusor hypertonia: a followup study. J Urol 1983;129:823-6.

The ICS definition of DLPP

- The lowest detrusor pressure at which urine leakage occurs in the absence of either a detrusor contraction or increased abdominal pressure*

*Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, van Kerrebroeck P, Victor A, Wein A; Standardisation Sub-committee of the International Continence Society. The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. Neurourol Urodyn. 2002; 21:167-78.

Controversies

- The exact value of DLPP to predict UUTD is debatable
- Measuring DLPP lacks standardization and carries pitfalls
- A common mistake:
  - Using DLPP in N-LUTD during detrusor contractions (neurogenic detrusor overactivity) instead of reduced bladder compliance

The ICS Urodynamics Committee Teaching Module

- Webcasted presentation in combination with a manuscript

- A standard education of Good Urodynamic Practice for everyone, who is caring for patients with N-LUTD

*http://www.icsoffice.org/eLearning/..... or via the QR code on this page.

Introduction

- The presentation
  - testing requirements, clinical workup and analysis
- The manuscript
  - scientific background review and the evidence base for the ICS Power Point presentation*
- Aim
  - To standardize and improve the method of DLPP measurement in patients with N-LUTD to minimize performer- and patient dependent variations

*http://www.icsoffice.org/eLearning/..... or via the QR code on this page.

Preparation and Technique

- Should be in accordance with:
  - ICS reports on Good Urodynamic Practices (GUP) and urodynamic equipment performance*
  - The International Children's Continence Society (ICCS) report on the standardization of terminology of LUT function**

*Schäfer W, Abrams P, Liao L, Mattiasson A, Pesce F, Spangberg A, Sterling AM, Zinner NR, van Kerrebroeck P; International Continence Society. Good urodynamic practices: uroflowmetry, filling cystometry, and pressure-flow studies. Neurourol Urodyn. 2002;21:261-74.

**Nevéus T, von Gontard A, Hoebeke P, Hjälmås K, Bauer S, Bower W, Jørgensen TM, Rittig S, Walle JV, Yeung CK, Djurhuus JC. The standardization of terminology of lower urinary tract function in children and adolescents: report from the Standardisation Committee of the International Children's Continence Society. J Urol. 2006;176(1):314-24

Technique I

- Standard urodynamic equipment
- Patients in supine position with empty bladder
- ICI recommends sitting position in suitable patients (grade B)*
- No evidence for the influence of specific positioning of patients with N-LUTD on the DLPP

*Rosier P.F.W.M., Kuo H-C, De Gennaro M, Kakizaki H, Hashim H, Van Meel TD, Hobson PT. Urodynamic Testing. In 5th International Consultation on Incontinence, Paris February, 2012.Editors: Paul Abrams, Linda Cardozo,Saad Khoury, Alan Wein. 5th EDITION 2013.

Technique II: Catheter

- Using progressively larger catheters increase DLPP
  - Small cystometry catheter (≤10 F)
  - As thin as possible, 'one-catheter-systems' LoE 4*
  - 5-8 F double lumen cystometry catheters during water cystometry
- Underestimation of DLPP when suprapubical catheter is used

*Rosier P.F.W.M., Kuo H-C, De Gennaro M, Kakizaki H, Hashim H, Van Meel TD, Hobson PT. Urodynamic Testing. In 5th International Consultation on Incontinence, Paris February, 2012.Editors: Paul Abrams, Linda Cardozo,Saad Khoury, Alan Wein. 5th EDITION 2013.

Technique III: Filling rate

- Not standardized in the ICS GUP
- Usually done with a rate dependent on age (from 20ml/min in children to 30-60 ml/min in adults)
  - Detrusor adaptation to volume (compliance) may be challenged in high filling rates
- Classified as physiologic and non-physiologic by ICS rather than slow-medium-rapid*

*Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, van Kerrebroeck P, Victor A, Wein A; Standardisation Sub-committee of the International Continence Society. The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. Neurourol Urodyn. 2002; 21:167-78.

Technique IV

- Day-to-day bladder capacity by using voiding or catheterization diary-volumes
- 5-10% of known or predicted capacity may be used in children*
- Slow filling rate needed in adult neurogenic patients with a known hypocompliant bladder (EO)

*Nevéus T, von Gontard A, Hoebeke P, Hjälmås K, Bauer S, Bower W, Jørgensen TM, Rittig S, Walle JV, Yeung CK, Djurhuus JC. The standardization of terminology of lower urinary tract function in children and adolescents: report from the Standardisation Committee of the International Children's Continence Society. J Urol. 2006;176(1):314-24

Technique V

- Infusion pump devices rather than gravity-type infusion systems
  - Avoid iatrogenic bladder pressure increases
- The influence of fluid temperature on DLPP is never studied
- More accurate representation of bladder activity with natural fill (ambulatory) cystometry in children

Technique VI

- Detection of urinary leakage
  - One person observing for leakage and another observing the recording and marking pressures
  - More accurately, fluoroscopic visualization of contrast around the catheter
- Cystometry may be stopped when*;
  - Pdet exceeds 40 cmH2O
  - Maximum bladder volume at intermittent catheterization is reached
  - A detrusor contraction occurs

*McGuire EJ, Cespedes RD, O'Connell HE. Leak-point pressures. UrolClin North Am. 1996;23:253-62

Technique VII

- End filling pressure (EFP)
  - When the cystometry is ended without leakage
- Neurogenic Detrusor Overactivity Leak Point Pressure (N-DO LPP)*
  - If leakage occurs with an episode of neurogenic detrusor overactivity (N-DO) any time during filling cystometry
- Detrusor Overactivity Leak Point Pressure (DO LPP)**
  - In non-neurogenic women with urgency

*N-DOLPP has not been defined yet, but suggested by the authors of this module

**Smith AL, Jaffe WI, Wang M, Wein AJ. Detrusor overactivity leak point pressure in women with urgency incontinence. Int Urogynecol J. 2012;23:443-6.

Basic Pathophysiology related to DLPP

- DLPP is the pressure which overwhelms the bladder outlet resistance and causes urinary leakage
- Reflection of the resistance of the bladder outlet or external sphincter
- DLPP > 40 cmH2O in patients with MMC were at risk of developing UUTD
- Accepted as a cutoff value without high LoE*
- Will reduction of outlet resistance improve safe bladder storage and preserve upper tracts?

*McGuireMcGuire EJ, Woodside JR, Borden TA. Upper urinary tract deterioration in patients with myelodysplasia and detrusor hypertonia: a followup study. J Urol 1983;129:823-6.

Clinical Implications I

- The absolute values of DLPP are unreliable
  - No UUT deterioration of several patients with DLPP's of >40 cmH2O in the long term follow-up*

*Combs AJ, Horowitz M. A new technique for assessing detrusor leak point pressure in patients with spina bifda. J Urol 1996; 156: 757-60.

Clinical Implications II

Neurourology and Urodynamics

Is 40 cm H_2O Detrusor Leak Point Pressure Cut-Off Reliable for Upper Urinary Tract Protection in Children With Myelodysplasia?

Tufan Tarcan,* Cagri Akin Sekerci, Cem Akbal, Ilker Tinay, Yiloren Tanidir, Ahmet Sahan, Bahadir Sahin, Tuncay Top, and Ferruh Simsek

- Higher sensitivity of 20 cm H2O DLPP cutoff to predict the risk group for UUT deterioration in children

DLPP	Percentage of patients with UUT deterioration (%)	*P*-value
>40 cm H_2O	37.8 (37/98)	0.510
20–40 cm H_2O	43.5 (27/62)	
20–40 cm H_2O	43.5 (27/62)	0.014
<20 cm H_2O	18.1 (6/33)	

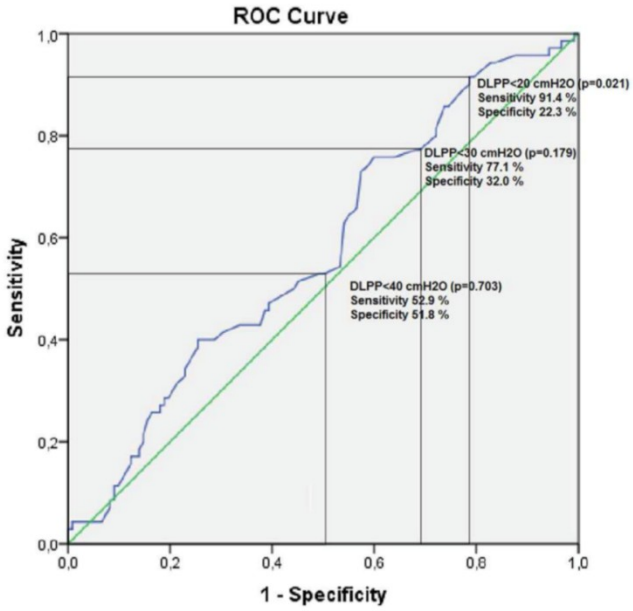


Fig. 1. UUT damage in three different DLPP cut-off values with their sensitivity and specificity is shown in ROC curve analysis.

Clinical implications III

- The (clinical) significance of N-DO LPP vs DLPP in N-LUTD?
- Similar risk for future UUT changes of frequent N-DO episodes with high LPP
  - Significant association with hydronephrosis in patients with N-DO >75 cmH2O*
  - The total duration of N-DO contractions**
    - The only statistically significant urodynamic variable for upper tract dilatation or VUR in spinal cord lesion patients

*Ozkan B, Demirkesen O, Durak H, Uygun N, Ismailoglu V, Cetinel B. Which factors predict upper urinary tract deterioration in overactive neurogenic bladder dysfunction? Urology. 2005 Jul;66(1):99-104.
**Linsenmyer TA, Bagaria SP, Gendron B et al. The impact of urodynamic parameters on the upper tracts of spinal cord injured men who void reflexly. J Spinal Cord Med 1998; 21:15-20

Clinical implications IV

- The treatment of patients with a high DLPP
  - Reducing number and amplitude of overactive detrusor contractions and improving bladder compliance

- DLPP may estimate how much and how long the urinary tract will be exposed to high pressure in-between bladder emptying periods (with or without CIC)

Clinical implications V

- Significant number of patients with N-LUTD do not leak during the study
- In patients with EFP or DLPP >40 cmH2O*
  - Increased bladder wall thickness
  - Increased urinary levels of TGF-b 1, NGF and TIMP-2
- Alternative methods, as biomarkers?

*Sekerci CA, İşbilen B, İşman F, Akbal C, Şimşek F,Tarcan T: Urinary NGF, TGF β-1, TIMP-2 and bladder wall thicknes predict neuro-urological findings in children with myelodysplasia. J Urol 2014; 191(1): 199-205.

Conclusions and recommendations I

- DLPP
  - A part of cystometric evaluation of children and adults with N-LUTD to help predicting (and preventing) UUTD (Grade B/C)
- Recommendations of ICS and ICCS should be followed for cystometric equipment and for the measurement technique

Conclusions and recommendations II

- Discrimination of high risk (for UUTD) patients on the basis of DLPP (Grade B/C)

- Not to be used as the sole parameter to decide on invasive therapies, e.g.
  - Bladder augmentation and sphincterotomy

Conclusions and recommendations III

- Other factors to predict UUTD in N-LUTD
  - Bladder compliance
  - Volume where leakage occurs
  - Duration and amplitude of detrusor contractions
  - Volume which obtained by CIC
- Low sensitivity of traditional cutoff >40 cmH2O for the prediction of UUTD

Conclusions and recommendations IV

- Future research to standardize the technique and better classify DLPP cutoffs in N-LUTD

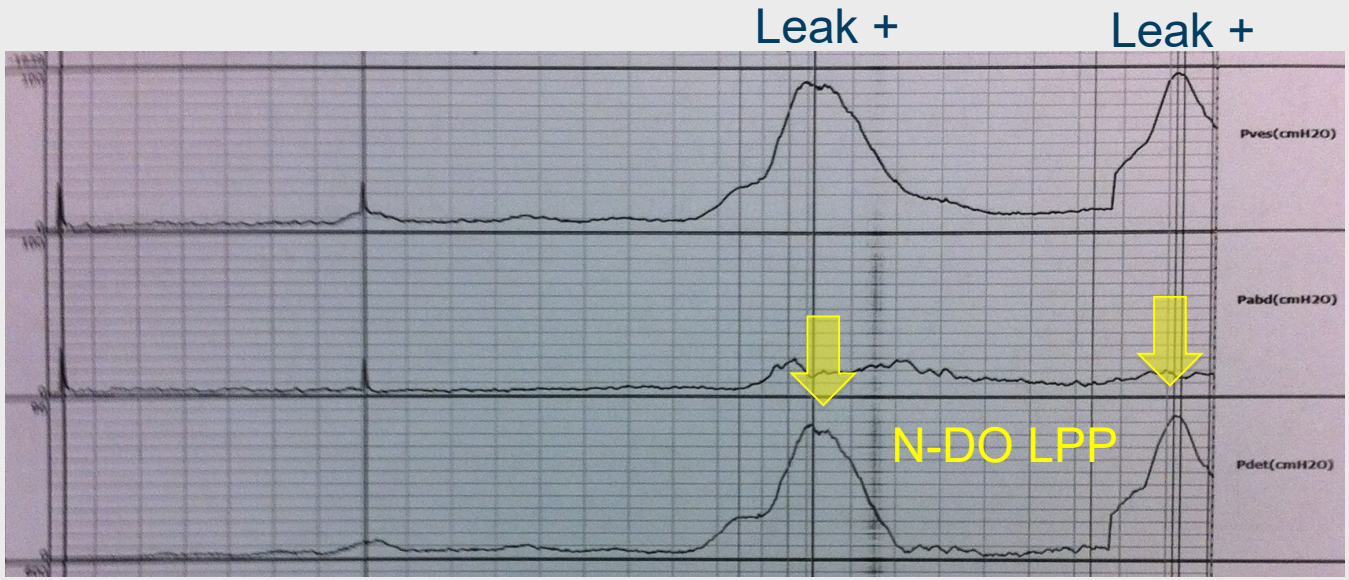
- The predictive value of LPP may differ according to underlying etiology of N-LUTD such as MMC, MS or SCI.

Conclusions and recommendations V

- Cystometric readings should be sub-classified and differentiated according to the presence of N-DO

Conclusions and recommendations V (cont'd)

- N-DO LPP: refers to the detrusor pressure that belongs to a spontanous N-DO leading to leakage during cystometry



Conclusions and recommendations VI

- EFP should be taken into consideration if the leakage does not occur during cystometry however, the clinical relevance of EFP is unclear.

Thank you