

# Uroflowmetry in the management of children`s lower urinary tract symptoms (LUTS)

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## Abstract

**Introduction and Objectives.** Epidemiological studies emphasized that, 20% of schoolaged children present lower urinary tract symptoms (EAU-ESPU). The understanding, the recognition and the proper management of LUTS in childhood, have an important role in the prevention of adult`s micturition disorders. The objective of this study is to emphasize the importance of uroflowmetry in the evaluation of children presenting LUTS, filling and voiding phase dysfunctions.

**Material and methods.** A retrospective study, based on the urodynamic findings of 108 (100%) children presenting LUTS.

**Results.** Mean age of children was 11,35 (3-16) years, 66 girls. Associated pathology: non urological (constipation-19 (17,59%), ADHD syndrome-3 (2,77%), intelectual disabilities-8 (7,40%), disorder of sleep-10 (9,25%), operated spina bifida-5 (4,62%), obesity-16 (14,81%)) urological (reccurent urinary tract infections- 34 (31,48%), asymptomatic bacteriuria-12 (11,11%), vesicoureteral reflux with conservative management 8 (7,40%), persistent VUR reflux after surgery 8 (7,40%), congenital anomalies: renal duplication- 2 (1,85%), solitary kidney:1 (0,92%), renal cyst-2 (1,85%), uretral orifice stenosis-3 (2,77%), phimosis-2 (1,85%) and hypospadiasis-3 (2,77%) cases. Storage symptoms: increased daytime voiding frequency 48 cases, 28 nocturia, 17 decreased daytime frequency, urgency 16, incontinence 32, 7 nocturnal enuresis, 87 cases (80,55%) with more than one symptom. Voiding symptoms: straining 12, weak stream 7, dysuria 15 patients. Other symptoms: holding maneuvers 11, feeling of incomplete emptying 6, 2 cases of incomplete urinary retention, post micturition dribble 3, lombar pain 1. Mixed symptoms in 12 cases. Bladder capacity: 98-474 ml, Q max :3-42 ml/sec, PVR : 0-200 ml. Curve patterns: bell 40, tower 25, staccato 13, interrupted 18, plateau shaped curve 12.

**Conclusions.** LUTS in children should have a multimodal evaluation, based on minimal invasive procedures. In case of children the most common urodynamic investigation is uroflowmetry, pressure flow studies and cystometries are indicated in refractory, complicated cases.

**Keywords:** uroflowmetry, child, micturition, LUTS, Qmax

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## Introduction, objectives:

LUTS among children show a rather high incidence, up to 20% of school-aged children are suffering, so an early recognition, and a proper management is of utmost importance in order to prevent the adult's suffering (1). Normal storage and complete emptying of the bladder is attained generally by the age of 3, while nighttime bladder control is attained later (age 4-5). Disorder of the filling, voiding phase or the combination of them, leads to various conditions such as: overactive bladder (OAB) and dysfunctional voiding (2,3). From urodynamic point of view during filling phase besides normal function, the detrusor can be overactive or underactive while voiding can be complete or incomplete, with staccato, interrupted or low amplitude prolonged flow (4). The evaluation of these conditions are based upon the following: medical, voiding history, physical examination, urinalysis, uroflowmetry, abdominal ultrasound with post – void residual urine determination (5,6,7). Uroflowmetry, the most simple method  $D=V/T$ , (8), is well tolerated by the little patients, so can be considered an optimal screening procedure (9,10).

Our retrospective study evaluates the importance of uroflowmetry in the clinical evaluation of a child presenting LUTS, in order to identify the aetiology, and to manage properly, personalised each child to prevent complications and progression of the disease.

## Material and methods:

In a 2 year period (2018-2019) at an ambulatory ward and the Urodynamic Unit of the Clinic of Urology, Tg Mures there were performed a total of 1230 urodynamic studies, 108 (8,78%) in case of children aged 11, 35 years (3-16 y.). The studies were performed with an Ellipse Andromeda, and MMS unit. Our diagnostic work up in cases of children followed the algorithm recommended by EAU-ESPU:

- Medical and voiding history
- Micturition diary (for 3 days) (fig.1)
- Urine analysis to exclude infection
- Physical examination (in order to exclude malformations, neurogenic pathology)
- Abdominal ultrasound and PVR (to evaluate emptying efficacy)
- Uroflowmetry (urine flow evaluation)
- Urodynamic studies (cystometry, pressure flow studies only in selected, refractory cases)

CALENDAR MICTIONAL

Name Medic DR: ..... Data: .....

NUME: ..... PRENUME: .....

	Ziua 1			Ziua 2			Ziua 3		
	Volu lichide consumate	Volu urina	Pierdere +minima ++ medie +++ mare	Volu lichide consumate	Volu urina	Pierdere +minima ++ medie +++ mare	Volu lichide consumate	Volu urina	Pierdere +minima ++ medie +++ mare
6-7 h									
7-8 h									
8-9 h									
9-10 h									
10-11 h									
11-12 h									
12-13h									
13-14h									
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21-22h									
22-23h									
23-24h									
24-1h									
1-2h									
2-3h									
3-4h									
4-5h									
5-6h									

Fig.1: Micturition diary (used by the urodynamic unit of the Clinic of Urology Tg Mures)

Uroflow evaluation consisted of:

- Aspect of the curve
- measuring the rate (Qmax., Qmed.)
- Voided volume
- Voiding time
- Time for Qmax.
- Acceleration, hesitancy

## Results:

From the total of 108 uroflowmetries 66 were performed in cases of girls, the rest 42 boys, 3-5 years of age 14 (12,96%), 6-10 years 32 (29,62%), 11-15 years 24 (22,22%) and 16-18 years 38 (35,18%) (fig.2). In each case there were two flowmetries performed, the one without artefacts was taken in consideration.

Concerning the associated pathology there were divided in two groups: non urological (constipation-19 cases (17,59%), ADHD syndrome-3 (2,77%), intellectual disabilities-8 (7,40%), disorder of sleep-10 (9,25%), operated spina bifida-5 (4,62%), obesity-16 (14,81%)) urological (recurrent urinary tract infections- 34 (31,48%), asymptomatic bacteriuria-12 (11,11%), vesicoureteral reflux with conservative management 8 (7,40%), persistent VUR reflux after surgery 8 (7,40%), congenital anomalies: renal duplication- 2 (1,85%), solitary kidney:1 (0,92%), renal cyst-2 (1,85%), uretral orifice stenosis-3 (2,77%), phimosis-2 (1,85%) and hypospadiasis-3 (2,77%) patients.

All of the children were sent by the pediatric nephrologist, mostly refractory cases to previous management, so the studies were not done for screening purposes.

The symptoms were classified into storage symptoms : increased daytime voiding frequency 48 cases

### Distribution of patients according to age

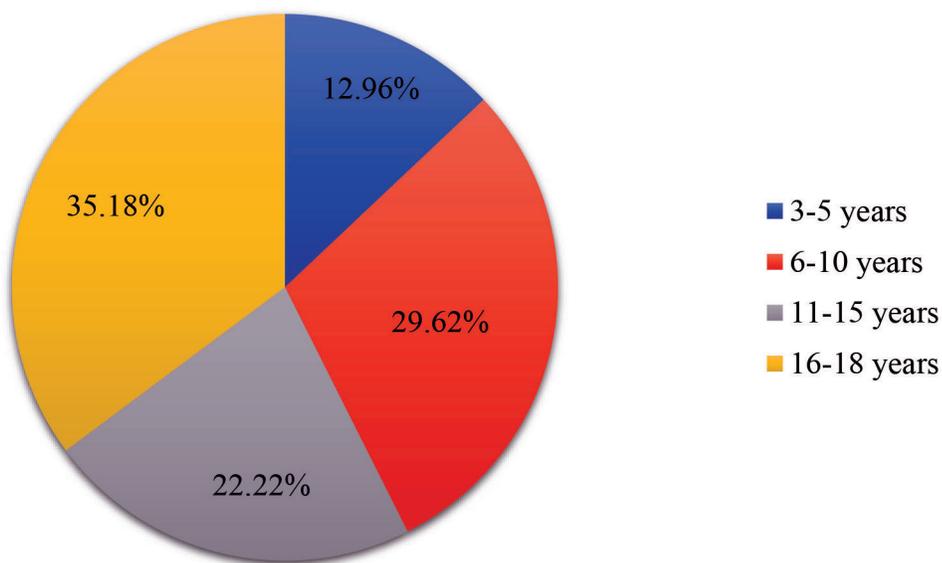


Figure nr 2: Distribution of the patients according to age

(more than 8 times)-44,44%, 28 nocturia (25,92%), 17 decreased daytime frequency (less than 3 times/24 hour)- 15,74%, urgency 16 patients (14,81%), incontinence 32 – 29,62% (9 stress and 23 urge), 7 nocturnal enuresis (6,48%), 87 children presenting more than one symptom (80,55%). Voiding symptoms were present as follow: straining 12 patients (11,11%), weak stream 7 (7,48%), dysuria 15 patients (13,88%). Other symptoms identified were the presence of holding maneuvers in 11 cases, feeling of incomplete emptying 6 children, 2 cases of incomplete urinary retention , post micturition dribble 3 cases, lombar pain in 1 case. In cases of 12 children the symptomatology was a mixed (filling and voiding) one (table nr.1).

incomplete urinary retention	2
post micturition dribble	3
lombar pain	1

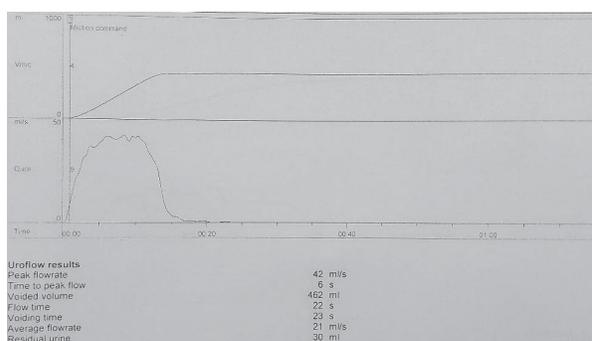
Table nr.1: Symptomatology of the children

Uroflowmetries performed identified the following results: bladder capacity between : 98-474 ml, Q max :3-42 ml/sec, PVR : 0-200 ml (table nr.2).

The curves were divided ( figure nr. 3):

- A. bell shaped curve : 40 patients
- B. tower shaped curve:25
- C. staccato shaped curve:13
- D. interrupted shaped curve:18
- E. plateau shaped curve : 12

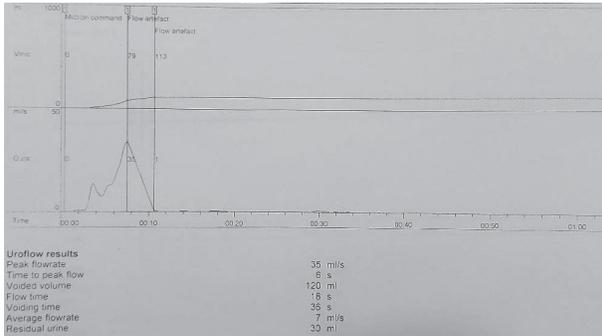
Storage symptoms	
increased daytime voiding frequency	48
nocturia	28
decreased daytime frequency	17
urgency	16
incontinence	32
stress	9
urge	23
nocturnal enuresis	7
Voiding symptoms	
straining	12
weak stream	7
dysuria	15
Other symptoms	
presence of holding maneuvers	11
feeling of incomplete emptying	6



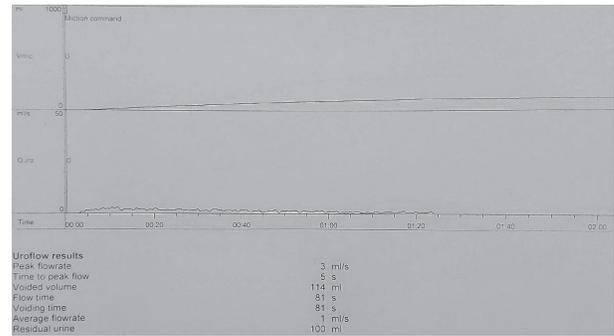
A. Bell shaped curve (Girl, 9 years old, who presented increased daytime voiding and VUR reflux )

Age group	Nr. Patients (%)	Qmax >15	Qmax=10-15 ml	Qmax<10
3-10 years	46 (42,59%)	30	2	14
11- 15 years	24 (22,22%)	12	4	8
16-18 years	38 ( 35,18%)	26	5	7
<b>Total</b>	<b>108</b>	<b>68</b>	<b>11</b>	<b>29</b>

Table nr.2: Qmax. and age group association

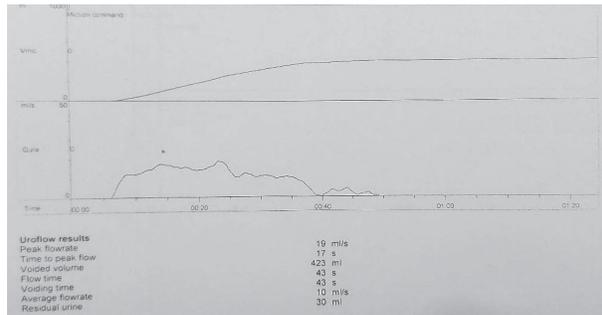


B. Tower shaped curve (Boy, 16 years old, presented polakiuria, straining, feeling of incomplete bladder emptying)

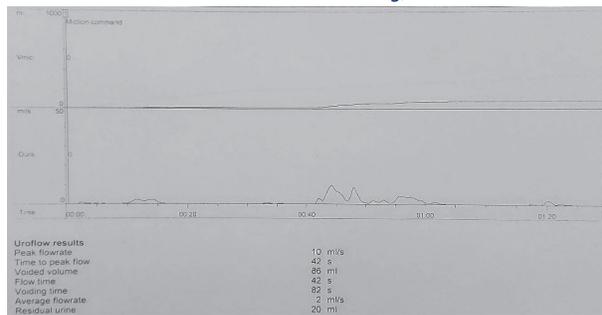


E. Plateau shaped curve (Boy, 6 years old, presented straining, dysuria, diagnosed with punctiforme phimosis)

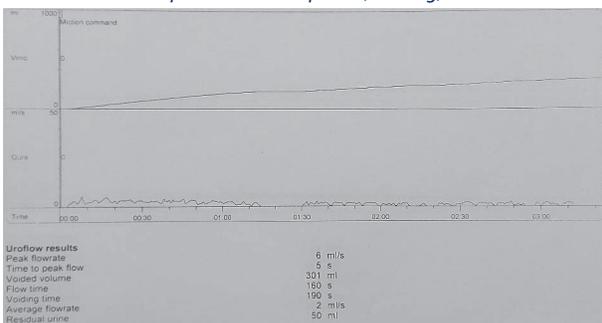
Figure nr.3 (A,B,C,D,E): Uroflow curve patterns



C. Staccato shaped curve (Girl, 8 years old, presented recurrent tract infections and straining)



C. Interrupted shaped curve (Girl, 9 years old, presented constipation, straining)



D. Interrupted shaped curve (Boy, 4 years old, stenosis of the meatus externus)

### Discussions:

Based on the recent documents proposed by the Children's Continence Society (ICCS) LUTS is the term that is suitable to use in order to group all functional bladder problems in children. Introduction of this terminology in all of the specialities dealing with children is of utmost importance. Recognition and a proper management of childhood dysfunctional voiding is an important issue for adult and children healthcare professionals because this can predict adult bladder control disorders. Studies concerning urodynamic studies in case of children are rather rare in the literature a review conducted by Keiran and co. found eight trials with data available for 1036 women (8). Our retrospective study presents data of 108 children, mainly girls, who underwent uroflowmetry in an adult health care unit. All of the children were sent by the pediatric nephrologist, mostly refractory cases to previous management. In Romania there are few centers that perform urodynamics, in Mures county there is only one center, an adult urology unit performing these investigations, for children also, this explains the low 8,78% rate of children versus adults.

Mean age of the studied group was 11,3 years (limits 3-16.), versus 10, 35 y. In a study conducted by Akil et co.(7). Micturition diary used in our diagnostic work up has an important role in the management of micturition disorders in adults and in children also, as it is emphasized in EAU-ESPU guidelines and in studies conducted by Akil, Clement (7,8). Uroflow evaluation and

flow patten classification followed the indication ICCS Standardization Committee (4). Most of the studied cases presented voiding symptomatology (increased daytime voiding frequency and /or nocturia) 44,44%. Incontinence urge and stress was present in 32 cases (29,62%) . In a study on 416 children, recruited in Turkey daytime urinary incontinence was present 6,7% of the cases (7). The combination of daytime incontinence and enuresis nocturna was present in 39 cases (36,11%) versus 45 children in a study conducted by Hyuga (9).

### Conclusions

LUTS in children should have a multimodal evaluation, based on minimal invasive procedures. By performing urodynamics in pediatric urology we can reproduce the child`s complaints and provide a physiopathological explanation for his problems.

In case of children the most common urodynamic investigation is uroflowmetry, pressure flow studies and cystometries are indicated in refractory, complicated cases.

A management based upon urodynamics of children`s lower urinary tract dysfunction (LUTD) is of utmost importance in order to prevent the adult`s suffering.

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