

## Research Article

## Comparison of Voiding and Filling Phase Abnormality Post Urodynamic with the Clinical Diagnosis in Cipto Mangunkusumo National Hospital

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### Abstract

Database on voiding dysfunction and urodynamics results are still scarce in Indonesia. Therefore, this study aimed to report the urodynamics profile in Department of Urology Cipto Mangunkusumo National Hospital, Indonesia. Data taken from 559 patients underwent urodynamics from 2015-2018 with average 140 per year. The most common pre-urodynamics clinical diagnosis was lower urinary tract LUTS (47%) followed by urinary retention, overactive bladder (OAB), stress incontinence, and pediatric voiding dysfunction (31%, 9%, 8% and 6% respectively). From 261 LUTS patients, findings revealed 141(54%) small bladder capacity, 88(34%) reduced compliance, 29(11%) detrusor overactivity (DO), 8(3%) DO with incontinence, 12(5%) and stress incontinence during the filling phase. Detrusor underactivity (DU), bladder outlet obstruction (BOO), and mixed of BOO and DU were found in 55%, 33% and 3% of patients respectively. Out of 170 urinary retention patients, we found patients with DO (16%), DO incontinence (7%), stress incontinence (4%), DU (50%), BOO (34%), and acontractile bladder (15%). Small bladder capacity (60%) and DO (40%) were the most common findings in OAB patients. Thus, in voiding phase DU and BOO are commonly diagnosed (44% and 19%) in OAB patient. On the contrary, 21% of patients with complaints of stress urinary incontinence showed stress UI (19%), DO(21%), DOI (7%), BOO(34%), and DU (44%). This study implies the role of urodynamics in diagnosing patients with various complaints of lower urinary tract problems. Furthermore, after urodynamics, problem in filling and voiding phase can be determined so that optimal treatment could be tailored based on patients' individual needs.

**Keywords:** urodynamics, voiding dysfunction, LUTS.

## Perbandingan Abnormalitas Fase Voiding dan Filling Pasca Urodinamik dengan Diagnosis Klinis di RSUPN dr. Cipto Mangunkusumo

### Abstrak

Basis data tentang disfungsi berkemih dan hasil urodinamik masih langka di Indonesia. Oleh karena itu, penelitian ini bertujuan untuk melaporkan profil urodinamik di Departemen Urologi RSUPN dr. Cipto Mangunkusumo, Indonesia. Data sampel diambil dari 559 pasien yang menjalani urodinamik pada tahun 2015-2018 dengan rata-rata 140 pasien per tahun. Diagnosis klinis pra-urodinamik yang paling umum adalah lower urinary tract LUTS (47%) diikuti oleh retensi urin, OAB, inkontinensia urine tekanan, dan disfungsi berkemih pada anak-anak (masing-masing 31%, 9%, 8% dan 6%). Dari 261 pasien LUTS, temuan urodinamik menunjukkan 141 (54%) kapasitas kandung kemih kecil, 88 (34%) compliance yang berkurang, 29 (11%) detrusor overactivity (DO), 8 (3%) DO dengan inkontinensia, 12 (5%) dan inkontinensia urine tipe tekanan selama fase pengisian. Detrusor underactivity (DU), bladder outlet obstruction (BOO), dan campuran BOO dan DU ditemukan masing-masing pada 55%, 33% dan 3% pasien. Dari 170 pasien retensi urin, kami menemukan pasien dengan DO (16%), inkontinensia DO (7%), inkontinensia urine tipe tekanan (4%), DU (50%), BOO (34%), dan kandung kemih acontractile (15%). Kapasitas kandung kemih kecil (60%) dan DO (40%) adalah temuan paling umum pada pasien OAB. Dalam fase voiding, DU dan BOO didiagnosis (44% dan 19%) pada pasien OAB. Sebaliknya, 21% pasien dengan keluhan inkontinensia urine tipe tekanan menunjukkan inkontinensia urine tekanan (19%), DO(21%), DOI (7%), BOO(34%), dan DU (44%). Penelitian ini mengimplikasikan peran urodinamik dalam mendiagnosis pasien dengan berbagai keluhan masalah saluran kemih bagian bawah. Setelah pemeriksaan urodinamik, masalah atau gangguan dalam fase filling dan voiding dapat ditentukan sehingga perawatan yang optimal dapat disesuaikan berdasarkan kebutuhan individu pasien.

**Kata kunci:** urodinamik, disfungsi berkemih, LUTS.

## Introduction

Urodynamic is a diagnostic method to assess the function of lower urinary tract (LUT) and its dysfunction.<sup>1</sup> The major functions of LUT (bladder, urethra, urethral sphincter) are urine storage and emptying (voiding). Specific interference on those processes and function are causing lower urinary tract symptoms (LUTS). Frequency, urgency, and nocturia are classified as storage symptoms, while weak, incomplete emptying, straining, and hesitancy as voiding symptoms.<sup>2</sup>

The aim of urodynamic is to make clinical observations simultaneously with LUT parameter measurements in order to imply the exact pathophysiological process underlying the patient symptoms.<sup>3</sup> Thus, this examination may either confirm a clinical diagnosis from earlier examination (pre-urodynamic) or provide a new urodynamic diagnosis (post-urodynamic). As an invasive method, specific indications for performing urodynamic are essentials. Individual with age more than 80 or less than 50 years old, post-void residual (PVR) urine more than 300 ml, maximum urinary flow rate more than 10 ml/s with severe symptoms, post-radical surgery in pelvic area, failure in invasive treatment for LUTS, voided volume less than 150 ml, and in history of neurologic abnormalities are several high-risk patient conditions indicated for urodynamic examination.<sup>4</sup>

Prevalence of LUTS and urinary incontinence (UI) reach 50% worldwide, with most of the UI came from stress UI (SUI) followed by mixed and urge UI (UII) type (50%, 40%, and 10% respectively).<sup>5</sup> In EPIC study (largest population-based survey to assess prevalence rates of OAB, UI, and other LUTS) at least one complaint of LUTS had been experienced in 66% women, with certain proportion of nocturia, UI, urgency and overactive bladder (OAB) syndrome (54.5%, 13.1%, 12.8%, and 11.8% respectively).<sup>6</sup> In Indonesia, multicentre studies in six hospitals recapitulated 13% prevalence rate of UI with the highest proportion came from wet OAB (4.1%) and SUI (4%).<sup>7</sup> No different proportion between gender and the incidence rate increased with aging. Previous study by Yunanto et al<sup>8</sup> in our centre stated that from 1091 patients underwent urodynamic 553 (50.6%) were diagnosed with LUTS. Those study also showed the role and superiority of urodynamic in diagnosing patients with voiding disorders, especially if mixed components in it. It is also important to notice that clinical diagnosis and urodynamic findings could be different that will have affected the management decision of the patients.

Big magnitude of LUTS and UI problem in Indonesia suggest that proper diagnosis methods

are essentials. Urodynamic examination is still the gold standard for diagnosing voiding disorder and the pathophysiology behind them. Therefore, profiling the usage of urodynamic is important to produce reliable voiding disorder diagnosis pattern. Database on voiding dysfunction and urodynamic results are still scarce with the latest profile of urodynamic were performed by Yunanto et al.<sup>8</sup> This study aimed to report the recent urodynamic profile in the Department of Urology dr. Cipto Mangunkusumo National Hospital (CMNH) and to compare with previous data in 2010-2015.

## Methods

This descriptive retrospective study consists of 559 patients in CMH who were examined in the polyclinics for urodynamic from January 2015 to December 2018. Patient characteristics (age, gender, pre-urodynamic diagnosis) and urodynamic parameters were retrieved from the medical records.

The pre-urodynamic diagnosis was condition of patient concluded from history taking, physical examination, and previous consultation or medications without any urodynamic examination. Those diagnosis were classified into five groups: LUTS, urinary retention, OAB, stress UI, and pediatric voiding dysfunction (age <18 years old).

In general, the examination divided into filling and voiding phase. Filling phase consisted of bladder capacity, compliance, (DO), DO incontinence, and urodynamic stress incontinence. On the other hand, filling phase examined bladder outlet obstruction (BOO) detrusor underactivity (DU), atonic bladder, detrusor sphincter dyssynergia (DSD), and combination of BOO and DU. The bladder capacity classification used in our centre are low (<250 ml), normal (250-500ml), and large (>500 ml). Bladder compliance is the shift or response in bladder pressure for a given change in volume, which was classified into low and normal compliance in this study.<sup>9</sup> While, the presence of spontaneous or provoked involuntary detrusor muscle contractions during the filling phase were defined as DO.<sup>10</sup> Urinary incontinence defined in two terms; clinical and urodynamic UI. Clinical UI is storage symptoms with any complaint of involuntary voided urine. While, urodynamic UI is involuntary voided urine in increased intravesical pressure secondary to increase abdominal pressure condition without any detrusor contraction. Those condition were confirmed during filling cystometry phase. Furthermore, DO/urge (DO) UI was defined as complaint of involuntary urine leakage started by sudden and strong needs to urinate.<sup>11</sup>

In this study, the filling phase also identified. The BOO was diagnosed with increased detrusor pressure with low urinary flow condition. In men, it was possible to identify intravesical obstruction with certain way called as bladder outlet obstruction index (BOOI) formula;  $P_{det}Q_{max} - 2 Q_{max}$ . The BOOI then classified the patients as obstructed (>40), equivocal (20-40), or unobstructed groups (<20).<sup>12</sup> Based on ICS detrusor underactivity is reduced strength and or duration of muscle contraction, leading into prolonged bladder emptying and or a failure to obtain complete bladder emptying for a normal time period.<sup>13</sup> Condition such as DSD also established in this study. DSD defined as BOO from

detrusor muscle contraction with complimentary involuntary urethral sphincter contraction based on urodynamic examination.<sup>14</sup> All data in this study were analysed using SPSS version 20.0.

**Results**

The characteristics of sample were elaborated in terms of age, year of examination, and pre-urodynamic diagnosis in Table 1. Most of the patients were men (55%). Average amount of patient underwent urodynamic per year was 140 with most of the cases were in 2017 (20%) followed by 2015 (27%), 2018 (23%) and 2016 (21%). LUTS (47%) and urinary retention (27%) had become the most common pre-urodynamic diagnosis in this study.

**Table 1. Characteristic of the Study Sample (n=559)**

<b>Characteristics</b>	<b>n (%)</b>
Gender	
Male	306 (55)
Female	253 (45)
Age group	
Pediatric (<18)	33 (5.9)
Productive (18-64)	387 (69.2)
Geriatric (>64)	139 (24.9)
Mean age	48,1±19.58
Pre-urodynamic diagnosis	
LUTS	261 (46.7)
Urine retention	170 (32)
Overactive bladder	52 (9.3)
Stress incontinence	43 (7.7)
Pediatric	33 (5.9)
Pediatric groups	
LUTS	19 (57.6)
Urinary retention	4 (12.1)
Enuresis	1 (3.0)
Neurological problems	2 (6.1)
Incontinence	5 (15.2)
Recurrent Infection	1 (3.0)
Vesicoureter reflux	1 (3.0)

The urodynamic result detailed in the Table 2. From 261 LUTS patients, the urodynamic findings revealed 141 (54%) small bladder capacity, 88 (34%) reduced compliance, 29 (11%) DO, 8 (3%) DO with incontinence, 12 (5%) urodynamic stress incontinence during the filling phase. DU, BOO, mixed of BOO and DU, and DSD were found in 55%, 33%, 3%, and 1% of patients respectively. Out of 170 urinary retention patients, small bladder capacity 81 (48%) and reduced compliance 73 (43%) were the most common filling phase urodynamic diagnosis. Thus, 85 (50%) patients with DU, 57(34%) BOO, and 26 (15%) atonic bladder were examined in

voiding phase. In OAB patients, small bladder capacity (60%) and DO (40%) were the most common findings. Two of OAB patients showed urodynamic stress incontinence during urodynamic. In voiding phase, DU (48%) and BOO (37%) took major proportion in OAB group. On the contrary, 44% of patients with complaints of stress urinary incontinence showed stress UI (19%), DO (21%), DOI (7%), BOO (34%), and DU (44%) post-urodynamic. Among 33 (8%) paediatric patients, LUTS were the most common pre-urodynamic diagnosis (58%), with most of them presented with BOO (63%) and DU (42%) in voiding phase.

Table 2. Comparison of Voiding and Filling Phase Abnormality Post Urodynamic with its Clinical Diagnosis

Pre-urodynamic Diagnosis	Post urodynamic diagnosis										
	Small Bladder Capacity n (%)	Reduced Compliance n (%)	Detrusor Overactivity n (%)	DO Incontinence n (%)	Stress Incontinence n (%)	Bladder outlet Obstruction n (%)	Detrusor Underactivity n (%)	Atonic Bladder n (%)	DSD n (%)	Mixed Intravesical obstruction with DU n (%)	
LUTS	261	141 (54)	88 (34)	29 (11)	8 (3)	12 (5)	85 (33)	144 (55)	8 (3)	2 (1)	8 (3)
Urinary retention	170	81 (48)	73 (43)	28 (16)	12 (7)	6 (4)	57 (34)	85 (50)	26 (15)	4 (2)	23 (14)
Overactive Bladder	52	31 (60)	12(23)	21 (40)	5 (10)	2 (4)	19 (37)	25 (48)	2 (4)	0 (0)	7 (13)
Stress Incontinence	43	23 (53)	18(42)	9 (21)	3 (7)	8 (19)	8 (19)	19 (44)	1 (2)	0 (0)	2 (5)
Pediatric	33	25 (76)	20 (61)	14 (42)	4 (12)	2 (6)	13 (39)	13 (39)	3 (9)	0 (0)	6 (18)
LUTS	19	13 (68)	13 (68)	10 (53)	2 (11)	1 (5)	12 (63)	8 (42)	2 (11)	0 (0)	6 (32)
Urinary retention	4	4 (100)	3 (75)	1 (25)	0 (0)	0 (0)	1 (25)	2 (50)	0 (0)	0 (0)	0 (0)
Enuresis	1	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)
Neurology problem	2	1 (50)	1 (50)	1 (50)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Incontinence	5	4 (80)	2 (40)	1 (20)	1 (20)	1 (20)	0 (0)	2 (40)	0 (0)	0 (0)	0 (0)
Recurrent Infection	1	1 (100)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Vesicoureter reflux	1	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)
<b>Total</b>	<b>559</b>	<b>301</b>	<b>211</b>	<b>101</b>	<b>32</b>	<b>30</b>	<b>182</b>	<b>286</b>	<b>40</b>	<b>6</b>	<b>46</b>

## Discussions

International continence society (ICS) has standardized the protocol for urodynamics, which comprises of clinical history taking, relevant clinical examination in abdominal, pelvic, and genital area, confirmation for possible neurological abnormalities, three days of bladder diary implementation, uroflowmetry with post-void residual (PVR), cystometry, and pressure flow studies examination (PFS).<sup>15</sup> We were performing examination in this study sample based on those guidelines to obtain full patient data and produce reliable post urodynamic diagnosis for further intervention plan.

As gold standard for diagnosing voiding disorder and its pathophysiology, certain sensitivity and specificity of urodynamic are measured to diagnose specific conditions. Javle et al<sup>16</sup> postulated that urodynamic or pressure-flow study has a sensitivity of 87% and specificity of 93% for detecting BOO due to prostate enlargement. While, in all types of urinary incontinence, Colli et al<sup>17</sup> stated that this examination produced lower specificity and sensitivity rate with the best rate came from stress type (sensitivity of 82% and specificity of 57%) followed by urge (69% and 60%), and mixed UI (51% and 66%). Previous preliminary study by Yunanto et al<sup>8</sup> also detailed the profile of urodynamic patient in our centre. In both of the study, the sample were dominant in males, all pre-urodynamic diagnosis classification was the same, the patient post urodynamic diagnosis was classified into filling or voiding phase problems. LUTS and urinary retention still become the most prevalent reasons for urodynamic in both studies. Our study included smaller sample (1092 patients) compare to Yunanto et al<sup>8</sup> (559 patients).

Most of the clinical diagnoses of LUTS and urinary retention had small bladder capacity (54% and 48%) and reduced bladder compliance (34% and 43%) post urodynamic. Those condition were also proved to be caused by other filling phase problems such as DO (11% and 16%), DO incontinence (3% and 7%), and stress UI (5% and 4%). LUTS and urinary retention problems might be originated from primary causes (neurological abnormality) or continuous obstruction that gradually impaired the function of bladder contraction in the filling phase.<sup>18</sup> Therefore, urodynamic examination is essentials in patient came with LUTS and urinary retention condition.

Furthermore, 40% and 10% of the patient with pre-urodynamic diagnosis of OAB had confirmed to suffer from DO and DO incontinence post-

urodynamic. Those proportion are smaller compare to Yananto et al<sup>8</sup> study, which elaborated 60% and 64% clinically diagnosed OAB are confirmed to have DO. In our study, there might be an over diagnosis of OAB in clinical settings. Those phenomena might occur because OAB complaints could also be triggered not only by involuntary contraction of the bladder but also relied on the bladder capacity, which almost 60% of OAB patients had small bladder sizes. Furthermore 11% of patient in LUTS, 16% in retention, and 21% in stress incontinence were identified as DO in urodynamic. Those results suggested that not all DO manifest as OAB in clinical sign and symptoms. Around 4% of clinical diagnosed OAB patient suffered from urodynamic stress UI. This finding might be due to an incorrect clinical diagnosis before urodynamic or because of the presence of a mixed incontinence component in those patients. The implication of this circumstances is OAB treatments will not fully relieved the patient condition. From 43 patients with a clinical diagnosis of SUI, 53% had small bladder capacity and 42% reduced compliance. Urodynamic stress UI (19%), DO (21%), and DO incontinence (7%) also existed in certain proportion. In voiding phase of patient with OAB and SUI, we also found BOO, DU, and mixed of BOO with DU. Those findings suggested that secondary occurrence of OAB might triggered by the presence of BOO. High PVR in certain proportion might also clinically manifest as frequency symptoms such as OAB. In chronic OAB patient, urodynamic BOO result might be existed due to functional obstruction. For stress urinary incontinence, BOO might be diagnosed due to initial pelvic organ prolapse in the patient.

In previous study, both of LUTS and retention complaint had significant percentage of BOO, DU, and atonic bladder. Those results implied that treatment plan of patients presenting with LUTS or retention with the presence bladder contraction function disturbance had to treat for both of intravesical obstruction and its contraction abnormality. In our study, 33% of patient with LUTS were having BOO. Thus, higher proportion of LUTS were found in bladder contractions impairment (DU 55%, atonic bladder 3%). Urinary retention patient (34%) also gave the same pattern regarding obstruction (50%), and bladder impairment proportion (15%). In several cases, combination of obstruction and DU were urodynamically confirmed. Around 14%, 13%, and 3% mixed BOO and DU were found in urinary retention, OAB, and LUTS patient. These groups had a possibility of persisting

complain despite of the obstruction release. Therefore, adequate information, explanation, and examination to the patient are essentials. One of study proved that patients with DU will have poor prognosis after obstruction releasing surgery, thus proper diagnosis using urodynamic are essentials.<sup>20</sup> Our study results in OAB and stress UI patients showed an implication such as increased risk of LUTS and retention with administration of antimuscarinic without confirming the presence of voiding problems such as BOO, DU, atonic bladder, and mixed condition by urodynamic. In OAB patient, 37% of patients were presented with BOO, 48% with DU, 4% with atonic bladder, and 13% with a combination of BOO and DU. Therefore, it is recommended to change the oral therapy of OAB in this circumstances with beta 3 agonists. Those drugs worked by stimulating relaxation of detrusor muscle during the storage phase of micturition and enhanced the storage capacity of the bladder without disturbing the voiding phase bladder contractions.<sup>21</sup> The importance of BOO and DU in SUJ patient is to make precaution before performing surgical intervention such as mid urethral sling, so the sling tightness could be adjusted. Moreover, in BOO and DU patient, it is essential to educate and prepare the patient of the possibility on using clean intermittent catheterization (CIC) afterwards.<sup>22</sup> In this study, paediatric patient also described in details; 33 paediatric patients were urodynamically examined from 2015-2018 with most of the clinical diagnosis of LUTS (57.6%) followed by urinary incontinence (5%) and retention (4%). Minor proportion of neurological problems 2%, enuresis 1%, recurrent infection 1% and vesicoureteral reflux 1% were identified in our study. Drzewiecki et al<sup>23</sup> reported that utilization of urodynamic studies in paediatrics patients is mandatory for the effective management of severe or unresponsive to previous treatment urinary tract abnormalities that might manifested as LUTS. Majority of LUTS in pediatric patient were caused by DU (42%) and atonic bladder (11%) while BOO was examined in 12 (63%) patients. There is a significant increase in the prevalence of BOO in pediatric patient with LUTS compared to Yunanto et al<sup>8</sup> study (25%). Our centre performed this profile study to provide further data in the utilization of urodynamic for urologic patient. As a result, more centres and hospital besides dr, Cipto Mangunkusumo national hospital started to implement urodynamic examination in proper indication as mention above. This study results also strengthened the previous preliminary

study performed by Yunanto et al<sup>8</sup>. The limitation in our study is no data regarding the details of clinical diagnosis judgement. Descriptive methods usage in this study did not provide high magnitude effects compare to analytic studies despite of its large sample inclusion. Therefore, further analytic studies using both of preliminary and our study data are essentials to provide more significant results.

## Conclusion

This study implies the role of urodynamic in diagnosing patients with various complaints of LUT problems. After urodynamic, problems in filling and voiding phase can be determined so that optimal treatment could be tailored based on patients' individual needs.

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