Original Research Article

A PREDOMINANT URODYNAMIC DIAGNOSIS CAN HIDE A MINOR ONE. STUDY IN NON-NEUROLOGIC WOMEN.

ABSTRACT

Aims :

Voiding dysfunction is a common condition among women. Since voiding and storage symptoms can coexist, evaluation necessitates further investigations with urodynamic studies. Unfortunately, some predominant dysfunction can hide a minor one.

The purpose of our study was to retrospectively review urodynamic records of non-neurologic women referred for evaluation of lower urinary tract dysfunction and to explain hidden concomitant urodynamic diagnoses that might have gone unnoticed without a thorough examination.

Methods

Urodynamic tracings of 404 consecutivenon-neurologic women referred for evaluation of lower urinary tract symptoms were reviewed. Initial urodynamic diagnosis had been proposed according with ICS/IUGA recommendations and a choice of specific urodynamic criteria. Concomitant urodynamic diagnoses were sought by analyzing the values of characteristic parameters which were hidden by predominant phenomenon.

Results

Concomitant diagnoses were found for 120 (29.7%) women. Coexistent diagnoses were 48 bladder outlet obstruction, 16 detrusor underactivity and 56 intrinsic sphincter deficiency. That condition was observed for women with predominant

diagnosis of detrusor overactivity (63.4%) and detrusor overactivity with impaired contractility (60.0 %).

Conclusions

Our study show a high prevalence of possible concomitant urodynamic diagnoses for non-neurologic women referred for evaluation of lower urinary tract dysfunction. The practitioner must pay attention to all the parameters measured in order to derive the correct urodynamic diagnosis from whichthe best management can be proposed.

Key words: *urodynamic diagnosis; concomitant urodynamic diagnoses; lower urodynamic tract dysfunction; women; non-neurologic.*

Introduction and Objectives

Lower urinary tract dysfunction (LUTD) is a common condition among women. Non-neurologic voiding dysfunction affects more than 6%of women over 40 [1].These patientspresent with a spectrum of different urinary symptoms, related to both storage and voiding, which may be multifactorial in origin or be related to one another.Incontinence (leaking urine) and other urination-related problems belong to a broad category of disorders called voiding dysfunctions. Although common, these conditions can be difficult to discuss and can dramatically diminish quality of life. Voiding dysfunction can be related to detrusor overactivity (DO), detrusor underactivity (DU), bladder outlet obstruction (BOO) and urethral incompetence (ISD). Since voiding and storage symptoms can coexist, they necessitate further evaluation with urodynamics studies (UDS).The goal of UDS is first to evaluate bladder and urethra behaviorduring the micturition cycle (filling, storage and void), then to propose a diagnosis of LUTD in order to guide towards the best management of the identified dysfunction. Urodynamic criteria for diagnosis are mainly based on

measures of pressure (vesical, abdominal and their difference which is the detrusor pressure). Typically, low detrusor pressure with normal flow is associated with unobstructed condition, high pressure with low flow with obstructed condition and low detrusor pressure with low flow with poor detrusor contractility.

But some predominant dysfunction can hide a minor one. Women with detrusor-underactivity-like urodynamic profiles could have concomitant occult bladder outlet obstruction [2]. Resnick first described the coexistence of “detrusor hyperreflexia” and impaired contractility (DHIC) [3]; that concomitant association is included in the main categories of urodynamic diagnoses according to ICS/IUGA recommendations [4]. Recently COUB a clinical syndrome identified as the coexisting overactive-underactive bladder has been reported which may not be the simple combination of both syndromes [5,6,7]. However, to our knowledge, there has been no study devoted to analysis of hidden concomitant urodynamic diagnoses.

The purpose of our study was to retrospectively review urodynamic records of non-neurogenic women referred for evaluation of LUTD and to explain how hidden concomitant urodynamic diagnosis (UD) that might have gone unnoticed without a thorough examination had been detected.

Methods

Urodynamic records of consecutive women referred for evaluation of LUTD were analyzed. Criteria for inclusion were PFs tracings providing maximum flow rate Q_{max} and detrusor pressure at Q_{max} ($p_{det.Qmax)}$ without significant contribution of abdominal pressure between onset of flow and Q_{max} (< 3 cm H_2O), a Q_{max}≥2 mL/s, a voided volume ≥ 100 mL, and a non-interrupted flow.

Criteria for exclusion were neurological disease, diabetes mellitus, stage ≥ 2 prolapse and failure to understand simple orders or a Mini-Mental State score < 20.

All patients were evaluated using medical history, review of medications, bladder diary for at least 3 days including voiding times and voided volumes both day and night, physical examination, and dipstick urinalysis to eliminate urinary tract infection. Urodynamic sessions were performed by the same team using the Dorado®unit from Laborie. Urodynamic tests were carried out according to the International Continence Society Good Urodynamic Practices [8]. Cystometry was performed with the patient in the sitting position. Bladder was filled with saline at room-temperature at a medium filling rate of 50 mL/min. Filling cystometrogram was obtained via a triple lumen urethral catheter 7 F allowing for urethral pressure recording, followed by an intubated flow (IF).Pressure transducers were zeroed to atmospheric pressure atthe upper edge of the symphysis pubis. Rectal pressure was recorded using a punctured intrarectal balloon catheter filled with 2 mL of saline according to the report of Good Urodynamic Practice guidelines [9]. Urethral pressure profilometry (UPP) was performed after IF, at rest, bladder filled at 200 mL; Valsalva maneuver was added to search for intrinsic sphincter deficiency (ISD).

According to ICS/IUGA recommendations [4] the maincategories of urodynamic diagnoses were bladder outlet obstruction (BOO), detrusor hyperactivity with impaired contractility (DHIC), detrusor overactivity (DO), or detrusor underactivity (DU). Some investigations were found ‘‘normal’’ (N) and other related to urethral dysfunction: ISD or voiding triggered byurethral relaxation [URA].

Each predominant urodynamic diagnosis was associated with specific urodynamic parameters values that were routinely used in our department.

- For BOO, cut-off values proposed by Defreitas and colleagues [10] were chosen: Q_{max}< 12 mL/s and $p_{det.Qmax}$> 25 cm H_2O. Comparison was made with the value of Solomon-Greenwell index BOOIf = ($p_{det.Qmax}$– 2.2*Q_{max})[11]: likely obstructed when BOOIf was higher than 5 and obstruction almost certain when BOOIf was higher than 18.

- DHIC mainly observed in elderly patients implied detrusor overactivity during storage and impaired emptying with low flow of long duration leading to possible high PVR [3].

- DO was the observation of detrusor contractions of varying durations and amplitudes during filling cystometry. DO was classified as phasic (during filling cystometry)and terminal (a single involuntary detrusor contraction that cannot be suppressed and that occurs when the maximum bladder capacity is reached, resulting in urinary incontinence and often complete bladder emptying)[12].

- For DU, which is characterized by low pressure-low flow, cutoff values proposed by Gammie et al. [13] were chosen: pdet@Qmax<20 cmH_2O, Q_{max}<15 mL/s and BVE%<90.

- N was associated with no abnormality detected during PFs.

- ISD was defined as low MUCP (maximum urethral closure pressure) *vs* age ((120 – age) - 20%) [14] or MUCP less than 20/35 cm H_2O [15] and/or positive VLPP less than 60 cm H_2O [16].

- URA was defined as voiding triggered by urethral relaxation (both urethral and flow curves recordings).

When detrusor contractility was needed to verify one proposal, VBN detrusor contractility parameter **k** [17] (without unit) and PIP1 index (PIP1 = $p_{det.Qmax}$+ Q_{max}) [18] (in cm H_2O) were calculated.

Minor UD were suspected when specific urodynamic parameters values were found close to the values allowing predominant UD were observed.

This retrospective study was conducted in accordance with the declaration of Helsinki. The local practice of our Ethics Committee does not require a formal institutional review board approval for retrospective studies.

Statistical analysis

Data are presented as mean ± SD and range. Analysis of variance (ANOVA), t-test, and the chi-square test were used asappropriate. All statistical results were considered significant at $p< 0.05$. Statistical analyses were performed using SAS, version 5.0 (SAS Institute, Inc., Cary, NC).

Results

Over a period of 8 years, 404 urodynamic tracings of consecutive non-neurogenic women referred for LUTS met study criteria. The urodynamic study was performed by the same team over time. Mean age was 58.4 ± 16.5 years [20-96 y]. Main complaint was urinary incontinence: 87 stress (SUI), 122 mixed (MUI), and 111 urge (UUI). Forty four women with complaints other than incontinence were called OTHER; among them, 33 complained of urinary frequency (PK) and 14 from dysuria (Dys) (Table1).

Table 1 : Main complaint vs. Predominant Urodynamic diagnosis

	BOO	DHIC	DO	DU	ISD	N	URA	Nbr
SUI	10	2	8	13	26	19	9	87
MUI	9	8	27	17	25	32	4	122
UUI	14	7	37	13	11	27	2	111
OTHER	11	3	10	17	7	29	7	84

Nbr	44	20	82	60	71	105	22	404

SUI : stress urinary incontinence ; MUI : mixed urinary incontinence ; UUI : urge urinary incontinence ; OTHER : urinary complaint without urinary incontinence.

BOO: bladder outlet obstruction; DHIC: detrusor overactivity with impaired contractility; DO detrusor overactivity; DU: detrusor underactivity; ISD: intrinsic sphincter deficiency; N investigations found ‘‘normal’’: URA: voiding triggered by urethral relaxation.

Nbr: number of patients.

Among predominant diagnoses, some coexistent diagnoses were found (Table 2).

Table 2 : **Concomitant diagnosis vs. Predominant urodynamic diagnosis (Nbr-%).**

Nbr-%	BOO 44(10.9%)	DHIC 20(4.9%)	DO 82(20.3%)	DU 60(14.8%)	ISD 68(16.8%)	N 105(26.0%)	URA 22(5.4%)
BOO/BOOIf>18	0	1(5.0%)	19(23.2%)	0	0	0	0
5<BOO/BOOIf<18	0	2(10.0%)	16(19.5%)	0	6(8.8%)	0	0
DU	0	2(10.0%)	3(3.6%)	0	8(11.7%)	0	3(13.6%)
ISD	10(22.7%)	7(35%)	14(17.1%)	22(36.7%)	0	0	3(13.6%)
Σ %concomitant diagnosis	22.7%	60.0%	63.4%	36.7%	20.6%	0	27.3%

BOOIf : Bladder Outlet Obstruction Index female

BOO: bladder outlet obstruction; DHIC: detrusor overactivity with impaired contractility; DO detrusor overactivity; DU: detrusor underactivity; ISD: intrinsic sphincter deficiency; N investigations found ‘‘normal’’: URA: voiding triggered byurethral relaxation.

Nbr: number of patients.

That co-existent condition was found in 120 (29.7%) women and was mainly observed in women with predominant diagnosis of DO (63.4%) and DHIC (60.0%).

Concomitant UD of BOO according to Defreitas' criteria [9] was found in 48 women first diagnosed as DHIC (3), DO (37) and ISD(8); among them,20(41.6%) had obstruction almost certain, 24 (50.0%) were likely obstructed and 4(8.3%) non-obstructed according to the Solomon-Greenwell index [10]. Values of contractility parameters were higher in patients with only BOO diagnosis (**k**= .81 ± .58; PIP1= 55.8 ± 22.5) vs those with concomitant BOO and ISD (**k**= .63 ± .37; PIP1= 48.7 ± 18.4).

Concomitant UD of DU according with Gammie's criteria [13] was found in 16 women with the first diagnosis ofDHIC (2), DO (3), ISD (8) and URA (3).

Concomitant UD of ISD was found in 56 women first diagnosed as BOO (10), DHIC (7), DO (14), DU (22) and URA (3).

For some women, two coexistent diagnoses were observed: 11 women (predominant UD: 2 DHIC and 9 DO) had two concomitant UD which were BOO and ISD and one woman (predominant UD was DO) had two concomitant UD which were ISD and DU.

Discussion

LUTD express as LUTS which are considered to represent a multifactorial constellation of non-specific symptoms that affect bladder function during both filling and voiding.

Symptoms such as stress urinary incontinence (SUI) and detrusor overactivity (DO) can co-exist in a number of patients. A non-infrequent situation is the co-existence of irritative (urgency, nocturia …) and obstructive (incomplete voiding, low flow…)

LUTS. So, high PVR can be due to detrusor underactivity (DU), bladder outlet obstruction (BOO) or a combination of both.

Recently, some studies have been devoted to the study of coexistent syndromes (COUB) [5-6-7] but to our knowledge there is no study which analyzes the possible concomitant urodynamic diagnosis in a non-neurogenic female population and the authors say that “Invasive urodynamic tests may be necessary in unclear cases or in cases not responding to initial treatment of the most troublesome symptoms“.

Detailed assessment of bladder function using more complex urodynamic studies is needed in any patient where previous therapy has proved unsuccessful. Butdifferent urodynamic findings may be present within a given clinical presentation, and the same urodynamic observations may be made in the presence of different symptoms. Moreover, due to the physiological variability of lower urinary tract function, there are some limits to urodynamic investigation.

But we can observe that some of these diagnoses are concomitant with some other possible diagnoses when reviewing other UDS parameters values. Thus secondary urodynamic diagnoses are basedon observation of values of characteristic parameters which are hidden by predominant phenomenon such as uninhibited detrusor contractions during filling (DHIC, DO) or combination of parameters values retained as characteristic of diagnosis, like DU. It is the case when there are low MUCP or/and VLPP< 60cm H_2O characteristic of ISD with predominant diagnosis of DHIC, DO and DU.

An interesting observation is that we can compare Defreitas’ criteria and Solomon-Greenwell index. Amongpatients with predominant diagnosis BOO according to Defreitas’criteria 72.7% were diagnosed obstruction almost certain according to Solomon-Greenwell index. Furthermore, when obstruction was almost certain

according to Solomon-Greenwell index, it was found in 72.7% in predominant diagnosis and only 34.5% when BOO is proposed as secondary diagnosis using the Defreitas criteria. So, these criteria/indices for BOO appear valuable despite the fact that there is no widely accepted precise definition for that condition without confirmation of the obstruction site by imaging (voiding cystogram or videourodynamic study).

Secondary UD of ISD is the most frequently observed in women with predominant UD of DHIC and DU.That observation is mainly due to aging. Women with these predominant UD are older, respectively 65 and 67 years which explain the low MUCP vs age observed.

ISD is present when predominant UD is BOO while the concerned population is younger (mean age 55 years old) and without neurologic pathology.That result could be an unexpected consequence of obstruction leading to an impaired sphincterfunction. That hypothesis is supported by the decrease of the values in contractility parameters.

A similar explanation can be proposed for occurrence of secondary UD of ISD for DO patients while important muscular relaxation is most likely explanation for URA patients.

Thus, urodynamic diagnosis must be proposed with circumspection in intricated clinical presentations and need the strict evaluation of all information obtained from pre urodynamic testing evaluation.

First limitation of this study is that it is retrospective and from a single-center. Second limitation is the choice of specific urodynamic criteria to give each predominant urodynamic diagnosis although for some there is no consensus. Third limitation is that the studied population includes women referred to our urodynamic laboratory for

evaluation of LUTS; the physician performing the urodynamic investigation was not the physician who originally requested urodynamics. Therefore, our findings can only be considered as advice.Lastly, there are limitations to the use of **k** as a detrusor contractility index, and those are primarily related to thevoiding performance. As already alluded to, thelimitations for **k** interpretation include a non-interrupted flow, a voided volume > 100 mL, Q_{max}> 2mL /s and no significantabdominal straining (to our knowledge these conditions have not been evaluated in the development of some other indices). However, the software allowing evaluation of **k** (in Excel) is easy to use and can be obtained (with instructions) on request from its authors.

Conclusion

Our study show a high prevalence of possible concomitant urodynamic diagnoses for non-neurologic women referred for evaluation of lower urinary tract dysfunction. Although the criteria generally accepted to render a urodynamic diagnosis are useful, thepractitioner must pay attention to all the parameters measured and pay close attention to diagnoses that might go unnoticed without a thorough examination in order to derive the correct urodynamic diagnosis from which the best management can be proposed.

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