

# Role of urodynamics in stress urinary incontinence: A critical appraisal

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## ABSTRACT

**Introduction:** Role of urodynamics prior to surgery of stress urinary incontinence (SUI) is under constant debate. Demonstration of the presence of detrusor overactivity is the only aspect that has been emphasized in the literature so far. We believe that there are number of other factors which may influence the evaluation and in turn the choice of surgical management and prediction of outcome of treatment. They are as follows: (1) Presence of voiding inefficiency, (2) asymptomatic detrusor overactivity, (3) and severity of SUI. These features may complicate the precise evaluation of patients of SUI. The main objective of this study is to analyze the dynamics of leakage and voiding using urodynamics. This study also aims at correlating these findings with clinical information.

**Materials and Methods:** One hundred consecutive cases referred to our center for preoperative evaluation of SUI were recruited in the study prospectively. All patients were interrogated using International Consultation on Incontinence Questionnaire. All patients underwent complete urodynamic evaluation including uroflowmetry, filling cystometry, leak point pressure measurement, and pressure flow studies, according to Good Urodynamic Practice guidelines. Patients' symptoms were correlated with urodynamic findings, with special emphasis on the presence of detrusor overactivity, severity of SUI, voiding efficiency, and presence of bladder outlet obstruction. Clinical information and urodynamic findings were correlated using Chi-square test.

**Results:** There is a statistically significant correlation between the presence of symptoms of urge urinary incontinence and urodynamic findings of detrusor overactivity at  $P < 0.05$ . There is a statistically significant correlation between the symptoms of urge incontinence (in addition to SUI) and urodynamic findings of intrinsic sphincter deficiency at  $P < 0.05$ . Fifteen of 51 patients who did not have associated storage symptoms were found to have some degree of detrusor overactivity on urodynamic evaluation. There was no statistically significant correlation between asymptomatic cases of urge incontinence and incidental finding of detrusor overactivity at  $P < 0.05$ . There is no statistically significant correlation between the urodynamic findings of symptoms of voiding dysfunction and urodynamic findings, suggestive of the same value at  $P < 0.05$ .

**Conclusions:** Urodynamic study in SUI has a potential of giving much more information than demonstration of Detrusor Overactivity alone. The predominant symptom of urge urinary incontinence can predictably diagnose detrusor overactivity in these cases. However, the incidence of asymptomatic detrusor overactivity remains as high as 15% and may have implication in postoperative results. This study clearly shows that there is a definite incidence of significant voiding dysfunction, which cannot be reliably evaluated without properly conducted pressure flow study. This factor may govern the choice of correct treatment which

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also predicts the outcome more reliably. Preoperative urodynamic study thus adds a dimension of precision to evaluation of the patients of SUI and may also influence technique and outcome measures in this group of patients.

**Key Words:** Stress urinary incontinence and voiding dysfunction, stress urinary incontinence evaluation, urodynamics in stress urinary incontinence

## INTRODUCTION

Stress urinary incontinence (SUI) is a common urological problem in the female population with an estimated prevalence between 4% and 35%.<sup>[1]</sup> Etiology of this problem is thought to be multifactorial.<sup>[1]</sup> Besides, there are a number of associated voiding problems, which make the management more complex and outcome more difficult to predict. Identification of the underlying disorders of bladder and urethral function is therefore of paramount importance in precise evaluation in this group of patients.<sup>[2]</sup>

Most of the objective tools of preoperative evaluation are aimed at identifying the presence of associated detrusor overactivity, either symptomatic or asymptomatic.<sup>[3]</sup> Documentation of asymptomatic detrusor overactivity seems important in preoperative evaluation.<sup>[4,5]</sup> However, there are a number of other features of bladder and urethral function which may influence the management of this common disorder. Some of these are associated with detrusor underactivity, obstructed bladder outlet, and varying degrees of severity of SUI. Besides, the presence of pelvic organ prolapse and failed previous surgery add further to the challenges to the precise preoperative evaluation of this group of patients. Identifying these factors may enhance preoperative evaluation and in turn translate into even better surgical outcomes in these patients.

The chief objective of this study is to use the tool of urodynamics to identify and quantify these various associated disorders as a part of preoperative assessment of the patients presenting with clinical SUI. An attempt is also made to correlate these findings with information obtained on a thorough clinical evaluation. It gives us an opportunity to determine the precise role of urodynamic investigation as a part of preoperative workup, which is so fiercely debated and challenged in the literature so far.

## MATERIALS AND METHODS

One hundred consecutive patients referred for urodynamic evaluation of SUI were included in this study prospectively. The study period was from February 2013 to January 2015. All patients had symptomatic SUI as their primary

complaint. All these patients were interrogated using validated questionnaire of International Consultation on Incontinence Questionnaire.<sup>[6]</sup>

A detailed history was taken, which included obstetrical history, previous treatment modalities with their details, and presence of other comorbidities.

Physical examination was performed with special emphasis on genital examination, estimation of pelvic floor strength, demonstration of urinary incontinence on coughing on full bladder, and neurological examination for the sacral reflex arc (this included perianal sensations, tone of anal sphincter, superficial anal reflex, and presence of bulbocavernosus reflex).

Ultrasound examination of the urinary tract and urine cultures were obtained, and the study was performed when cultures were sterile. Frequency/volume charts were obtained wherever possible to obtain information on the voiding patterns of these patients.

### Performing urodynamic investigation

The entire procedure was carried out conforming to standards of the Good Urodynamics Practices recommended by Schäfer *et al.* in 2002.<sup>[7]</sup>

- Urinary flow rate measurement was performed when patient attended with comfortably full bladder, and this study was performed in their natural voiding position either sitting on a commode or squatting over a special chair
- In the supine position, two catheters were introduced into the bladder (size 8 F for filling and 4.5 F for the measurement of pressure), under all aseptic precautions. Residual urine was measured by emptying bladder via the filling line. A 4.5 F rectal line was placed to measure abdominal pressure
- Transducers were zeroed to atmospheric pressure at the upper margin of symphysis pubis before connecting them to the pressure lines
- All patients had filling at the rate of 50 ml/min in the supine position
- During filling, provocative cystometry measures were performed to induce detrusor overactivity. These measures included an increase in filling rates, coughing, and change of posture with a catheter *in situ*.

Leak point pressure measurement was performed at two points during filling cystometry after removal of the filling line:

- At half of the expected bladder capacity
- At capacity in sitting position.

Every patient was encouraged to perform Valsalva maneuver with incremental force until leak occurred. Leak was also tested by cough impulses with incrementally rising force.

Each patient was asked to sit or squat at bladder capacity and was encouraged to void in his/her natural position after removing filling line. Synchronous pressure and flow values were monitored and recorded. Patients with pelvic organ prolapse had two pressure flow studies, one with and the other without reduction of the prolapse.

Figure 1 shows Urodynamic tracing with demonstration of leak on coughing without rise in Detrusor Pressure. It also demonstrates typical voiding pattern of women with SUI.

Figure 2 shows Demonstration of leak on coughing and attempted valsalva maneuver in urodynamic study. It also shows evaluation of a case of SUI with cough at Half and Full capacity

Bladder outlet obstruction and detrusor contractility were calculated by the following formulae:<sup>[8]</sup>

$$BOO = P_{det} Q_{max} / Q_{max}^2$$

$$\text{Detrusor contractility index} = P_{det} Q_{max} + Q_{max}$$

Data thus obtained from this study were subjected to statistical analysis using Chi-square test.

## RESULTS

Patients with associated storage symptoms were compared with urodynamic findings of detrusor overactivity [Table 1].

There was no statistically significant correlation between the clinical findings of increased urinary frequency, urgency with or without urge incontinence, and urodynamic findings of detrusor overactivity at  $P < 0.05$ . This indicates that clinical history will not be able to identify detrusor overactivity with a degree of precision.

Table 2 shows the correlation between the patients with symptoms of SUI who had associated symptoms of urge urinary incontinence on interrogation and urodynamic findings of detrusor overactivity.

There is a statistically significant correlation between the presence of symptoms of urge urinary incontinence and

urodynamic findings of detrusor overactivity at  $P < 0.05$ . This suggests that detrusor overactivity can be predicted on the basis of symptoms predominantly of urge incontinence. Thus, it can be said that symptoms of urge

**Table 1: Patients with associated storage symptoms compared with urodynamic findings of detrusor overactivity**

Symptoms of storage	Urodynamic findings of detrusor overactivity	
	Present (n=38)	Absent (n=62)
Present (n=49)	23	26
Absent (n=51)	15	36

$P=0.710$

**Table 2: Correlation between the patients with symptoms of stress urinary incontinence who had associated symptoms of urge urinary incontinence on interrogation and urodynamic findings of detrusor overactivity**

Symptoms of urge incontinence	Urodynamic finding of detrusor overactivity	
	Present (n=38)	Absent (n=62)
Present (n=31)	23	8
Absent (n=69)	15	54

$P=1.006$

**Table 3: Symptoms of urge incontinence and urodynamic findings suggestive of severe intrinsic sphincter deficiency (abdominal leak point pressure <60 cm water)**

Symptoms	Urodynamic findings	
	Yes (n=12)	No (n=88)
Yes (n=31)	8	23
No (n=69)	4	65

$P=0.0044$

**Table 4: Incidence of asymptomatic detrusor overactivity**

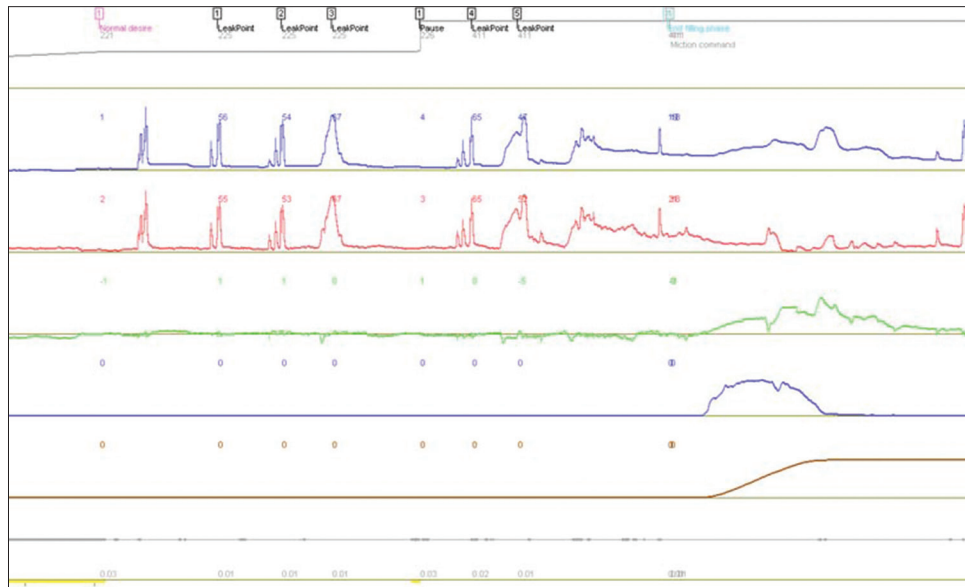
Symptoms	Urodynamic findings of detrusor overactivity	
	Yes (n=38)	No (n=62)
No (n=51)	15	36
Yes (n=49)	23	26

$P=0.07$

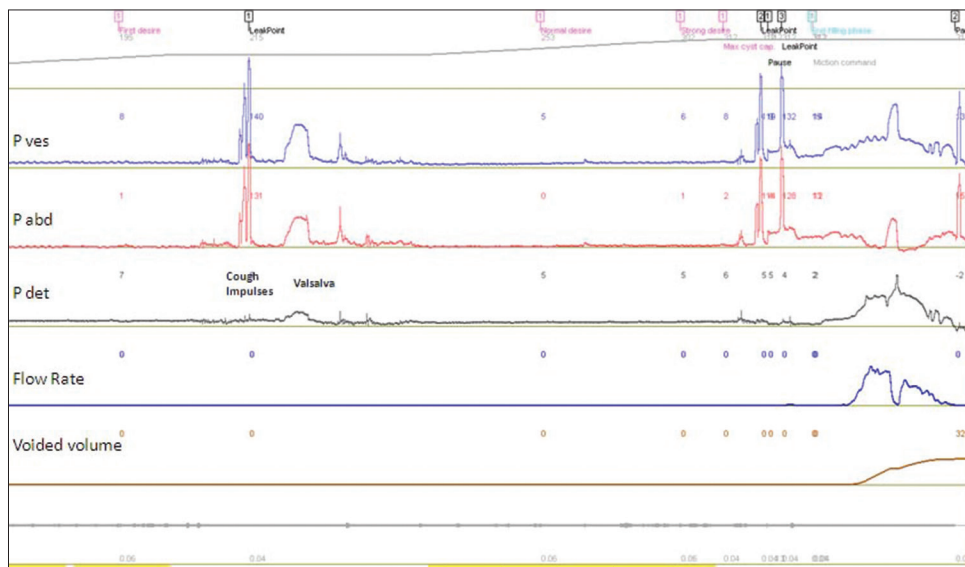
**Table 5: Incidence of associated symptoms of voiding dysfunction in the study population**

Symptoms	Urodynamic findings of either detrusor underactivity and/or bladder outlet obstruction	
	Yes (n=40)	No (n=60)
Yes (n=53)	25	28
No (n=47)	15	32

$P=0.12015$



**Figure 1:** Evidence of leak point pressure on coughing



**Figure 2:** Tracing showing evidence of leak on Valsalva maneuver

incontinence were compared favorably with the findings of detrusor overactivity on provocative cystometry.

Table 3 shows the symptoms of urge incontinence and urodynamic findings suggestive of severe intrinsic sphincter deficiency (abdominal leak point pressure <60 cm water).

There is a statistically significant correlation between the symptoms of urge incontinence (in addition to SUI) and urodynamic findings of intrinsic sphincter deficiency at  $P < 0.05$ , suggesting that findings of severe intrinsic sphincter deficiency may also manifest as urge incontinence in the population we studied.

Table 4 shows the incidence of asymptomatic detrusor overactivity.

Fifteen of 51 patients who did not have associated storage symptoms were found to have some degree of detrusor overactivity on urodynamic evaluation. There was no statistically significant correlation between asymptomatic cases of urge incontinence and incidental finding of detrusor overactivity at  $P < 0.05$ , suggesting that the absence of symptoms of storage does not rule out the presence of detrusor overactivity. It may also suggest that the incidence of asymptomatic detrusor overactivity may be as high as 15% in this population of patients.

**Table 6: Patients having symptoms of voiding dysfunction and urodynamic findings of underactive detrusor alone**

Symptoms	Urodynamic findings of detrusor underactivity alone	
	Yes (n=43)	No (n=67)
Yes (n=53)	18	35
No (n=47)	25	22

$P=0.0526$

**Table 7: Urodynamic findings of bladder outlet obstruction**

Symptoms	Urodynamic findings of bladder outlet obstruction	
	Yes (n=32)	No (n=68)
Yes (n=53)	22	31
No (n=47)	24	23

$P=0.3386$

Table 5 shows the incidence of associated symptoms of voiding dysfunction in the study population.

There is no statistically significant correlation between the urodynamic findings of symptoms of voiding dysfunction and urodynamic findings, suggestive of the same value at  $P < 0.05$ . This shows that urodynamically proven voiding dysfunction cannot be predicted on clinical information alone.

Table 6 describes patients having symptoms of voiding dysfunction and urodynamic findings of underactive detrusor alone.

There is no statistically significant correlation between the symptoms of voiding dysfunction and urodynamic findings of detrusor underactivity at  $P < 0.05$ .

Table 7 shows the urodynamic findings of bladder outlet obstruction.

This table shows that there is no statistically significant correlation between the symptoms of voiding dysfunction and bladder outlet obstruction at  $P < 0.05$ , indicating that symptom of voiding dysfunction will not be predicted by underlying bladder outlet obstruction.

Both the above-mentioned tables show that voiding dysfunction cannot be reliably predicted by symptoms alone, and urodynamic studies may be necessary to uncover these abnormalities. Value of urodynamic evaluation can be further enhanced by distinguishing between bladder outlet obstruction and detrusor underactivity in qualifying the voiding dysfunction further.

## DISCUSSION

There is a fierce debate over the role of preoperative urodynamic evaluation in the management of SUI in women. Majority of studies have proposed that urodynamics does not give any special dimension in preoperative evaluation except in selected situations as follows:<sup>[9,10]</sup>

- Failed previous surgical intervention
- Suspicion of associated detrusor overactivity leading to urge incontinence.

Majority of studies have put the thrust into the diagnosis of associated detrusor overactivity.<sup>[11]</sup> However, to have a more comprehensive evaluation, we need to have information on voiding inefficiency and detrusor contractility which may, in principle, influence the choice of treatment and predict subsequent outcome.

In practice, we find various difficulties in the management of SUI such as:<sup>[12]</sup>

- Presence of voiding inefficiency
- Presence of associated bladder outlet obstruction
- Ambiguity in clinical evaluation (particularly in our society)
- Symptom variation according to the severity of incontinence
- Presence of mixed symptoms due to associated detrusor overactivity.

This was a prospective study of 100 women presenting to the department of urodynamics with symptomatic SUI. This study was carried out with the main objective of uncovering various aspects of voiding dysfunction in women presenting with SUI. These patients were mainly referred for preoperative evaluation.

Clinical information including history, clinical examination, frequency/volume charts, and uroflowmetry are routinely used to arrive at a precise clinical diagnosis.<sup>[13]</sup> These clinical modalities are also used to find the presence of SUI, magnitude of leakage, presence of detrusor underactivity, and bladder outlet obstruction.

An attempt is made to compare all these features with urodynamic parameters. We also need to find the exact role of urodynamics in this group of patients, who were considered for invasive treatment.

In our study, as shown in Table 1, symptoms of increased urinary frequency, urgency with or without urgency incontinence, do not correlate favorably with urodynamic findings of detrusor overactivity. This indicated that only symptomatic evaluation will not help in ruling out detrusor



overactivity. This finding was consistent with a study conducted by Bing *et al.*<sup>[14]</sup>

However, when one considers predominant symptoms of urge incontinence alone, diagnosis of detrusor overactivity is more predictable. As can be seen from Table 2, there is a statistical correlation between predominant symptoms of urge incontinence and urodynamic findings of detrusor overactivity. This indicated that predominant symptoms of urge incontinence may correlate with urodynamic findings of detrusor overactivity. Similar findings were noted in a study conducted by Ouslander *et al.*<sup>[15]</sup>

Some of the patients having urge incontinence as their predominant symptom with the absence of detrusor overactivity on urodynamic study were found to have intrinsic sphincter deficiency of a severe degree as a cause of their symptoms (severe intrinsic sphincter deficiency was defined as abdominal leak point pressure <60 cm water on Valsalva maneuver<sup>[16]</sup>). Thus, it is possible that the symptom of severe SUI was perceived as urge incontinence for fear of leakage by women, at least in this study population.

As can be seen from Table 3, severe ISD can be predicted by symptoms alone. However, differentiation between the cause of urge incontinence as to whether it is due to detrusor overactivity alone or intrinsic sphincter deficiency will need urodynamic evaluation. These findings were similar to a study conducted by Ward *et al.*<sup>[17]</sup>

Presence of symptomatic detrusor overactivity which appears *de novo* after surgery for SUI may have its roots in preoperative asymptomatic detrusor overactivity.<sup>[18]</sup> Therefore, documentation of this feature of detrusor function may be helpful from medicolegal point of view.<sup>[18]</sup> Similar findings were also noted in a study conducted by Alperin *et al.*<sup>[18]</sup>

Table 4 shows that there is no statistical correlation between patients who are asymptomatic for storage symptoms and presence of incidental detrusor overactivity. This indicates that absence of symptoms of urgency, frequency, and urge incontinence may not reliably exclude detrusor overactivity. Similar findings were also noted in a study conducted by Byrne *et al.*<sup>[19]</sup>

Out of 100 patients, 53% of the women in our study group had associated voiding symptoms. These symptoms were mainly in the form of straining to pass urine, hesitancy, and poor urinary flow.

Twenty-five out of 53 patients (47%) had either significant detrusor underactivity or presence of bladder outlet obstruction (as determined by criteria mentioned above).

We also found in this group that symptoms of voiding inefficiency did not help in distinguishing between the underlying bladder outlet obstruction and/or underactive detrusor. Similar findings were also noted in a study conducted by Bradley and Rovner<sup>[20]</sup> and Miller *et al.*<sup>[21]</sup> This becomes an important finding in predicting postoperative voiding difficulties and urinary retention.

Eighteen of these 25 women were found to have significantly impaired detrusor contractility as shown Table 6. Remaining 7 out of 25 patients had demonstrable bladder outlet obstruction.

Preoperative counseling of patients in such circumstances is helpful only after a properly conducted urodynamic evaluation. We also found that patients of underactive detrusor could not be diagnosed by history and clinical examination alone. Although results show that symptoms can help in the diagnosis of bladder outlet obstruction, proper differentiation will need urodynamic evaluation. Similar results were also noted in a study conducted by Wang and Chen.<sup>[22]</sup>

We perceive it is important to underline this dysfunction since either bladder outlet obstruction or detrusor underactivity may influence the choice of surgical technique and may have a higher incidence of urinary retention postoperatively. Similar findings were also noted in a study conducted by Jensen *et al.*<sup>[23]</sup> and Nager *et al.*<sup>[24]</sup>

On the basis of results, we observed in our prospective study, it appears that much more information on the voiding dynamics can be obtained after properly conducted urodynamic evaluation, which may enhance patient evaluation and care in general.

## CONCLUSIONS

Storage symptoms of urgency and frequency with or without urge incontinence do not predict detrusor overactivity. However, the predominant symptom of urge incontinence may predict detrusor overactivity more reliably.

Voiding dysfunction due to associated bladder outlet obstruction or underactive detrusor cannot be reliably predicted by history alone. Urodynamics, therefore, plays a major role in uncovering these features, making preoperative assessment more precise.

Asymptomatic detrusor overactivity was seen in a substantial number of patients in this group, suggesting that adequate preoperative counseling is essential and is possible only after urodynamic evaluation.

Conversely, severe degree of SUI (as diagnosed by very low leak point pressure) may also manifest as urge incontinence in population we studied. This casts further doubt on the credibility of presenting symptoms in uncovering various aspects of voiding dysfunction in women.

Complete urodynamic evaluation, therefore, offers much more information on the dynamics of voiding and leakage than the diagnosis of detrusor overactivity alone. It thus makes preoperative evaluation much more precise to make overall patient care more comprehensive in all aspects.

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### Conflicts of interest

There are no conflicts of interest.

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