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Urodynamic findings in female incontinence.*

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Thirty female patients with urinary incontinence were investigated to determine the frequency of abnormal urodynamic findings, and to correlate the urological symptoms and the findings. There were 15 cases with bladder instability, one of the commonest causes of female incontinence next to urethral sphincter incompetence. There were 15 cases with demonstrable negative urethral closure pressure on coughing although 6 of these also had bladder instability. There were 7 cases with abnormal pressure-flow relationship, 12 cases with low maximal cystometric capacity of the bladder and 4 cases with residual urine greater than 100 ml. There seemed to be a poor correlation between the symptom scores and the urodynamic findings. Urodynamic investigations should be performed routinely in female incontinence in order to detect any abnormal bladder and sphincter dysfunctions before operation.

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พิชัย บุณยะรัตเวช, อุดม พัฒนถาบุตร. การตรวจพบทาง urodynamic ในผู้ป่วยหญิงที่มีอาการกลั้นปัสสาวะไม่ได้. จุฬาลงกรณ์เวชสาร 2530 กันยายน; 31(9) : 701 – 710

ผู้ป่วยหญิงที่มีอาการกลั้นปัสสาวะไม่ได้ 30 คน ได้รับการตรวจด้วยการซักประวัติเพื่อให้คะแนนอาการทางการถ่ายปัสสาวะ และตรวจด้วย urodynamics เพื่อวัดอัตราไหลของปัสสาวะ, วัดปัสสาวะตกค้าง, วัด urethral pressure profile เพื่อหาความยาวใช้งานของท่อปัสสาวะ (functional urethral length) กับแรงดันปิดท่อปัสสาวะ (urethral closure pressure) ขณะปกติและขณะไอ, การตรวจแรงดันของกระเพาะปัสสาวะขณะใส่น้ำ (filling cystometry) เพื่อตรวจ instability ของกระเพาะปัสสาวะและความจุสูงสุดในขณะตรวจ (maximal cystometric capacity), การตรวจแรงดันของกระเพาะปัสสาวะควบกับอัตราไหลขณะถ่ายปัสสาวะ (voiding cystometry และ pressure flow study)

สิ่งผิดปกติที่พบบ่อยที่สุดถึง 15 คนคือ instability ของกระเพาะปัสสาวะ ซึ่งเป็นสาเหตุที่พบบ่อยเป็นที่สองของอาการกลั้นปัสสาวะไม่ได้รองจากอาการที่กล้ามเนื้อหูรูดใช้ไม่ได้ นอกจากนั้นพบมีแรงดันปิดของท่อปัสสาวะเป็นลบขณะไอได้อีก 15 ราย ซึ่งในจำนวนนี้มี instability ของกระเพาะปัสสาวะ 6 ราย, มี 7 รายที่มีแรงดันกระเพาะปัสสาวะกับอัตราไหลขณะถ่ายปัสสาวะผิดปกติ, 12 รายมีความจุสูงสุดในขณะตรวจต่ำ, 4 รายมีปัสสาวะตกค้างมากกว่า 100 มล. ส่วนการถ่ายปัสสาวะผิดปกติมีความสัมพันธ์กันน้อยกับการตรวจทาง urodynamic ผู้วิจัยสรุปว่า การตรวจทาง urodynamics ควรจะเป็นการตรวจประจำอย่างหนึ่งก่อนการผ่าตัดในผู้ป่วยผู้หญิงกลั้นปัสสาวะไม่ได้ เพื่อค้นหากระเพาะปัสสาวะและหูรูดซึ่งทำงานผิดปกติ

Incontinence of urine in females is a fairly common condition affecting more than 5% of the female population in the western countries and the incidence increases with age.[1] The incidence in Thai females is probably higher because multiparity is more common in this country. As many as 6 or 7 operations to treat female incontinence have been described[2] reflecting the high degree of failure rates which have been reported to be as high as 45% for anterior colporrhaphy[3] to 7.9% for a retropubic cystourethropexy.[4] Two of the most common causes of incontinence in females are urethral sphincter incompetence, and bladder instability which is an uninhibited contraction of the detrusor provoked by a sudden increase in intra-abdominal pressure causing the bladder neck to open passively. The third cause of incontinence is overflow incontinence which is a result of chronic retention of urine; there may be leakage of urine on coughing. The type of incontinence most amenable to surgery is the first. The latter two may not improve after surgery and may even become worse. Good history taking is important and may reveal some of these patients. However, there may be some misinterpretation of the patient's symptoms. This leads to poor selection of patients for operation and poor results.

With the introduction of urodynamics and better understanding of the mechanism of urinary incontinence, patients may be more thoroughly evaluated and several reports have been published claiming better results if patients were selected by urodynamic criteria.[5,6,7,8,9] Urodynamic may reveal bladder instability. The condition may be idiopathic or secondary to obstruction,[10] and can be detected only by urodynamic study. A number of patients may have genuine stress incontinence as well as bladder instability. The symptom may improve slightly after the operation for stress incontinence. But a number of patients who have only bladder instability will not benefit from the operation or may get worse. The failure rate after an operation for incontinence was 4 times higher in the bladder with instability.[6] Urodynamic investigation may also reveal the presence of negative urethral closure pressure (UCP) on coughing, short functional urethral length, and the presence of a large residual urine as a result of chronic retention. Negative UCP indicates detrusor pressure exceeding urethral pressure (i.e., urethral sphincter incompetence) during sudden increase in intra-abdominal pressure (Fig 1). A short functional urethra may produce urinary incontinence because the sphincter mechanism relies on the length of urethra to produce enough urethral pressure. The presence of a residual urine after micturition is an indication of an imbalance between detrusor and the urethral resistance; cystometry often will reveal some abnormal pressure flow relationship such as an obstructive type of relation (high p_{det} and low urinary flow rate) or a decompensating type of pressure-flow (low p_{det} and low flow rate).

The purpose of this study is to survey the urodynamic findings in Thai women with urinary incontinence, to determine whether bladder instability is a major problem and whether there may be any other abnormal detrusor function which may cause incontinence.

Patients and methods

Thirty female patients with an average age of 48.13 years (range 33-72) who presented with incontinence of urine were included in the study. They were cases referred from the Department of Obstetrics and Gynaecology for urodynamic examination before operation, and were cases referred by themselves to our unit with urinary incontinence. Cases with gross neurological deficit, stones, cystitis or other gross bladder pathology were excluded. Detailed history taking was made to obtain urological symptom scores. Symptoms may be classified as obstructive or irritative. Scores ranging from 1 to 4 are given according to the severity of the symptoms as summarized in Table 1. In addition all the obstructive and irritative scores were averaged to obtain mean obstructive score and mean irritative score.

All cases underwent urodynamic investigations performed on a DISA 2100 urodynamic system. Each patient attended the urodynamic laboratory with a relatively full bladder and was asked to pass urine into the uroflowmeter. The volume voided must be at least 200 ml to validate the test. The bladder was catheterized to determine the residual urine and to perform cystometry. The intravesical pressure (p_{ves}) was obtained via a fluid filled 20G polyethylene tube passed per urethram. The intraabdominal pressure (p_{abd}) was measured from the rectum via a fluid filled 20G polyethylene tube with the tip covered. True detrusor pressure (p_{det}) was obtained by subtracting electronically p_{abd} from p_{ves}. Filling cystometry was done, with the patient sitting, by filling the bladder with distilled water at room temperature via a 10F urethral catheter at a medium fill rate of 60 ml/min. Voiding cystometry was done with the patient sitting

and the urethral catheter removed. Urethral pressure profile (UPP) was performed by using a Gaeltec solid 8F urethral catheter with one microtransducer located at the tip and another at 5 cms from the tip. The bladder was filled to 100 ml and the catheter was withdrawn at a rate of 1 mm/second, using the catheter puller of the profilometer unit. The two transducers thus recorded p_{ves} and urethral pressure (p_{ura}). The two pressures were subtracted electronically to obtain urethral closure pressure (UCP). The method was similar to that described earlier.[11] After normal measurements of the UPP, the patient was asked to cough repeatedly while the microtransducers were again recording UPP. Other methods, definitions and units conform to the standards recommended by the International Continence Society.[12]

The occurrences of the followings which may contribute to the cause of incontinence were noted:

I. Maximal flow rate (Q_{max}) < 15 ml/sec, and a residual urine > 100 ml.
II. Urethral pressure profile:
Negative UCP during cough (Fig 1),
High UCP at rest (above 75 cmH_2O).
Short functional urethral length (defined as below 2 cm).
III. Filling cystometry:
Bladder instability (Fig. 2)
Low bladder compliance (defined as below 10 ml/cmH_2O).
Low maximal cystometric capacity (below 300 ml).
IV. Voiding cystometry : Abnormal pressure-flow relationship.

Table 1 Symptom Scores

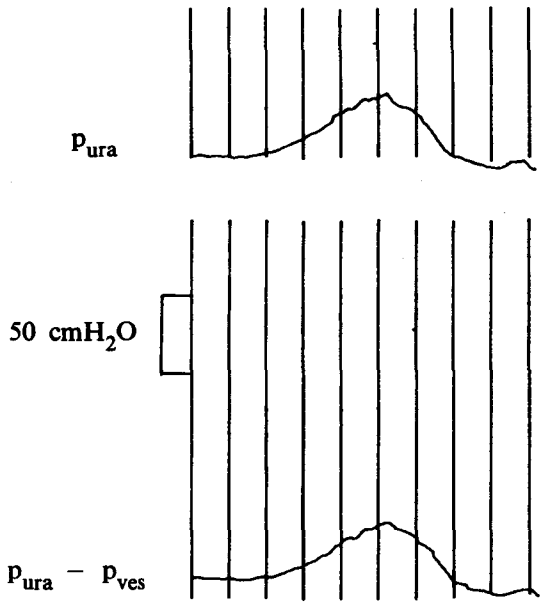
Symptoms	1	2	3	4
I. Obstructive symptoms :				
Hesitancy	None	rare	frequent	always
Poor stream	None	rare	frequent	always
Straining	None	rare	frequent	always
Intermittency	None	rare	frequent	always
Terminal dribbling	None	rare	frequent	always
Sense of incomplete emptying	None	rare	frequent	always
II Irritative scores :				
Frequency	1–4	5–6	7–9	> 9
Nocturia	0–1	2–3	4–5	> 6
Urgency	None	rare	frequent	always
Stress incontinence	None	rare	frequent	always
Urgency incontinence	None	rare	frequent	always

Mean obstructive score = sum of all obstructive scores ÷ 6
Mean irritative score = sum of all irritative scores ÷ 5

Table 2 Mean obstructive symptom score and mean irritative symptom score in thirty females with urinary incontinence

	mean	range
Obstructive symptom score	1.42	1 – 2.8
Irritative symptom score	2.68	1.6 – 4

Figure 1 Above : typical tracing of UCP without coughing. Below left : normal tracing of UCP on coughing, with positive pressure almost throughout the entire length of urethra. Some negative pressure only after the highest point has been reached. Below right : negative UCP on coughing almost throughout the entire length of urethra indicating sphincter incompetence.



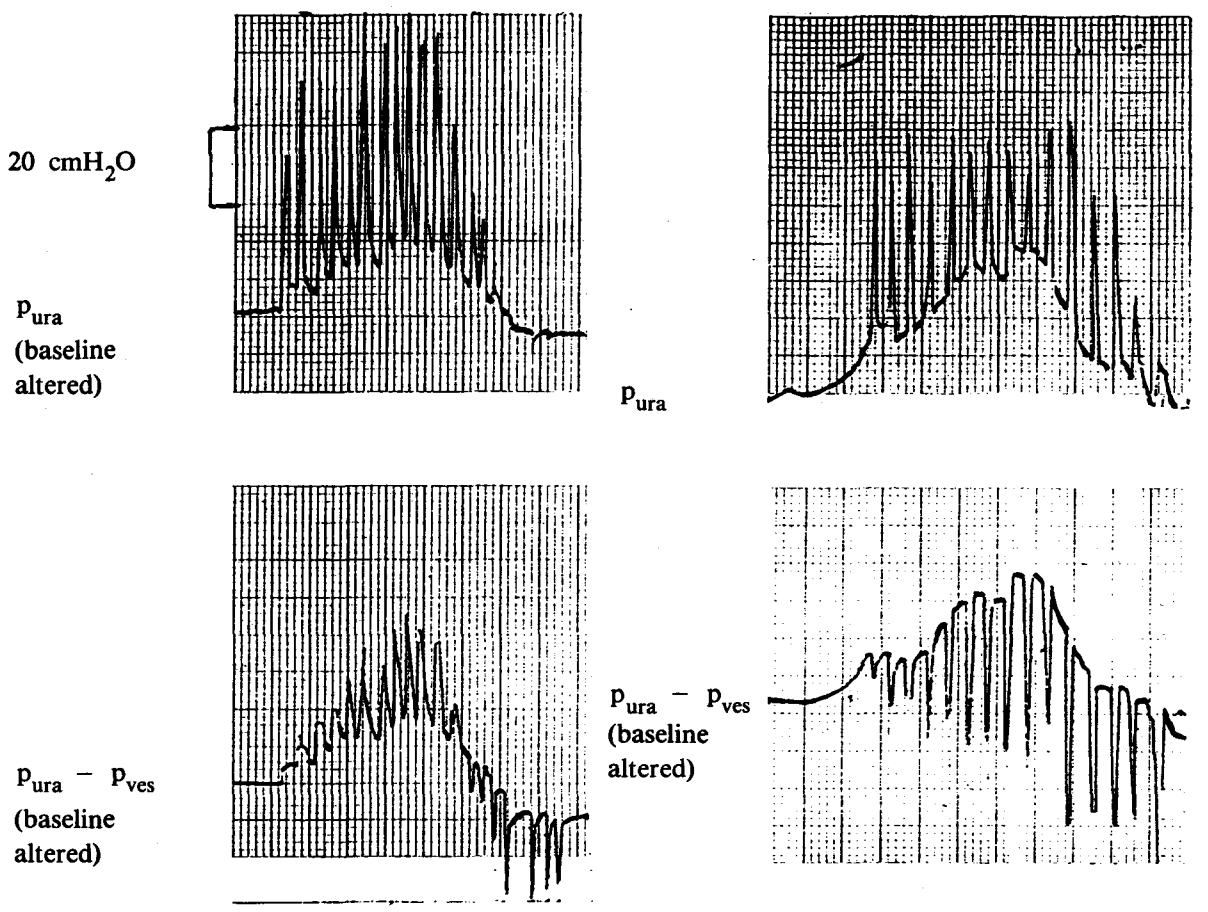
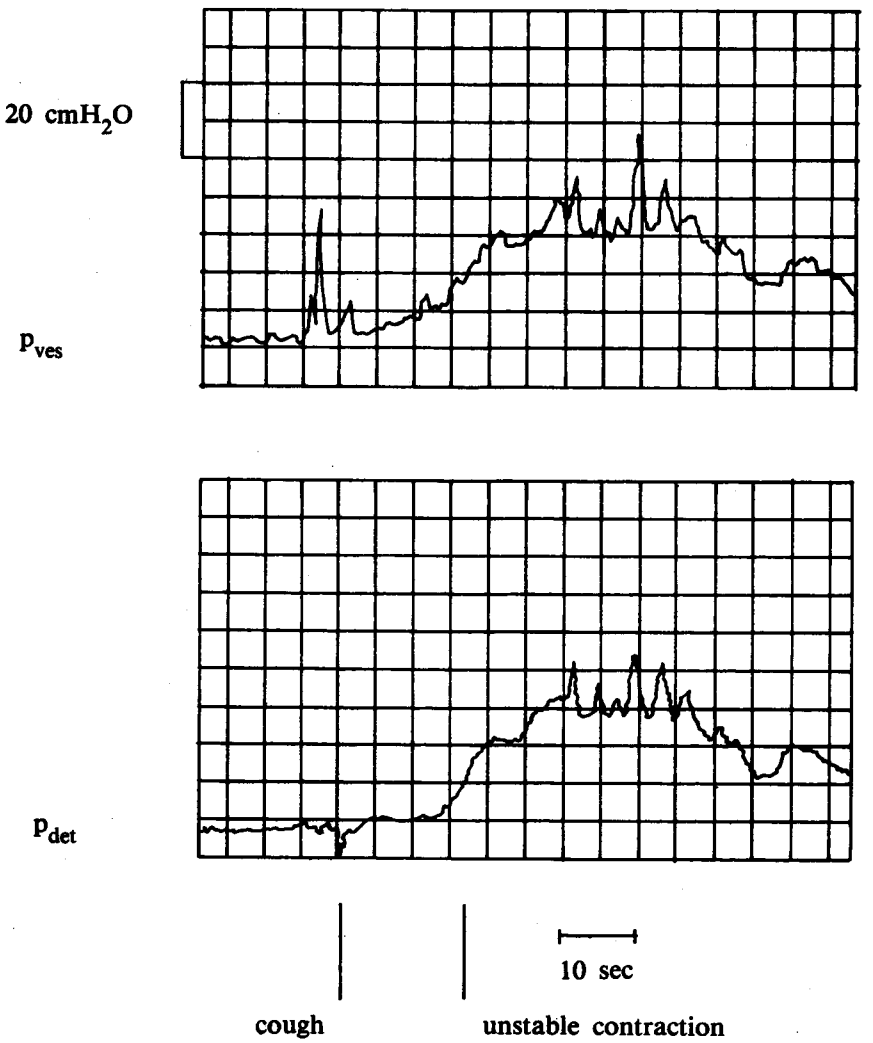


Figure 2 Typical bladder instability as shown by a rise in detrusor pressure (p_{det}) of more than 15 cmH_2O Provoked by a cough. Upper tracing is the intravesical pressure (p_{ves}), lower tracing is the subtracted pressure or true detrusor pressure (p_{det}).



Results

In these 30 patients the mean obstructive symptom score was 1.42 (range 1 to 2.83) and the mean irritative symptom score was 2.68 (range 1.6 to 4). Most of these patients had irritative symptoms more than obstructive symptoms.

Urodynamic findings in these thirty patients are shown in Table 3. The urethral pressure profile showed abnormally short functional urethra in only 5 cases. There were as many as 15 cases of negative UCP on coughing, 6 of these also had bladder instability. There were 9 more, totalling 15 cases, of bladder instability. The resting UCP was high in 8 cases, the remaining patients had normal resting UCP and none had UCP lower than 20 cmH_2O. Low bladder compliance did not seem to be a common finding and was found in only 5 cases. Low maximal cystometric capacity (arbitrarily defined as below 300 ml) was found in 12 cases but was associated with bladder instability in only 3 cases. None had maximal cystometric capacity below 200 ml. Abnormal pressure-flow relationship with high pressure (above 50 cmH_2O) and low flow rate (below 15 ml/sec) was found in 3 cases, high pressure and normal flow rate was found in 13 and normal pressure and low flow rate was found in 3 cases. There were 11 cases with normal pressure and normal flow rate. Most of the patients under study had normal free urine flow rate except 3 cases; one of which had a previous antero-posterior colporrhaphy but continued to have incontinence, this patient also had a low p_{det}. There were 4 cases with residual urine above 100 ml.

The presence of bladder instability did not seem to correlate with mean irritative symptom score or urge symptom score as shown in table 4.

Table 3 Urodynamic findings in thirty females with incontinence

I. Urethral pressure profile :			
Presence of negative UCP during coughing		15	50.00%
– with bladder instability	6		
– without bladder instability	9		
Presence of high UCP (>75 cmH_2O) at rest		8	26.67%
Presence of a short functional urethra (<2 cm)		5	16.67%
II. Filling cystometry			
Presence of bladder instability		15	50.00%
Presence of low bladder compliance (<10 ml/cmH_2O)		5	16.67%
Presence of low maximal cystometric capacity (<300 ml)		12	40.00%
III. Voiding cystometry			
Presence of abnormal pressure-flow relationship		7	23.33%
Pressure > 50 cmH_2O, Flow < 15 ml/sec	3		
Pressure < 50 cmH_2O, Flow < 15 ml/sec	4		
IV. Uroflowmetry			
Presence of low maximal flow rate (Q_{max})		3	10.00%
Presence of residual urine > 100 ml		4	13.33%

Table 4 Comparison of urge and mean irritative scores to bladder instability

Scores	Total	Stable bladder	Unstable bladder
Urge score < = 2	15	10	5
Urge score > 2	15	9	6
Mean irritative score < = 2	10	5	5
Mean irritative score > 2	20	15	5

Discussion

Estimation of urological symptom scores showed the mean irritative score to be higher than the mean obstructive score. The mean obstructive symptom score was higher than one probably because patients with irritative symptoms have obstructive symptoms due to the frequent desire to micturate; in the presence of low bladder volume it is difficult to initiate voiding. These patients therefore have symptoms of obstruction although they may in fact have irritation of the bladder.

Urodynamic studies in our series showed as many as 15 cases (50%) with bladder instability. Although 6 cases had instability in the presence of sphincter incompetence (as determined by negative UCP). It would be alarming to see that some of these bladder instability may be subjected to the operation used to correct sphincter incompetence. Several reports have been made on high failure rates of anti-incontinent operation in the presence of bladder instability,[6,13] although bladder instability may reverse to normal after the operation in a number of cases.[8,9] Symptom scores alone cannot be relied upon to detect bladder instability; there is a poor correlation between the irritative symptom score and detrusor instability in our previous study[14] and also in this study, although the symptoms of urgency and urgency incontinence may have a higher degree of correlation to bladder instability.[15]

There were 15 cases of negative UCP on coughing indicating a sphincter incompetence.[16] We were not able to detect negative UCP on coughing in the other 15 cases. This may indicate the patients had no true sphincter incompetence. However, we were able to relate only 9 of these latter 15 cases with bladder instability. High UCP at rest is a feature of adult enuretics with unstable bladder.[17] We found 8 such cases (26.67%) The remaining patients had normal UCP. None had UCP below 20 cmH_2O. Short functional urethral length (below 2 cm) as measured at the time of UPP was found in only 5 cases (16.67%). The significance of these findings in relation to incontinence is not known but probably are not very important in selecting patients for operation.

Other causes of urgency and frequency may include patients with small volume of bladder and chronic obstruction. In our series, the number of patients with a small bladder was 12 cases and the number of patients with low bladder compliance was only 5 cases. However this did not seem to be associated with bladder instability as we could observe both conditions together in only 3 cases. A small bladder may lead to frequency and urgency which the patient may describe wrongly as being unable to hold urine and may be misinterpreted as incontinence. Chronic obstruction in our series may be shown by an abnormal pressure-flow relationship such as high pressure and low urinary flow rate. This occurred in 3 cases. A high pressure but normal flow rate occurred in 13 cases. There were 11 cases with normal pressure flow relationship. There were 3 cases with normal pressure and low flow rate which may indicate chronic obstruction to the point of detrusor decompensation. Low free flow in uroflowmetry was found in 3 cases (10%), the rest had normal free urinary flow rate. This indicates that even the simple noninvasive free urinary flow measurement may identify only a few patients with detrusor problems warranting further urodynamic investigation. Four patients (13.33%) had a residual urine larger than 100 ml and one of these had a residual urine of 253 ml and a low urinary flow rate. These patients may in fact be incontinent because of chronic retention with overflow.

It is clear from our study that there are some urodynamically abnormal patients among those presented for treatment of urinary incontinence. It would seem that these patients may not improve or even become worse after the operation. In an earlier double blind study,[8] patients who had treatment similar to what the urodynamic data suggested had a cure rate of 80% as opposed to 65% cure rate for patients whose treatment choice differred from what the urodynamic data suggested. However, direct proof is still lacking and would require further study.

There are some controversies regarding the value of urodynamic tests in diagnosis of female incontinence. Some would rely on the history and physical demonstration of urine leakage from the urethral orifice to distinguish the surgically curable incontinence from bladder instability. But the same article also stated that the patient's history of urinary incontinence can be unreliable.[18] Some would rely on a simple measurements of residual urine and bladder volume.[19] Some would perform radiologic examination of urethro-vesical angle and the mobility of the bladder neck.[20] It has also been suggested that the presence of nocturnal frequency often indicates that incontinence is the result of detrusor dysfunction rather than sphincter incompetence[21] Theoretically, in bladder insta-

bility the uninhibited detrusor contraction with or without leakage of urine occurs a few seconds after coughing (see Fig. 2). If history taking is done carefully, one should be able to distinguish leakage of urine during coughing, which is the feature of genuine stress incontinence, from leakage of urine a few seconds after coughing, which is the feature of bladder instability. Unfortunately it is not always possible to distinguish the two by history taking alone because some of the patients are poor historian and some never pay attention to details. Physicians may also be impatient when seeing this type of patients.

There have been reports of doubt on the use of such time consuming investigative procedure in selecting patients for operation.[18] Urodynamics has its definite place when used to confirm a clinical impression but whether it may be helpful in selecting the types of operation, or the patients for an operation requires more evidence.[22] At present, it may safely be said that patients with abnormal urodynamic findings should proceed to surgery with caution.

Conclusion.

Abnormal urodynamic data were found in many of the 30 cases of female incontinence. The most common abnormality was bladder instability which accounted for 50% of the cases. Others included abnormal pressureflow relationship and large residual urine. These abnormalities have been shown to be associated with poor results after surgical treatment of urinary incontinence in the females. Urodynamic studies should be done routinely for all cases of female incontinence. Patients with abnormal urodynamic findings must be selected for surgery with caution.

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