

# The Overactive Bladder

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## INTRODUCTION

The term overactive bladder is not well known in Thailand because it has just been introduced for a few years.<sup>1,2</sup> The term was initiated and defined by Paul Abrams from Bristol, United Kingdom. An overactive bladder is associated with symptoms of urinary frequency, urgency and/or urge incontinence. Overactive detrusor function is characterized by involuntary detrusor contractions during the filling phase, which may be spontaneous or provoked (by rapid filling, alternations of posture, coughing, walking, jumping, etc.) while the patient is attempting to suppress them.

The diagnosis of overactive bladder may be divided into those with an unstable detrusor and those with detrusor hyperreflexia. Detrusor hyperreflexia is defined as overactivity due to disturbance of nervous control mechanisms such as cerebrovascular accident or suprasacral cord injury. The unstable detrusor or detrusor instability can be caused by bladder outlet obstruction (BOO) such as benign prostatic hypertrophy in males and external meatal stenosis in females, or be idiopathic in origin. The term "overactive bladder" may be used when the diagnosis is made on the basis of symptoms, and the term "detrusor overactivity" may be reserved for a diagnosis based on urodynamics.

Frequent urination is defined as urination more than 8 times in 24 hours, urgency is defined as a strong desire to void, and urge incontinence is defined as the involuntary flow of urine associated with urgency. The clinical conditions associated with these symptoms are termed motor urgency and motor urge incontinence. Sensory urgency or sensory urge incontinence are terms used when these symptoms are present but there are no involuntary detrusor contractions on filling cystometry.

## EPIDEMIOLOGY

At the outpatient Urology Clinic at Siriraj Hospital, there are about 3-4 female patients and 2-3 male patients presenting with symptoms of overactive bladder each day. There will be about 1,300-1,820 patients per year having symptoms of overactive bladder presenting to the Division of Urology.<sup>3,4</sup>

The incidence of overactive bladder between the ages of 20 and 60 years has been estimated at 10% in the asymptomatic elderly (Turner and Warwick, 1979)<sup>5</sup>, an overactive bladder is common, occurring in 50% of men over 70 years and in 30% of women of a similar age (Abrams, 1984).<sup>6</sup> In the symptomatic elderly over 75 years, the incidence is 80% in women and 90% in men (Malone-lee, 1988).<sup>7</sup>

## AETIOLOGY

Two categories of underlying pathophysiology of overactive bladder are :-

1. Neurogenic detrusor instability.
2. Myogenic detrusor overactivity.

### *A neurogenic basis for detrusor overactivity*

Bosch (1990)<sup>8</sup> proposed the causes of detrusor overactivity as shown in Table 1.

Normal storage of urine depends on

1. Spinal reflex mechanisms that activate sympathetic (via the lumbar cord) and somatic (via the pudendal nerve) pathways to the urethral outlet.
2. Tonic inhibitory systems in the brain that suppress the parasympathetic excitatory outflow to the detrusor muscle.

Voiding is mediated by inhibition of sympathetic and somatic pathways and activation of a spinobulbospinal parasympathetic reflex pathway

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**Table 1.** Causes of overactive bladder based on pathophysiology as proposed by Bosch (1990).**1. Disorders of the micturition reflex**

- a. Increased peripheral afferent activity, leading to increased efferent activity.
- b. Decreased inhibition from suprasacral centres, leading to increased efferent activity.
- c. Decreased inhibition from the periphery (pelvic floor and urethral sphincter), leading to increased efferent activity.

**2. Disorders of neurotransmission**

- a. Change in type of neurotransmitter involved.
- b. Change in quality of neurotransmitter involved.
- c. Increased responsiveness of detrusor muscle.
  - i increase in receptor density
  - ii increase in receptor affinity

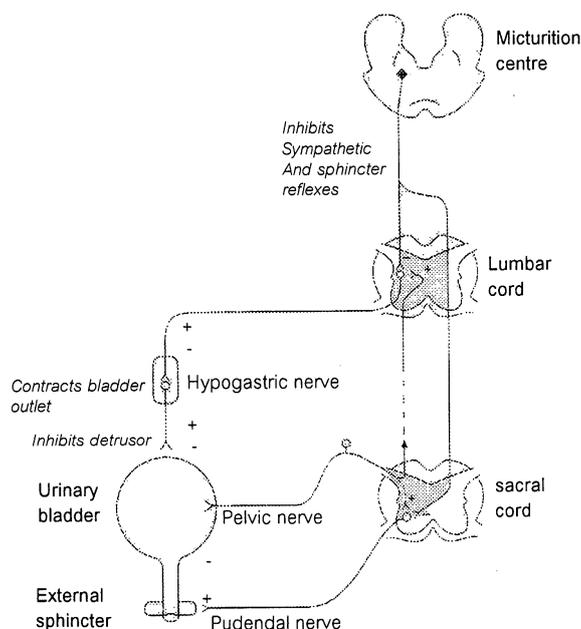
**3. Myogenic disorders**

- a. Abnormal synchronization of spontaneous activity, leading to net increase of activity.
- b. Intrinsic biochemical disorders of bladder smooth muscle.
- c. Membrane instability (denervation supersensitivity).

**4. Behavioural/psychological disorders**

passing through a micturition center in the rostral pons which functions as a switch in the micturition reflex pathway. The switch seems to regulate bladder capacity and also coordinates the activity of the

bladder and external urethral sphincter<sup>9,10</sup>. The pontine micturition center is under the influence of higher brain centers as shown in figure 1.

**Figure 1.** Diagram showing detrusor-sphincter reflexes.

**A myogenic basis for detrusor overactivity**

It is the belief of many research workers that the aetiology of the overactive bladder involves changes in the properties of the smooth muscle itself. In the normal bladder, smooth muscle cells are spontaneously active. During filling, however, the activity is not synchronous, because each smooth muscle cell is coupled to only a few of its neighbours, and extensive coupling between bundles does not exist. The synchronous activation seen during voiding requires dense innervation and a large number of smooth muscle cells to be directly activated by the nerves.<sup>11,12</sup>

Elbadawi et al.(1993a,b) used electron microscopy to investigate detrusor biopsies taken from geriatric patients with urodynamically defined voiding dysfunctions. The investigators described a dysjunction pattern, which was present in those patients who had an overactive bladder. The pattern consisted of moderately widened intercellular spaces, scarce intermediate cell junctions, but an abundance of distinctive protrusion junctions and closed cell abutments. It was proposed that the protrusion junctions and abutments mediate cell coupling between muscle cells and that they are involved in the generation of myogenic contractions in those with an overactive bladder. Five patients in this original study, who originally had a stable detrusor, progressed

to detrusor overactivity; ultrastructural studies from new biopsy material showed that they had developed this dysjunctional pattern since their original investigation (Elbadawi et al., 1997).<sup>13</sup>

**EVALUATION AND DIAGNOSIS**

As with all medical conditions, patients presenting with symptoms of overactive bladder, i.e., frequency, urgency and urge incontinence are first evaluated by history and physical examination involving the urological, gynaecological and neurological systems.

Usually the patient is asked to keep a voiding chart; that is a voiding diary frequency/volume chart over at least 3 days. The chart is used to record the time of micturition, volume, any episodes of urgency, incontinence and also the use of incontinence pads. This offers reliable information about a patient's symptoms.

**Urodynamics study**

**Uroflowmetry**

Uroflowmetry gives measurements of flow rates and flow patterns and is a useful screening test, mainly to evaluate bladder outlet obstruction. Consistently low flow rates generally indicate outlet obstruction but may also indicate decreased detrusor contractility as shown in figure 2.

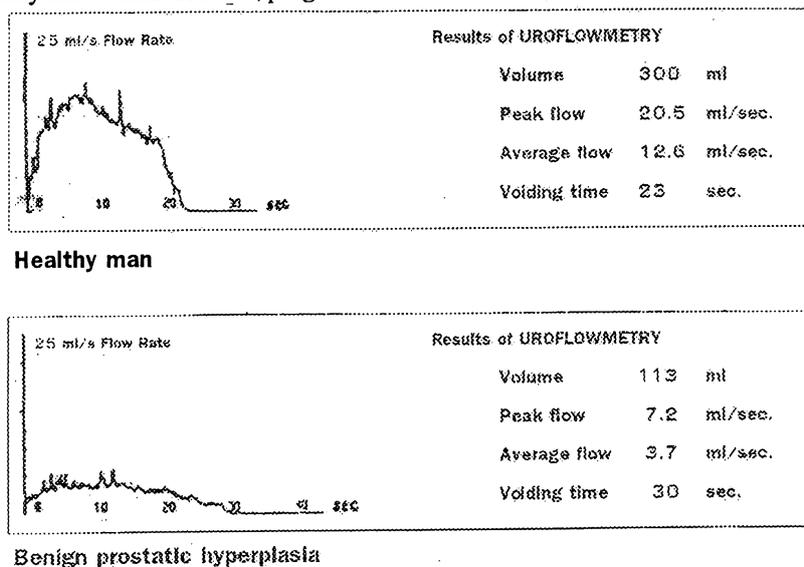


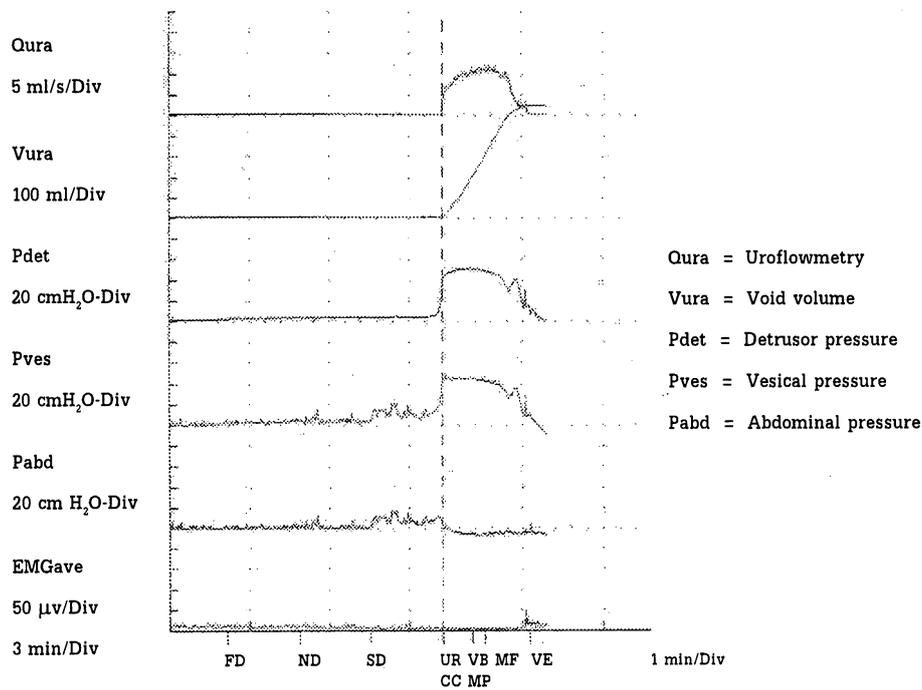
Figure 2. Uroflowmetry in a healthy man and a patient with benign prostatic hyperplasia.

**Voiding cystometry**

Voiding cystometry produces information regarding detrusor pressure during bladder emptying. Detrusor pressure and flow rate are measured continuously and are graphically plotted together. A patient can be said to have overactive bladder if the detrusor contraction produces phasic curves in intravesical and detrusor lines but not the intra-abdominal line. Figure 3 shows normal cystometry while Figure 4 shows an overactive bladder.

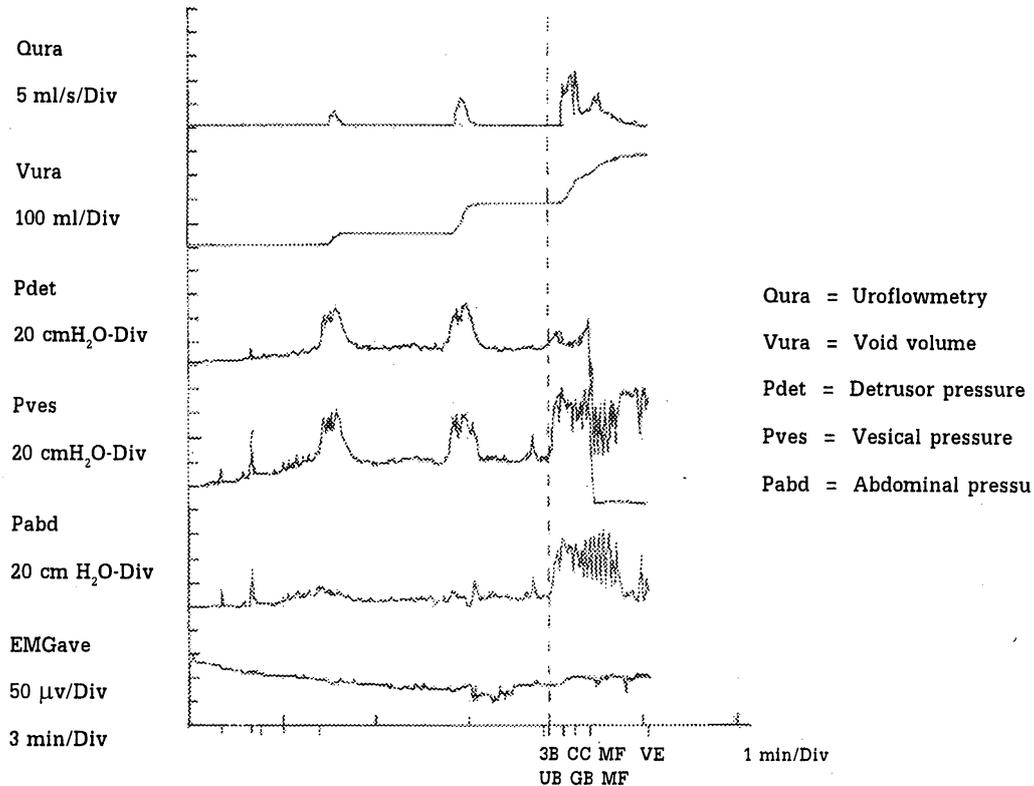
A patient can be said to have outlet obstruction when low flow rates are observed despite a high detrusor voiding pressure being generated (as in figure 5).

If low flow rates occur with low detrusor or no detrusor voiding pressures and the bladder fails to empty completely, then this is suggestive of an underactive or acontractile detrusor (as shown in Figure 6).



RESULTS (Storage Phase)	Vinfus	Pdet	Compliance
Residual Volume	0 ml.		
First Desire to Void	109 ml.	1 cmH <sub>2</sub> O	
Normal Desire to Void	246 ml.	3 cmH <sub>2</sub> O	103.7 ml/cmH <sub>2</sub> O
Strong Desire to Void	380 ml.	3 cmH <sub>2</sub> O	N.A. ml/cmH <sub>2</sub> O
Urgency	514 ml.	39 cmH <sub>2</sub> O	3.7 ml/cmH <sub>2</sub> O
Max. Cystometric Capacity	515 ml.	42 cmH <sub>2</sub> O	0.4 ml/cmH <sub>2</sub> O

Figure 3. Normal cystometry. Vinfus = Volume infusion, Pdet = Detrusor pressure, N.A. = Not analysis



**RESULTS (Storage Phase)**

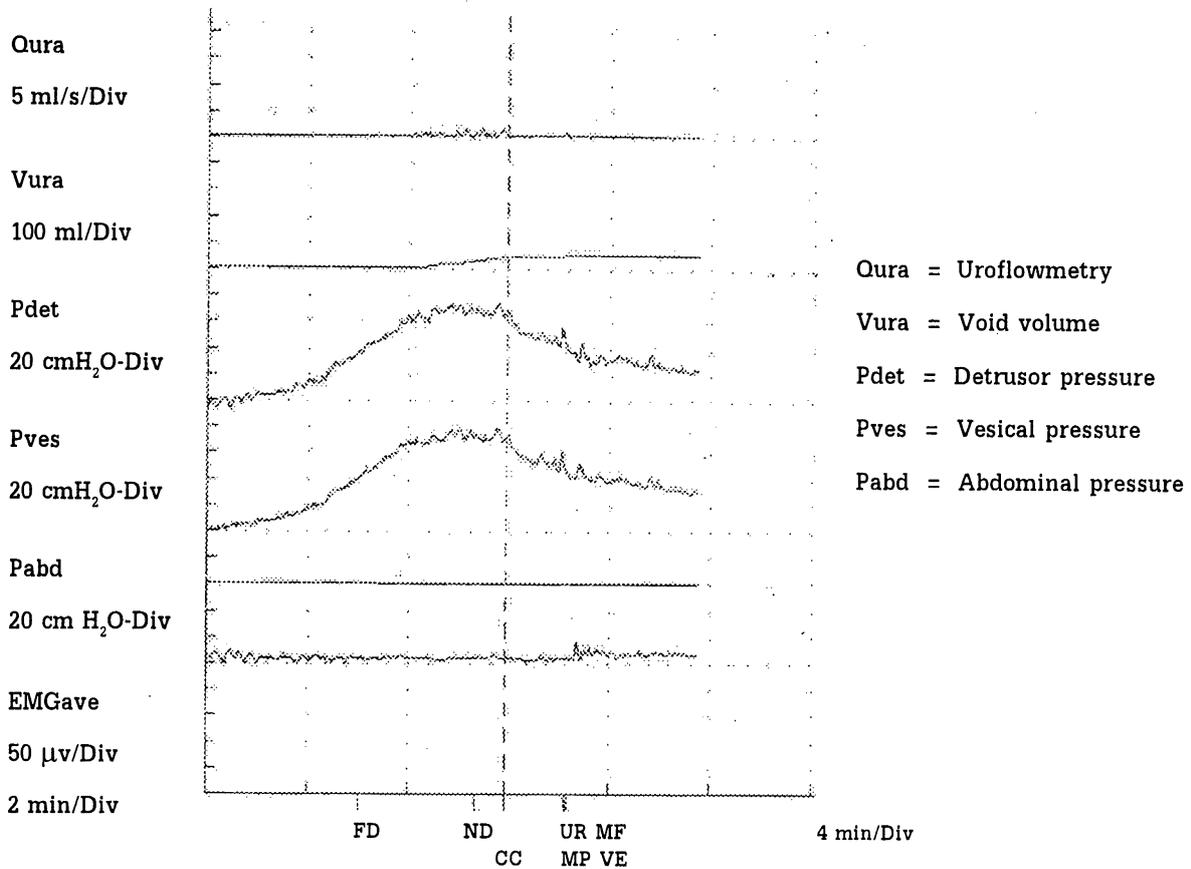
	Vinfus	Pdet
Residual Volume	0 ml	
First Desire to Void	115 ml	7 cmH <sub>2</sub> O
Normal Desire to Void	211 ml	13 cmH <sub>2</sub> O
Strong Desire to Void	415 ml	14 cmH <sub>2</sub> O
Urgency	424 ml	16 cmH <sub>2</sub> O
Max. Cystometric Capacity	426 ml	18 cmH <sub>2</sub> O
Multiple detrusor contractions with urinary leakage		

Figure 4. Overactive bladder. Vinfus = Volume infusion, Pdet = Detrusor pressure

**Pad tests**

The degree of urinary incontinence can be objectively measured by using one of a variety of pad tests available. A pre-weighed pad is placed over the vulva for a fixed amount of time. The patient may be asked to perform various provocative manoeuvres, such as exercise, coughing or washing hands under running water or she may just be allowed

to perform her usual daily activities. After use, the pad is re-weighed and the difference represents the amount of urine lost. The most accurate test is the 24-hour or 48-hour weighed pads which, after use, are sealed in plastic bags (to prevent evaporation) and later weighed. Pad tests tend to be used only in research situations as a means of comparing efficacy of treatments.



RESULTS (Storage Phase)	Vinfus	Pdet	Compliance
Residual Volume	290 ml		
First Desire to Void	152 ml	32 cmH <sub>2</sub> O	
Normal Desire to Void	266 ml	36 cmH <sub>2</sub> O	3.8 ml/cmH <sub>2</sub> O
Strong Desire to Void	N.A. ml	N.A. cmH <sub>2</sub> O	N.A. ml/cmH <sub>2</sub> O
Urgency	N.A. ml	N.A. cmH <sub>2</sub> O	N.A. ml/cmH <sub>2</sub> O
Max. Cystometric Capacity	295 ml	68 cmH <sub>2</sub> O	N.A. ml/cmH <sub>2</sub> O

Figure 5. Hyperactive neuropathic bladder with DSD. Vinfus = Volume infusion, Pdet = Detrusor pressure, N.A. = Not analysis

**Cystoscopic examination and urethral calibration**

Calibration of the urethral lumen is necessary in Thai woman because of the high incidence of stricture of the urethral lumen that causes an overactive bladder.

Cystoscopic examination is necessary to detect benign prostatic hypertrophy or contracture of the bladder neck in a male patient because an overactive bladder is the result of the obstruction.

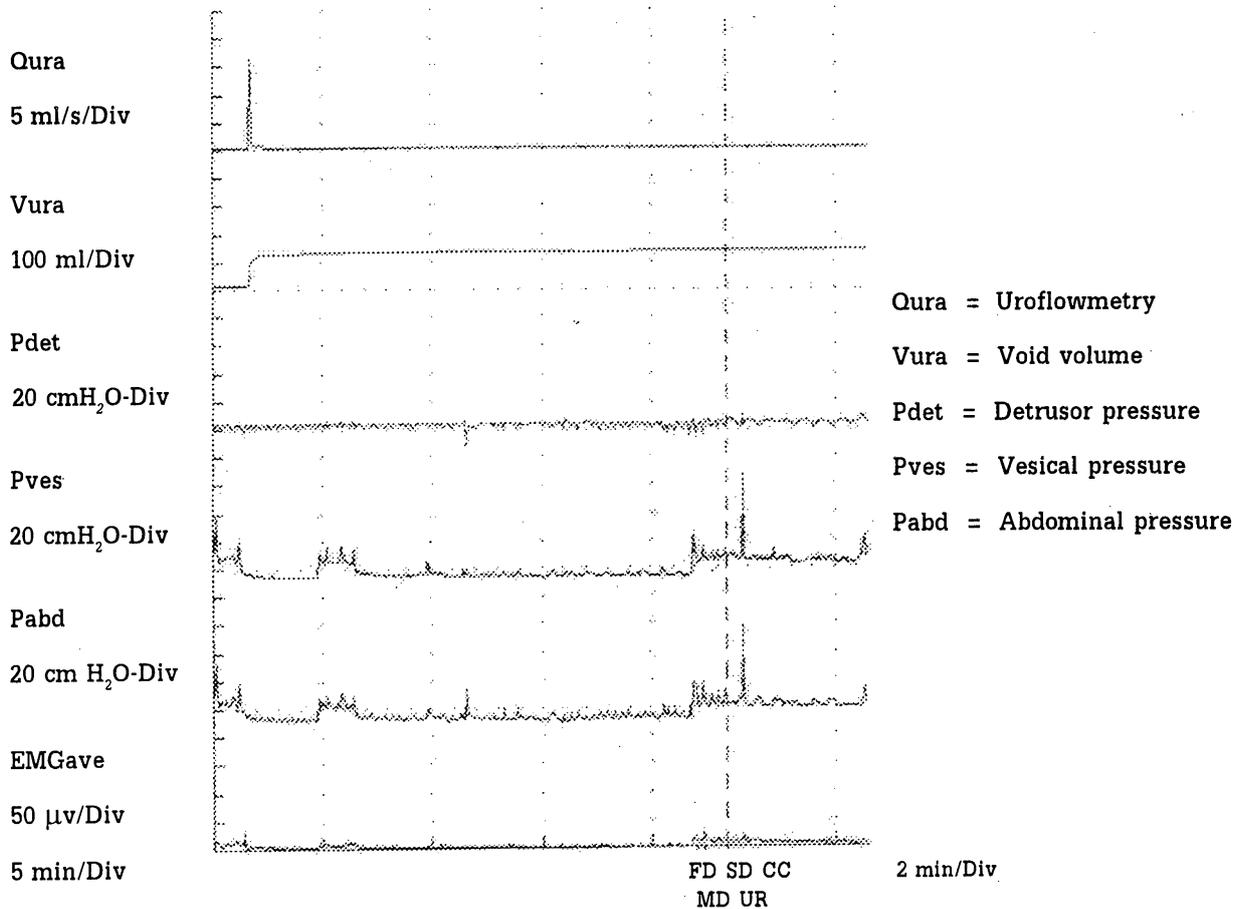
Cystoscopy is also performed in the patient with a neuropathic bladder in order to detect bladder abnormalities such as a stone, diverticulum, etc.

**TREATMENT**

**Conservative treatments**

**1. Bladder retraining or bladder drill**

Bladder retraining was introduced by



RESULTS (Storage Phase)	Vinfus	Pdet
Residual Volume	565 ml	
First Desire to Void	500 ml	-7 cmH <sub>2</sub> O
Normal Desire to Void	514 ml	3 cmH <sub>2</sub> O
Strong Desire to Void	565 ml	6 cmH <sub>2</sub> O
Urgency	565 ml	6 cmH <sub>2</sub> O
Max Cystometric Capacity	565 ml	5 cmH <sub>2</sub> O

Figure 6. Shows hypoactive neuropathic bladder in a known case of Diabetes Mellitus. Vinfus = Volume infusion, Pdet = Detrusor pressure

Frewen in 1979 with the use of frequency volume charts.<sup>14</sup> The patient is encouraged to increase gradually the interval between voiding and the volumes voided. The aim is to reduce voiding frequency until a 3-4 hourly pattern is achieved. In some cases, bladder sedatives are used to help achieve this. Long term success is achieved in around 50% of individuals (Holmes et al., 1983).<sup>15</sup>

## 2. Biofeedback

Biofeedback has been used to treat some patients (Cardozo et al., 1978).<sup>16</sup> During urodynamic studies the pressure signal is transduced into visual or auditory signals when a bladder contraction occurs. The patient is instructed to try to inhibit these contractions. The idea is that the patient learns how to recognize, and then consciously inhibits a

contraction when it occurs during everyday activities. Although initial results are encouraging, the long-term outcome is uncertain. In addition, the technique has failed to find favour because of the lack of availability of urodynamic equipment, as well as the need to catheterize patients repeatedly to assess bladder activity.

### 3. Pelvic floor exercises

Pelvic floor exercises may be useful for one or two reasons. The first is the incidental finding that pelvic floor exercises performed by women mainly because of stress incontinence lead to a reduction in concomitant detrusor overactivity. The reason behind this is unclear, but may be related to the fact that improved pelvic floor function prevents leaking of urine into the urethra, which can be a trigger for a bladder contraction. Pelvic floor exercises may also allow the woman to increase voluntarily her urethral closure pressure, and thus prevent incontinence, in the presence of a bladder contraction.

### 4. Electrical stimulation

Electrical stimulation has been used throughout Europe, though it has failed to find favour in the USA. The technique was developed from work in Sweden by Fall (1978).<sup>17</sup> The stimulation has two possible modes of action: 1) direct stimulation of the pelvic floor causing contraction and 2) indirect inhibition of the micturition reflex. Maximal electrical stimulation was shown to be effective in 50% of patients at 1 year (Eriksen et al., 1989).<sup>18</sup> The treatment is not popular in some patients, usually because improvements are slow to appear or because the patients do not like to wear the device (especially men using the rectal probe).

### 5. Other forms of treatment

Other treatments have been advocated by some, e.g., hypnotherapy (Freeman and Boxby, 1982)<sup>19</sup> and acupuncture, and subjective success has been claimed. However, these alternatives have failed to gain universal appeal.

### Pharmacotherapy

Various drugs are currently available for the

alleviation of an overactive bladder.<sup>20</sup> The majority have antimuscarinic activity and produce inevitable unwanted effects which the clinician must balance against any perceived benefit.

The available drugs are as follows: anticholinergic agents (antimuscarinic), musculotropic relaxants, calcium antagonists, potassium channel openers, prostaglandin inhibitors,  $\beta$ -adrenergic agonists, tricyclic antidepressants, estrogens, etc.

### Intravesical instillation

Intravesical instillation of drugs are available as Capsaicin, Resiniferatoxin<sup>27</sup> and Oxybutynin. In Thailand intravesical instillation with Capsaicin (Table 2) is available at Siriraj Hospital and has been reported by Viroj et al. (1999)<sup>26</sup> and Banjerd et al. (2001)<sup>28</sup> with good results.

These are specific neurotoxins that desensitize C-fibre afferent neurones which may be responsible for signals that trigger detrusor instability. Resiniferatoxin is 1,000 times more potent than Capsaicin, but with minimal initial excitatory actions.

### Neuromodulation

Neuromodulation is a relatively new technique which utilizes sacral nerve root stimulation in the treatment of the overactive bladder.<sup>29</sup> The exact mechanism of action is not well defined, but activation of the spinal interneurons or  $\beta$ -adrenergic neurones which inhibit bladder activity has been postulated. Patients are initially subjected to temporary sacral foramen nerve stimulation via percutaneous electrodes at the S3 level. If these temporary electrodes produce a successful result, then a permanent device can be surgically implanted. Shaker and Hassouna (1998)<sup>30</sup> used the technique in 18 patients with urge incontinence and showed a large decrease in incontinent episodes and increased cystometric bladder capacity. This new technique is still under evaluation but these early studies suggest that neuromodulation will be a useful alternative treatment for overactive bladder.

### Surgery

Many surgical techniques have been used in a bid to alleviate the overactive bladder. Procedures

**Table 2.** Clinical series of the use of intravesical capsaicin for the treatment of neurogenic bladder dysfunction.

Authors	No. of patients	Dose (mM/L)	Symptomatic improvement	Urodynamic improvement	Maximum duration of effect (months)
Fowler <sup>21</sup>	14	1-2	9/14 (64%)	10/14 (71%)	6
Gerisson <sup>22</sup>	10	2	4/10 (40%)	9/10 (90%)	7
Igawa <sup>23</sup>	5	1-2	5/5 (100%)	5/5 (100%)	6
Cruz <sup>24</sup>	16	1	14/16 (88%)	13/16 (81%)	9
de Ridder <sup>25</sup>	30	1-2	14/18 (78%)	-	3-5 years
Viroj <sup>26</sup>	14	1	12/13 (92%)	9/14 (64%)	-

to denervate the bladder using either a postsacral or a paravaginal approach have been described (Torrens and Griffiths,<sup>31</sup> 1974; Ingleman-Sundberg,<sup>32</sup> 1975). Other techniques have been employed in an attempt to disrupt the innervation and structure of the detrusor. These include open bladder transection, endoscopic transection, cystolysis and periureteric phenol injections to try to damage nerves to the detrusor. All of these techniques produced successful alleviation of detrusor overactivity in the short term. However, after 2 years most patients experienced a return of their symptoms, and on repeat urodynamic investigation they were shown to have detrusor overactivity. The most commonly used surgical techniques are ileocystoplasty and detrusor myomectomy.

## CONCLUSION

The overactive bladder remains a clinical problem to sufferers and to those called upon to treat it. Patients should seek help and treatment. The doctor should take a careful history and examination and investigate carefully. The treatment used depends on the cause and severity of symptoms. If the cause is bladder outlet obstruction, after dealing with the obstruction, the symptoms will recover dramatically. If the causes are idiopathic or neurological in origin, the results of treatment are still a challenge to urologists. Treatment modalities vary from conservative to surgical treatments. Most of the pharmacological therapies used are antimuscarinic but they produce side effects. In Thailand, intravesical instillation with Thai capsaicin is a promising and cost effective treatment.

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