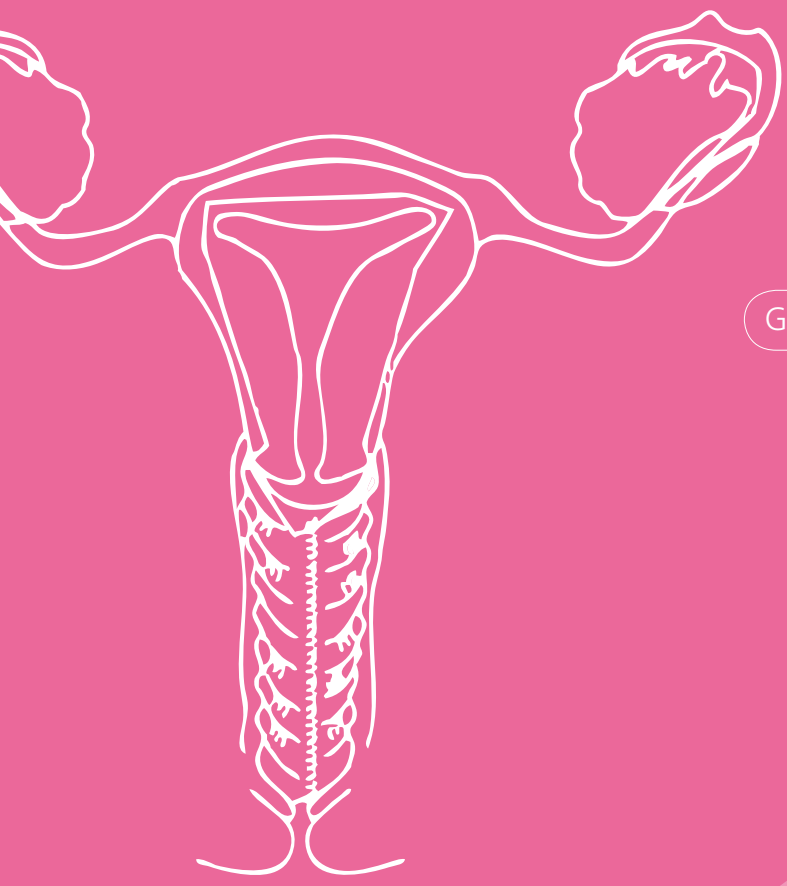
BladderScan®

Bladder Function in Gynaecology Patients



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Bladder Function in Gynaecology

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Bladder dysfunction and urinary incontinence is a common and socially distressing condition. A Mori Poll in 1993 (Brocklehurst 1993) showed that 10.9% of women under the age of 50 had been incontinent in the past. This figure rose to 15.4% in women aged 50 to 60 years and to 16.8% in the over 60 age group. Over half of women in nursing homes are thought to be incontinent of urine (Royal College of Physicians 1995). The causes of urinary dysfunction are multi-factorial and are shown in Table 1.

Table 1: Aetiology of bladder dysfunction in women.

A: Genuine stress incontinence

- Connective tissue weakness
- Genital prolapse
- Oestrogen deficiency
- Trauma to pubo-urethral ligaments
- Urethral fibrosis

B: Detrusor instability

- Idiopathic
- Psychomotor
- Neuropathic (hyper-reflexia)
- Post incontinence surgery

C: Urinary retention

- See Table 2

D: Congenital disorders

- Ectopic ureter
- Bladder dystrophy

E: Functional disorders

F: Fistulae

Previous childbirth, especially with the use of forceps is thought to be a principal cause, but a caesarean section is thought to be protective (Wilson et al 1996). Hormonal influences may have a role as seen in the rise in incontinence after the age of 50 years which correlates to the average age of the menopause. As far back as 1973 Bates (Bates 1973) coined the phrase "the bladder is an unreliable witness" to describe the poor correlation between symptoms and the underlying cause. As a consequence, urodynamics are usually necessary and are now considered mandatory before any surgical intervention is proposed (Thaker et al 2000). There is considerable overlap between genuine stress incontinence (GSI) and detrusor instability (DI) which are the principle causes of bladder dysfunction. In a study of 200 women with mixed symptoms attending an urodynamic clinic, Cardozo (Cardozo et al 1980) identified GSI in 55% of women, DI in 35% and mixed incontinence in the remainder. The residual bladder volume is an important aspect of the urodynamic study. The causes of high residual urine in women are shown in Table 2.

Table 2: Aetiology of voiding dysfunction

A: Obstructive

- Post incontinence surgery
- Impacted pelvic mass
- Fibroids
- Retroverted gravid uterus
- Ovarian cyst
- Cystocele
- Foreign body in urethra
- Bladder polyp/carcinoma

B: Inflammatory

- Genital herpes
- Acute vulvo vaginitis
- Cystitis/urethritis
- Post posterior repair

C: Pharmacological

- Epidural anaesthesia
- Tricyclic antidepressants
- Anti cholinergic medication

D: Neurological

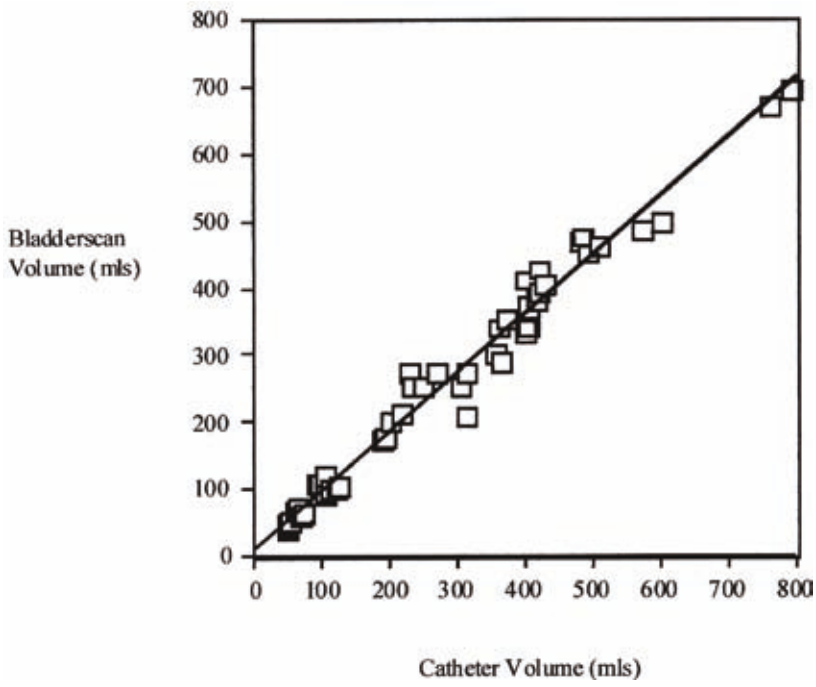
- Multiple sclerosis
- Spinal cord injury
- Cerebrovascular accident
- Parkinson's disease
- Prolapsed intervertebral disk
- Diabetic neuropathy

Inadequate emptying results in an increased frequency of micturition both day and night and therefore can be confused with detrusor instability. Urinary tract infections are more common in women with high post void urine measurements which can result in GSI and DI. The development of denovo DI increases after anti-incontinence surgical procedures such as colposuspension, but this must be differentiated from incomplete emptying. Large residual urine volumes with overflow incontinence can mimic stress incontinence, especially in the elderly (Yu et al 1990). Accurate routine assessment of bladder residual volume should therefore be readily available in an Obstetric and Gynaecology Department.

Urethral catheterisation of the female bladder remains the "gold standard" for the measurement of residual bladder volume (Mainprize et al 1989). However, this is often painful and frequently unnecessary since only small volumes are obtained. The bladder volumes may be underestimated if only a supine measurement is obtained; this is usually associated with a concomitant cystocele where an erect measurement should be taken. The residual bladder volume may be over estimated if the bladder is allowed to drain for a long period before the residual measurement is taken, if the patient is taking diuretic therapy or has recently had a high fluid intake especially containing caffeine. There is also a morbidity associated with catheterisation due to development of urinary tract infections and direct trauma to the urethra.

Ultrasound offers a safe, non invasive, method of measuring bladder volumes. Measurements are usually taken of the saggittal height (H), saggittal depth (D) and transverse width (W), and a calculation H x D x W x 0.625 (Hakenberg et al 1983) is usually employed. However the equipment is often heavy, expensive, cumbersome and not always readily available. For this reason portable ultrasound devices are becoming increasingly used as a ward or bedside management diagnostic tool. Coombes (Coombes et al 1994) showed that portable ultrasound is as accurate as urethral catheterisation (r=0.97). This was confirmed by Barrington (Barrington et al 1996a) in a study of 50 women attending an urodynamic clinic. There was a close correlation (r=0.989) between the bladder volumes obtained by BladderScan® after a flow rate study and the catheterised volume (Fig 1) over a wide range of volumes.

Fig 1: Relationship between BladderScan® and urethral catheter volume.



Measurement of bladder volume using a supra pubic catheter has often been suggested as an alternative to urethral catheterisation, since it is less traumatic than repeated catheterisation and the incidence of urinary tract infection is lowered. Arunkalaivanan (Arunkalaivanan et al 2002) has shown that portable ultrasound is as accurate as supra pubic catheterisation and conventional real-time ultrasound.

In this study the bladder volume in 26 women who had recently undergone an anti-incontinence operation was estimated using a BladderScan® BVI 3000 which was then compared with that obtained by a conventional real-time ultrasound machine.

The bladder was immediately emptied using the supra pubic catheter and it was apparent that there was no statistical difference between the obtained volumes (Fig 2).

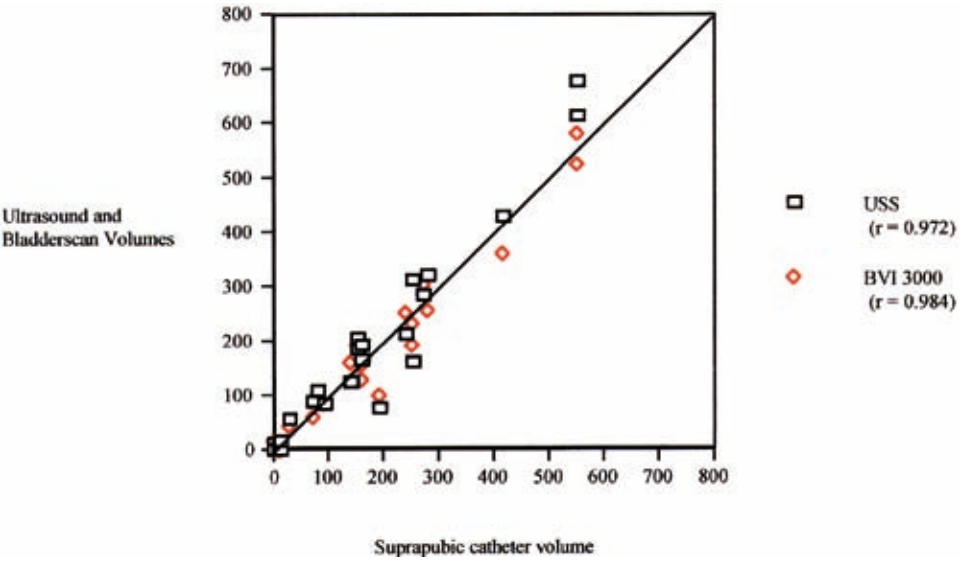


Fig 2: Comparison in bladder volume between BladderScan®, real-time ultrasound and suprapubic catheterisation.

It is important to ascertain that a hysterectomy has not been previously performed: the complex algorithms contained within a BladderScan® machine take into account the presence of the uterus. If a hysterectomy has therefore been carried out, the woman must be entered as a male subject to maintain accuracy. If the bladder architecture is altered such as seen following an augmentation "CLAM" ileo cystoplasty the use of portable ultrasound is inaccurate (Barrington et al 1996b).

Urinary retention is not commonly encountered ante-natally. The classic cause is impaction of the retroverted gravid uterus at about 16 weeks gestation. The usual explanation is that the bladder is displaced into the lower abdomen thus stretching and narrowing the urethra (Barnick et al 1991). Alternatively retention may occur due to the pelvic tumour interfering with the normal mechanism by which the internal meatus opens (Francis 1960).

The rate at which the bladder fills during labour is influenced by several factors, especially the amount of allowed fluid. Voiding dysfunction can commonly occur during labour due to forward displacement and compression of the urethra against the symphysis pubis. A full bladder, especially if epidural anaesthesia is used where painless over distension may occur, may interfere with the rate of progress in the first and second stage of labour. Since a single episode of acute urinary retention can cause long term voiding dysfunction the bladder is periodically emptied with a urethral catheter which is often unnecessary. The bladder is also routinely emptied prior to instrumental delivery or caesarean section. The use of portable ultrasound in labour has been investigated and found to be accurate so long as the membranes have ruptured (Arunkalaivanan et al 2001). The presence of amniotic fluid may interfere with the equipments algorithms and hence the correlation is poor ($r=0.128$). If the membranes are absent, a good correlation is obtained ($r=0.851$). Portable ultrasound has also been used on the post-natal ward to diagnose retention after caesarean section (Barrington et al 2001).

The enlarged post partum uterus does not seem to affect the accuracy of a BladderScan® machine (r=0.807) so long as sufficient time and care is taken to locate the bladder which is often elongated superiorly, compressed from anterior to posterior and levorotated in the immediate postnatal phase.

Conclusion

Bladder dysfunction and incontinence is a frequent presentation to Obstetrics & Gynaecology departments. A BladderScan® portable ultrasound machine based on the ward or outpatient clinic offers a rapid diagnostic test. The measurement of bladder volume is inexpensive and reduces the morbidity associated with the alternative of bladder catheterisation with improved patient acceptability.

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