

## TRANSABDOMINAL AND TRANSPERINEAL ULTRASOUND: A STUDY OF RELIABILITY AND VALIDITY

### Hypothesis / aims of study

Transperineal ultrasound (TP) is an established reliable method of evaluating women with incontinence. It has been used to assess bladder neck movement and levator activity and as biofeedback to teach pelvic floor muscle (PFM) exercises.

Transabdominal ultrasound (TA) has been used more recently by physiotherapists as a totally non-invasive method to assess the "lifting" aspect of the pelvic floor by observing movement of the endo-pelvic fascia during PFM exercises in asymptomatic women [1], women with incontinence and pelvic organ prolapse [2], and subjects with lumbo-pelvic pain [3].

Because elevation of the bladder neck is critical for maintenance of continence it is important to establish if elevation of the endo-pelvic fascia during a PFM contraction TA ultrasound predicts elevation of the bladder neck measured by TP ultrasound.

The aims of the study were 1) to assess the reliability of TP and TA ultrasound during a PFM contraction, Valsalva manoeuvre and abdominal curl up exercise and 2) to validate TA ultrasound against TP ultrasound for predicting the direction of bladder neck movement in women with incontinence and normal control subjects.

### Study design, materials and methods

Using a cross sectional study design TP ultrasound was compared with TA ultrasound. One hundred and twenty women, aged 20-55yrs with a mean age 43 (SD 7) yrs, BMI 24 (SD 4) and a median parity of 1.5 (range 0-5), were recruited from the community. Sixty women reported symptoms of incontinence. Ethical approval was received. The women were assessed in crook lying with a comfortably full bladder by a qualified sonographer, using TP and TA ultrasound (Philips HDI 5000 Sono CT) with two curved probes, 5-2MHz and 7-4MHz. Ten women were tested on two occasions for reliability. A measure of the position of the bladder neck, using TP ultrasound and the endo-pelvic fascia, using TA ultrasound, was taken at rest and the change from the resting position was measured in millimeters during PFM contraction, Valsalva manoeuvre and abdominal curl up exercise. The subjects were classified into categories as to whether they elevated or depressed the bladder neck (TP), or endo-pelvic fascia (TA).

### Results

Statistical analysis showed good reliability between trial 1 and 2 for PFM contraction for both TP and TA ultrasound. The reliability of the measurements for Valsalva and abdominal curl was higher with TP ultrasound than TA ultrasound (Table 1).

**Table 1**

	TP ICC (SEM)	TA ICC (SEM)
PFM contraction	0.91 (0.11)	0.93 (0.13)
Valsalva	0.87 (0.16)	0.51 (0.35)
Abdominal curl	0.79 (0.33)	0.53 (0.41)

There was a significant correlation between the measurements taken using TA and TP ultrasound for 120 subjects (Table2).

**Table 2**

	r	p
PFM contraction	0.63	< 0.0001
Valsalva	0.69	< 0.0001
Abdominal curl	0.40	< 0.0001

Twenty-three percent of subjects depressed the bladder neck (TP) and 21% depressed the pelvic floor (TA) during PFM contraction. There was a significant agreement between

direction of movement for the measurement taken with TP and TA ultrasound during PFM contraction  $Kappa = 0.56$   $p < 0.0001$ . TA ultrasound was able to predict the direction of bladder neck movement measured by TP ultrasound during PFM contraction in the majority of cases 102 (85%) but there were divergent measures in 18(15%) cases.

### **Interpretation of results**

TA ultrasound in expert hands is a reliable method of assessing movement of the endo-pelvic fascia during PFM contraction. It is less reliable than TP ultrasound at measuring movement during Valsalva and abdominal curl.

The measurements of the movement of the endo pelvic fascia during PFM contraction using TA ultrasound were significantly correlated to the movement of the bladder neck measured by TP ultrasound. The movement of the pelvic floor is likely to be in the same direction as the bladder neck but this was not always the case. A possible explanation for this, from concurrent research, is that the pelvic floor is susceptible to changes in intra-abdominal pressure resulting from increased abdominal and chest wall muscle activity.

### **Concluding message**

Transabdominal ultrasound is a non-invasive technique that can be used as an adjunct to the standard physiotherapy assessment of women with PFM dysfunction. It measures the lifting aspect and therefore correctness of PFM contraction but it cannot always predict the direction of bladder neck movement. It gives good visual feedback to therapist and patient and is clinically useful for retraining PFM dysfunction.

### **References**

1. Transabdominal ultrasound measurement of pelvic floor muscle activity when activated directly or via transversus abdominus muscle contraction. *Neurourology and Urodynamics*, 2003. **22**: p. 582-588.
2. Levator plate movement during voluntary pelvic floor muscle contraction in subjects with incontinence and prolapse: A cross sectional study and review. *Int Urogynecol Jnl*, 2003. **12**(4): p. 84-88.
3. Alterations of motor control in subjects with impaired lumbo-pelvic stability during the active straight leg raise test. *Spine*, 2002. **27**(1): p. 1-8.

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