

## VALIDATING ULTRASOUND GENITOHIALAL PARAMETERS FOR ASSESSMENT OF PELVIC FLOOR MUSCLE FUNCTION

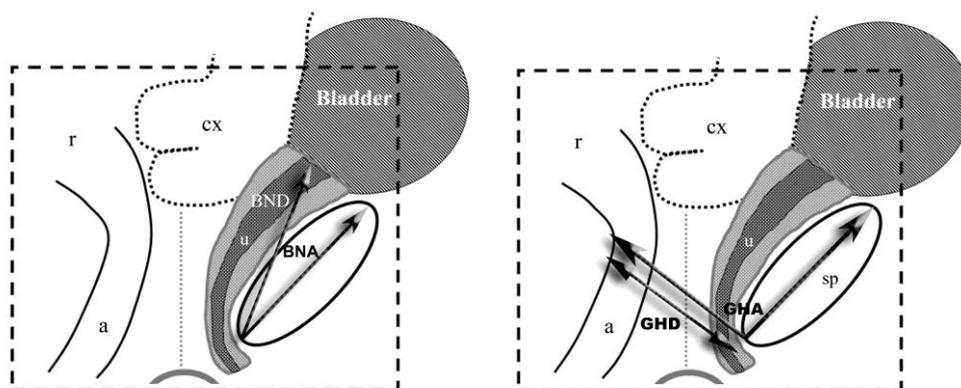
### Hypothesis / aims of study

Subjective bias with limited repeatability is the inherited limitation of intravaginal digital palpation for pelvic floor muscle contraction (PFMC) [1]. Ultrasound has been reported as a more valid approach than intravaginal digital palpation and clinical inspection to assess pelvic floor muscle function. [2] We designed this study to (a) validate ultrasonographic parameters against intravaginal digital examination, a gold standard, for assessment of PFMC; (b) identify the affecting factors of ultrasonographic parameters; (c) explore the effect of pelvic organ prolapse, from anterior, middle or posterior vaginal compartments, on these parameters and (d) recognize their functional implications in subjects with urodynamic stress incontinence;

### Study design, materials and methods

We retrospectively reviewed the database, compiled from June 2005 to December 2007, to indentified subjects who had documented urodynamic stress incontinence and who had undergone pelvic floor assessment, which include pelvic examination, intravaginal digital examination, and ultrasound scanning of pelvic floor.

1. Pelvic examination was performed when the patients were examined in the dorsal lithotomy position using a split speculum. Site-specific analysis of pelvic organ prolapse was defined using ICS POP-Q system.
2. PFMC was graded according to modified Oxford grading system, ranging from 0, no contraction detected; 1, flicker ; 2, weak contraction; 3, moderate contraction with slight finger lifts and no resistance; 4, strong contraction with finger lifts effect and slight resistance and 5, very strong contraction with finger lifts effect and strong resistance.
3. The sonographic assessment of pelvic floor included measurement of the morphologic features of the central pelvic floor and lower urinary tract at rest and during squeezing. The images were frozen at rest and at maximal PFMC to obtain specific measurement. The position of the bladder neck was expressed as two parameters in polar coordinates: the angle between bladder neck-symphyseal line and the midline of the pubic symphysis (BNA) and the distance between bladder neck and the lower border of pubic symphysis (BND) (Fig. 1). The genitohiatal angle (GHA) was defined as the angle between the anorectal reflection-symphyseal line and the midline of the pubic symphysis; the genitohiatal distance (GHD) was the distance between anorectal reflection and the lower border of the pubic smphysis (Fig. 2). The vector of the bladder neck motion (vectorBN) and anorectal motion (vectorAR) during squeezing was calculated from the resting and squeezing positions of the bladder neck and anorectal reflection in polar coordinates by a mathematic formula, respectively.



### Results

A total of 209 women with a mean age of 50.8 ( $\pm$  11.9) years, mean parity of 3.1 ( $\pm$  2.1), mean BMI of 24.4 ( $\pm$  3.9)kg/m<sup>2</sup> and mean modified Oxford grading of 2.7 ( $\pm$  1.0) were identified and constituted the study group.

- A. Reproducibility. Initially, a preliminary 15 ultrasonographic datasets were retrieved and analyzed by two investigators to examine the intra- and interobserver reproducibility. There was good correlation of interobserver results agreement ranging from 0.82 to 0.93. The intraobserver reproducibility was also good with an ICC coefficient of 0.54-0.82.
- B. Validation. Squeezing BND and GHD were the only two ultrasonographic parameters significantly correlated with PFMC ( $r=0.153$ ,  $P=0.045$  and  $r=-0.350$ ,  $P<0.001$ , respectively)
- C. Affecting factors

	sqBNA	sqBND	sqGHA	sqGHD	vectorBN	vectorAR	MOG
Age	ns	$r=-0.195^{**}$	ns	$r=0.165^*$	ns	ns	$r=-0.145^*$
Parity	ns	$r=-0.282^{**}$	$r=0.153^*$	$r=0.191^{**}$	ns	ns	ns
BMI	ns	ns	ns	ns	ns	ns	ns
Menopause	ns	$r=-0.159^*$	ns	ns	ns	ns	ns
D. Effect of pelvic organ prolapse							
	sqBNA	sqBND	sqGHA	sqGHD	vectorBN	vectorAR	MOG
Aa	ns	$r=-0.183^{**}$	ns	ns	ns	ns	ns
Ba	ns	$r=-0.268^{**}$	$r=0.153^*$	ns	ns	ns	ns
Ap	ns	ns	ns	ns	ns	ns	ns
Bp	ns	ns	ns	ns	$r=0.162^*$	ns	ns
C	ns	$r=-0.216^{**}$	$r=-0.160^*$	ns	ns	ns	ns

- E. Functional correlation

	sqBNA	sqBND	sqGHA	sqGHD	vectorBN	vectorAR	MOG
MUCP	ns	ns	ns	r=-0.190*	ns	ns	ns
VLPP grading	ns	ns	ns	ns	ns	ns	ns
1-h Pad test	ns	ns	ns	ns	ns	ns	ns

sqBNA, squeezing bladder neck angle; sqBND, squeezing bladder neck distance; sqGHA, squeezing genitohiatal ange; sqGHD, squeezing genitohiatal distance; vectorBN, the vector movement of the bladder neck during squeezing; vectorAR, the vector movement of the anorectal reflection during squeezing; MOG, modified Oxford grading of PFMC. \*:  $P < 0.05$ ; \*\*:  $P < 0.01$

#### Interpretation of results

Ultrasound provided a reliable assessment of pelvic floor muscle function in a sample of women with urodynamic stress incontinence. Squeezing BND and GHD were the two significant parameters correlated with the strength of PFMC. The strength of PFMC decreased with increasing age (lower modified Oxford grading, shorter squeezing BND and longer squeezing GHD). Defects in different vaginal wall compartments did not affect ultrasonographic measurement of squeezing GHD and digital assessment of PFMC. Squeezing GHD was the only parameter in relation to maximum urethral closure pressure.

#### Concluding message

Ultrasonography is a reliable tool for the measurement of PFMC. Squeezing GHD is a valid index for the assessment of pelvic floor muscle strength and is not affected by the coexisting defects in different vaginal wall compartments.

#### References

1. Phys Ther (2005) 85; 269-282.
2. Neurourol Urodyna (2003) 22; 582-588.

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<b>Is this a clinical trial?</b>	No
<b>What were the subjects in the study?</b>	HUMAN
<b>Was this study approved by an ethics committee?</b>	Yes
<b>Specify Name of Ethics Committee</b>	Mackay Memorial Hospital IRB
<b>Was the Declaration of Helsinki followed?</b>	Yes
<b>Was informed consent obtained from the patients?</b>	Yes