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DOES STANDARDISATION OF VALSALVA AFFECT BLADDER NECK MOBILITY AND CORRELATE WITH POP-Q STAGING?

Hypothesis / aims of study

Bladder neck mobility (BNM) is a validated standardised measurement that can be used to assess the effect of delivery on the pelvic floor (1). However researchers have used different techniques to standardise abdominal pressure (2,3) when performing the valsalva manoeuvre and therefore it is possible that measurements of BNM may be inaccurate. The aims of this study were to assess BNM using two different techniques (maximum valsalva manoeuvre and a standardised valsalva force using a sphygmomanometer) and comparing these measurements to POP-Q staging during pregnancy and after delivery.

Study design, materials and methods

Pregnant women attending the anomaly scan appointment at 20 weeks gestation were invited to participate in this study. Only women who were able to communicate with the investigator, had no neurological disorder or diabetes mellitus and had an uncomplicated singleton pregnancy were included. Women had perineal ultrasound examinations (B&K Medical, Denmark, 2400 Viking and a 6 MHz curvilinear probe) at three time points namely, during the second trimester, the third trimester and 14 weeks after delivery. Bladder neck mobility was assessed with a maximum valsalva manoeuvre (BN_{max}) and a modified sphygmomanometer to standardise the valsalva force as described earlier (3). Women were asked to blow into the sphygmomanometer to a pressure of 30 mmHg (BN_{30mmHg}) which corresponds to approximately 40cm H_2O. Bladder neck mobility was assessed establishing a vector from the resting (R) to the valsalva (V) position using a co-ordinate system. The x-axis coincides with the longitudinal axis of the pubic bone and the y axis intersecting at the inferior margin of the pubis. Conventional bladder neck movement (BN_{max}) was calculated using the following formula $\sqrt{(V_{max}x\text{-}Rx)^2+(Ry\text{-}V_{max}y)^2}$ (1) and for standardised valsalva with sphygmomanometer (BN_{30mmHg}) the formula $\sqrt{(V_{30mmHg}x\text{-}Rx)^2+(Ry\text{-}V_{30mmHg}y)^2}$ (2) was used. Pelvic organ prolapse (POP) was assessed using the validated International Continence Society staging method (POP-Q) during the 2nd and 3rd trimester and 14 weeks after delivery.

Statistical evaluations have been performed using the one sample T-Test to compare the two techniques of bladder neck mobility, the paired T-Test to compare bladder neck mobility at different time points and independent T-Test to compare the difference between primiparous and multiparous women, vaginal delivery and CS. Pearson's correlation was used to investigate the relationship of BN_{max} with BN_{30mmHg} and BN_{max} and BN_{30mmHg} with POP-Q points Aa and Ba. Kendall's taub correlation was performed to investigate the relationship between POP-Q stage with BN_{max} and BN_{30mmHg}.

Results

BNM was measured in 364 women at 22/40, 308 women at 36/40 and 260 women at 14 weeks after delivery. Bladder neck mobility during pregnancy and after delivery is shown in Table 1. BN_{30mmHg} was significantly smaller compared to BN_{max} (Table 1). BN_{max} and BN_{30mmHg} correlated significantly at each visit (22/40: $p<0.001$; 36/40: $p<0.001$; 14 weeks post natal: $p<0.001$). In all women BN_{max} decreased significantly during the third trimester compared to the second trimester (Table 1, $p<0.001$) and the postnatal period (Table 1, $p<0.001$). BN_{30mmHg} did not decrease significantly during the third trimester ($p=0.098$) but increased significantly after delivery ($p<=0.001$).

Table 1: BNM during pregnancy and after delivery in all women

	BN_{max} mean cm (SD)	BN_{30mmHg} mean cm (SD)	P value T-Test
22/40 n=364	1.03 (0.56)	0.43 (0.33)	<0.001
36/40 n=308	0.89 (0.51)	0.39 (0.31)	<0.001
14 weeks postnatal n=260	1.07 (0.53)	0.49 (0.36)	<0.001

BN_{max} and BN_{30mmHg} significantly correlated with POP-Q stage and POP-Q points Aa and Ba at each time point (Table 2).

Table 2: Correlation of BNM with POPQ-stage and POP-Q points Aa and Ba during pregnancy and after delivery

	BN_{max} 22/40	BN_{30mmHg} 36/40	BN_{max} 36/40	BN_{30mmHg} 36/40	BN_{max} 14 weeks postnatal	BN_{30mmHg} 14 weeks postnatal
POP-Q stage	R^2=0.290 p=0.000	R^2=0.122 p=0.004	R^2=0.245 p=0.000	R^2=0.147 p=0.002	R^2=0.275 p=0.000	R^2=0.144 p=0.004
Aa	R^2=0.375 p=0.000	R^2=0.184 p=0.000	R^2=0.313 p=0.000	R^2=0.167 p=0.004	R^2=0.337 p=0.000	R^2=0.205 p=0.001
Ba	R^2=0.399 p=0.000	R^2=0.188 p=0.000	R^2=0.285 p=0.000	R^2=0.157 p=0.006	R^2=0.429 p=0.000	R^2=0.227 p=0.000

R^2=Correlation coefficient

Interpretation of results

This study of BNM demonstrates that there is a good correlation between the use of maximum and standardised valsalva and POP-Q stage. However compared to $BN_{max,}$ BN_{30mmHg} appears to consistently underestimate bladder neck mobility during pregnancy and after delivery. In addition, during the 3rd trimester, compared to $BN_{max,}$ BN_{30mmHg} measurements did not detect a significant decrease of BNM. Therefore data from studies that use BN_{30mmHg} should be interpreted with caution. The technique using BN_{max} might not be as standardised as the technique using the sphygmomanometer, but it produces a longer vector due to the maximum valsalva pressure and makes changes in bladder neck mobility more obvious. It is possible that some women who blow into a sphygmomanometer system may be closing their glottis inadvertently and consequently having minimal effect on intra-abdominal pressure and BNM. The positive correlation between POP-Q points Aa and Ba and BNM would suggest that both methods of assessing the anterior compartment are valid although BN_{max} shows a better correlation coefficient (R^2) than $BN_{30mmHg.}$

Concluding message

This study shows that while there is a good correlation between BN_{30mmHg} and $BN_{max,}$ BN_{30mmHg} appears to underestimate bladder neck mobility during pregnancy and in the puerperium. However, BN_{max} detects the significant changes of BNM during the 3rd trimester of pregnancy and therefore might be more sensitive. Both POP-Q measurements and BNM appear to be valid methods of assessment of the anterior compartment.

References:

1) Obstet Gynecol. (1995) 85:220-4.
2) Obstet Gynecol. (2003) 102(2):223-8.
3) BJOG (1998) 105:1300-1307.

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CLINICAL TRIAL REGISTRATION: This clinical trial has not yet been registered in a public clinical trials registry.

HUMAN SUBJECTS: This study was approved by the South London Research Ethics Committee and followed the Declaration of Helsinki Informed consent was obtained from the patients.