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PELVIC FLOOR INVOLUNTARY RESPONSE DURING COUGHING IN CONTINENT AND STRESS URINARY INCONTINENT POSTMENOPAUSAL WOMEN

Hypothesis/aims of study

The pelvic floor musculature (PFM) is recognized as playing a major role in continence since it participates in urethral occlusion. It has been suggested that an involuntary PFM contraction precedes the increase in intra-abdominal pressure (IAP) in continent women during a cough [1] in order to prevent urinary leakage. Therefore, impairments in the involuntary pre-activation of the PFM may lead to stress urinary incontinence (SUI) during coughing. The purpose of the study was to compare the characteristics of PFM involuntary response occurring during coughing between continent and SUI postmenopausal women.

Study design, materials and methods

Sixty-one postmenopausal women were recruited from uro-gynecology and menopause clinics as well as by local newsletter announcements. Continence status was assessed by the Urogenital Distress Inventory Questionnaire and participants' self-reported symptoms.

During the PFM measurements, the women adopted a supine lying position with knees and hips flexed, feet flat on a conventional examination table. A dynamometric speculum was inserted in the vaginal cavity to evaluate the PFM involuntary response during coughing. This instrument is known to provide a direct and valid measurement of the PFM during an increase in IAP [2]. To monitor the intensity of coughing, the IAP was measured with an intra-rectal balloon connected to a pressure transducer. The dynamometric assessment of the pelvic floor was conducted at a vaginal aperture of 15 mm (antero-posterior diameter). All signals were recorded simultaneously with a laptop computer. The subjects were instructed to perform two maximal coughs. The mean of two trials was considered in the calculations. The following parameters were used to assess the involuntary response of the PFM during coughing: 1- PFM maximal force (peak amplitude obtained during coughing minus the baseline value recorded just before the effort); 2- the maximal rate of force development of the PFM contraction; 3- the PFM force at the onset of increase in the IAP; 4- the PFM delay between the onset of the PFM and the onset of IAP (PFM onset - IAP onset). For this parameter, negative values indicate that the PFM contracts before the increase in IAP. PFM and IAP onset was determined by a technique based on the standard deviation (SD) of the signal baseline. Since the data was not normally distributed, Mann-Whitney non-parametric tests were used to compare the PFM involuntary response between continent and stress incontinent women.

Results

Thirty-one women were continent and 30 had SUI symptoms. Their mean ages were 55.8 years (±5.6 SD) and 56.8 years (±5.9 SD) for continent and incontinent women, respectively. Continent women had a mean parity of 1.4 (±1.2 SD) while incontinent women had 1.0 (±1.0 SD). Differences between the two groups regarding these characteristics were non-significant ($p>0.1$).

An example of PFM and IAP curves is given in Figure 1. Table 1 shows the PFM involuntary parameters in continent and incontinent women. The main finding was the significant difference for the maximal rate of force development. SUI women tend to have a lower PFM peak force.

Table 1 – PFM involuntary parameters during coughing

Parameters	**Median (25e – 75e percentiles)**		**p value**
	Continent	**SUI**	
PFM peak force (N)	3.1 (2.0 – 4.3)	2.2 (1.2 – 3.6)	p = 0.126
Maximal rate of force development (N/s)	15.5 (10.3 – 23.2)	8.6 (5.8 – 19.5)	p= 0.032**
PFM force at the onset of the IAP (N)	0.7 (0.4 – 1.0)	0.5 (0.3 – 1.3)	p= 0.655
PFM delay (s)	-0.08 (-0.11 – -0.05)	-0.09 (-0.16 – -0.03)	p= 0.955

**Sign. p<0.05

Interpretation of results

The lower rate of maximal force development in SUI women suggests that the speed of PFM contraction is important to prevent urinary leakage during coughing. Since the time delay between the increase in the IAP and the PFM contraction is not different between continent and SUI women, this time relationship does not seem to be a crucial factor contributing to SUI.

A possible model that integrates the speed characteristics in SUI is illustrated in Figure 2. Assuming that the absolute level of pressure to occlude the urethra is approximately similar for all subjects (continent and SUI women), the low rate of force development in SUI women could determine a lengthening of the time they take to block the urethra. Consequently, during this period, there is more probability that urinary leakage occurs.

Figure 1 – PFM response during coughing

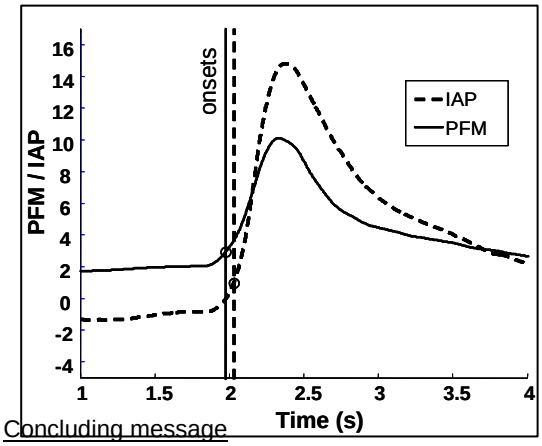
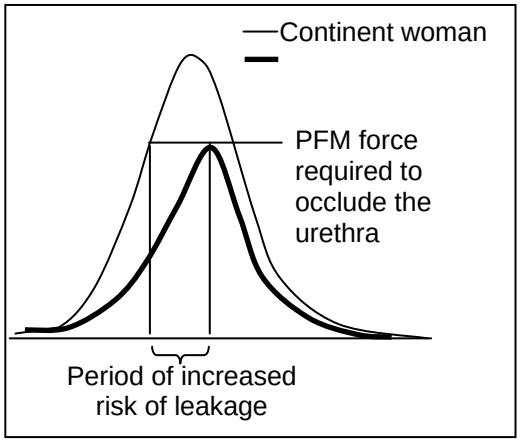


Figure 2 – PFM force during coughing



Concluding message

The timing of PFM activation prior to the increase in IAP was not different across the two groups, suggesting that pre-activation of the PFM is not a crucial factor contributing to SUI. However, the reduced PFM speed of contraction in SUI women suggests that a neuro-muscular impairment is associated with SUI. These measurements may prove useful for defining the underlying changes in the PFM function following treatment and, hence, for improving SUI treatment efficacy.

References

[1] Prog Clin Biol Res 1981, 78: 113-120.
[2] Neurourol Urodyn 25 (6) 530-531.

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HUMAN SUBJECTS: This study was approved by the Comités d'évaluations scientifique et d'éthique de la recherche du CHUM and followed the Declaration of Helsinki Informed consent was obtained from the patients.