

IS THERE A DIFFERENCE IN THE PELVIC FLOOR MUSCLE RESPONSE TO DIFFERENT ABDOMINAL WALL MOVEMENTS DURING COUGHING AND FORCED EXPIRATION?

Hypothesis / aims of study

In the joint report (IUGA/ICS) on pelvic floor muscle (PFM) function standardization, an involuntary PFM contraction (PFMC) is described as a contraction that precedes an intra-abdominal pressure (IAP) rise, e.g. during coughing, sneezing. A physiological cough or forced expiration pattern is associated with a simultaneous contraction of the anterior abdominal muscles (AAMs) and the PFMs, leading to an inward movement of the lower abdominal wall [1]. In the clinical setting, however different activation patterns of AAMs and PFMs are observed during coughing and forced expiration. In this observational study we aimed to determine the occurrence of different muscle activity patterns of AAMs and PFMs during coughing and forced expiration in young healthy nulliparous volunteers.

Study design, materials and methods

Healthy nulliparous women without a history of pelvic floor dysfunction confirmed by a German validated questionnaire participated in the study. The participants performed 1 series of three maximal expulsive coughs, followed by three forced expirations (loud vocal "hey") during which respiratory inductive plethysmography (RIP) method was used to measure ribcage- and abdominal motion [2]. The inward abdominal movement was considered as physiological RIP (P-RIP) and the outward movement of the abdominal wall as non-physiological RIP (NON-P-RIP). The trans perineal ultrasound (TPU) was applied to assess displacement of the bladder neck [3]. During a second series visual inspection of the abdominal wall was used to assess abdominal movement and visual inspection of the perineum to detect occurrence of PFM activity. In a third series PFMC was assessed by vaginal palpation. All measurements were done in standing position.

Results

149 women between 19 and 35 years (mean 26.3) were in the study included, one dropped out due to vaginismus. We observed 89 subjects in the NON-P-RIP group and 60 subjects in the P-RIP group during coughing. There was a difference in occurrence of cranioventral bladder neck displacement during coughing: 10 out of 60 subjects (16.7%) in the P-RIP group compared to 2 out of 89 (2.3%) subjects in the NON-P-RIP group. The odds of bladder neck displacement assessed by TPU is in subjects of the P-RIP significant higher than in subjects with NON-P-RIP (OR 8.7, 95% CI 1.83 to 41.30, (p <0.01). The PFMC assessed by vaginal palpation differed in the study groups during coughing as well: 23 out of 60 subjects (38.3%) in the P-RIP group compared to 2 out of 89 subjects (2.3%) in the NON-P-RIP group. The odds of PFMC assessed by palpation is in subjects of the P-RIP significant higher than in subjects with NON-P-RIP (p<0.001).

During forced expiration we found 93 subjects in the NON-P-RIP group and 56 subjects in the P-RIP group. There was a difference in occurrence of bladder neck displacement during forced expiration: 28 out of 56 subjects (50%) in the P-RIP group compared to 17 out of 93 (18.3%) subjects in the NON-P-RIP group (OR 4.47, 95% CI 2.13 to 9.39, p<0.001). PFMC assessed by palpation during forced expiration indicated a similar result as described for coughing. In addition, all results are adjusted for age as well (table 1).

	N	P-RIP n/N (%)	NON-P-RIP n/N (%)	Crude OR (95% CI)	p-value	Adjusted OR (95% CI) [†]	p-value
Coughing							
TPU*	149	10/60 (16.67)	2/89 (2.25)	8.7 (1.83 to 41.30)	0.006	9.12 (1.89 to 44.00)	0.006
VIP**	149	6/60 (10.00)	1/89 (1.12)	9.78 (1.15 to 83.43)	0.037	10.46 (1.19 to 91.60)	0.034
Palpation***	149	23/60 (38.33)	2/89 (2.25)	27.04 (6.06 to 120.61)	0.000	29.62 (6.48 to 135.43)	0.000
Forced expiration							
TPU*	149	28/56 (50.00)	17/93 (18.28)	4.47 (2.13 to 9.39)	0.000	4.51 (2.14 to 9.49)	0.000
VIP**	149	2/56 (3.57)	1/93 (1.08)	3.41 (0.30 to 38.47)	0.322	3.87 (0.33 to 45.23)	0.281
Palpation***	149	16/56 (28.57)	2/93 (2.15)	18.20 (4.00 to 82.91)	0.000	20.82 (4.42 to 98.19)	0.000

* transperineal ultrasound for cranioventral displacement of the bladder neck defined as positive values in x- and y-axis

** Visual inspection of perineum, no downward movement (present PFMC)

*** Palpation, present PFMC

† Adjusted for age

Interpretation of results

In this study we observed a relation between the abdominal movement during coughing/forced expiration and PFM activity. Overall the majority of subjects had an outward movement of the abdominal wall (NON-P-RIP group). An inward movement of the

abdominal wall was significantly more often associated with a PFMC in all measurements except visual inspection of the perineum during forced expiration. Influencing factors which has an impact of the occurrence of the P-RIP are not yet known. A lack of PFMC during coughing is often described as a PFM dysfunction. We assume that an absent of PFMC could also be due to the abdominal pattern. In general, the low rate of PFMC observed during coughing and forced expiration could be influenced by the ability of the applied methods in our study

Concluding message

Our study results suggest that the abdominal movement has an impact on the PFM response. Therefore, clinicians should be aware of differences in abdominal movement during coughing and forced expiration and be considered in diagnostics and treatment of PFM dysfunction.

References

1. Hodges PW, Sapsfors R, Pengel LH, Postural and respiratory functions of the pelvic floor muscles. *Neurourol. Urodyn* 2007;26(3):362-71
2. Schaer GN, Koechli OR, Schuessler B, Haller U. Perineal ultrasound: Determination of reliable examination procedures. *Ultrasound Obstet Gynecol* 1996;7:347-52
3. Clarenbach CF, Senn O, Brack T, Kohler M, Bloch KE. Monitoring of ventilation during exercise by a portable respiratory inductive plethysmograph. *Chest* 2005;128:1282-90

Disclosures

Funding: Non **Clinical Trial:** Yes **Public Registry:** No **RCT:** No **Subjects:** HUMAN **Ethics Committee:** Kantonale Ethikkommission Bern (CH) **Helsinki:** Yes **Informed Consent:** Yes