

COUGHING AND CONTINENCE: PELVIC FLOOR MUSCLE ACTIVITY IN WOMEN WITH CHRONIC LUNG DISEASE.

Hypothesis / aims of study

The aims of this study were to investigate pelvic floor muscle (PFM) activity during phases of coughing and the therapeutic technique of huffing in women with and without chronic lung disease. Specifically:

1. to compare pelvic floor muscle activity during coughing, huffing and short (1 second) and prolonged (20 second) maximum voluntary contractions (MVC's) in these two subject groups.
2. to determine the effect of a physiotherapy PFM training program on PFM activity in cough, huff and MVC in women with chronic lung disease and self-reported urinary incontinence.

Study design, materials and methods

Thirty-one women (22-65 years) were recruited, 17 with chronic lung disease and 14 aged matched controls without lung disease. Ethics approval was obtained from the local Human Research Ethics Committee.

1. PFM activity was measured with the subject in reclined lying during a series of three 1 second and 20 second MVC's, three coughs and three huffs, by surface EMG (μV) using a vaginal electrode. Thoracic movement was measured to determine time of onset and end of the cough and huff, onset and duration of the pre-cough/huff inspiration, and duration of the cough/huff by videotaped antero-superior displacement of a reference marker on the sternum. EMG data of PFM activity was obtained during these phases. Chest movement and EMG data were synchronised using LED lights and associated microvolt signals, indicating the start and finish of each task and analysed using the PEAK motion analysis system.

PFM activity was then measured as vertical displacement (mm) for the same series of manoeuvres using real-time transabdominal ultrasound (Dornier Medtech, USA), with a 2-5Mhz curved linear array transducer placed immediately supra-pubically in the mid-sagittal plane with the subject in reclined lying. On-screen calipers measured the displacements, positive displacements indicating elevation and negative scores depression of the pelvic floor. Due to equipment limitation, no 20 second MVC was measured on US. Results were analysed graphically and differences between groups analysed using Mann-Whitney U test.

2. Nine symptomatic women undertook a 3 month physiotherapy treatment program and formed a case studies series. They were measured at baseline, 3 and 6 months (Trials 1, 2 & 3) on EMG and US measures of PFM and standard continence tools. US and EMG data are presented on two case studies.

Results

Identification of onset, peak and end of cough-related PFM EMG activity was graphed using a least squares (LOWESS) curve of best fit on the EMG trace (Figure 1).

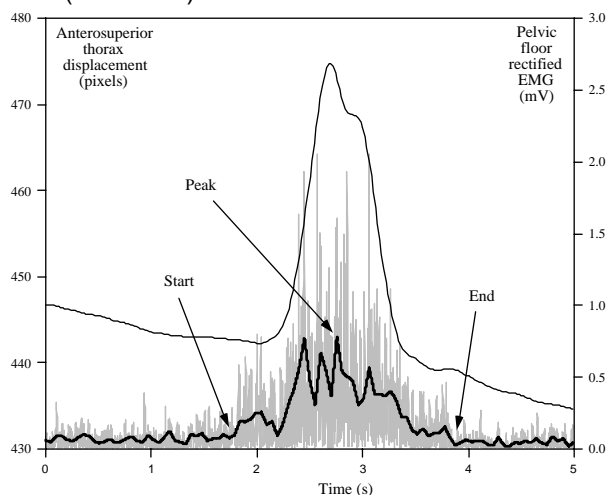


Figure 1

1. There was no significant difference between groups in the mean resting PFM EMG ($p=0.4$), or in the magnitude of the PFM EMG during a 1 second ($p=0.5$) or 20 second MVC ($p=1.0$). No significant differences between groups were found for coughing and huffing in timing or pattern of the PFM EMG throughout the cough, the onset, duration, end of activity or peak activity of the PFM. In contrast, Mann-Whitney U tests indicate significant differences in PFM activity for MVC and huffing on US measures (Table 1).

Table 1. Vertical displacement of PFM measured on US (mm)

	Lung disease		Control		P
	Mean	SD	Mean	SD	
MVC(1 sec)	-1.8	8.92	4.16	6.26	0.025
Cough	-31.3	14.0	-25.4	16.8	0.247
Huff	-2.3	8.68	-20.0	14.96	<0.001

2. For the case studies, the percentage change in PFM activity during MVC (EMG and US), cough and huff (US) are presented in Table 2.

Table 2.

		Subject 1			Tr1-Tr3	Subject 2			Tr1-Tr3
		Tr 1	Tr 2	Tr 3	%change	Tr 1	Tr 2	Tr 3	%change
EMG μ V	MVC 1	1.98	1.95	2.79	40	8.39	7.22	15.67	87
	MVC20	1.05	1.05	1.53	45	3.77	6.66	13.68	262
US mm	MVC 1	-3.3	-4.4	1.9	42	7.6	5.0	10.0	32
	Cough	-27	-9.5	-11.6	57	-39	-23.7	-26.3	32
	Huff	-25	-6.6	-7.5	70	-31	-24.3	-24.3	27

Tr=trial

Interpretation of results

There were no significant differences between groups in EMG derived data for any PFM activities, indicating that PFM activation is not affected by chronic lung disease. However, differences emerged with US data. EMG data indicates electrical activity in PFM, while US data gives direction and magnitude of that activity. On US, both groups showed similar pelvic floor descent in coughing, but the pelvic floor rose in the control group, compared to descent in the lung disease group, in a voluntary contraction. During huffing, lung disease women descended significantly less than the control group. A lift of the pelvic floor is a concentric muscle action while a descent is either eccentric contraction in an attempt to overcome a large force, or passive if a Valsalva. A correct voluntary contraction is therefore visualised as a lift on US. Women with lung disease and urinary incontinence undergoing a PFM training program improved voluntary PFM activation and reversed incorrect PFM action.

Concluding message

Coughing appears to be similar in PFM activity for adult women with and without chronic lung disease. Coughing has a known association with urinary incontinence (1) but it is not known what specific features of the cough mechanism are most associated with urinary incontinence. No differences emerged when examining phases of cough or huff. However, a specific risk factor may be PFM descent seen in voluntary (MVC) PFM activity. This descent is likely to be related to decreased motor control or strength, as a physiotherapy PFM training program was successful in improving voluntary PFM activation and reversing incorrect action.

Reference

- 1) The prevalence and severity of symptoms of incontinence in adult cystic fibrosis patients. (2000) *Physiotherapy Theory and Practice*. 16:35-42

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