

POSTURAL RESPONSE OF THE PELVIC FLOOR MUSCLES IS AFFECTED BY STRESS URINARY INCONTINENCE

Hypothesis / aims of study

Previous studies have shown that pelvic floor (PF) muscle activity increases as a component of the postural adjustment associated with rapid arm movements. This activity is argued to be associated with the change in intra-abdominal pressure associated with abdominal muscle activity during these adjustments. The aim of this study was to determine whether the onset and amplitude of postural activity of the PF and abdominal muscles differs between continent and incontinent women during rapid arm movements.

Study design, materials and methods

Based on previous data in continent subjects, at 80% power, 95% confidence and a standard deviation of 28 ms, 15 subjects in each group would be required to detect at 30% difference in reaction time of the PF muscles. In 16 women with stress urinary incontinence (SUI) and 14 continent women electromyographic activity (EMG) of the PF, internal obliquus abdominis, obliquus externus abdominis, rectus abdominis and erector spinae muscles were recorded with surface electrodes during rapid shoulder flexion and extension. Onset of trunk and PF muscle EMG activity relative to onset of anterior (flexion) and posterior (extension) deltoid muscle EMG were detected for each muscle from data averaged over ten repetitions. Data were further analysed by comparison of root mean square raw (between groups comparisons) and normalised (postural response comparison) EMG amplitude recorded 150-250 ms before (baseline) and 0-100 ms after (response) the onset of deltoid muscle EMG.

Results

Normalised EMG activity of all muscles was increased in association with arm movement (all: $p < 0.001$). Unlike the abdominal and erector spinae muscles (all: $p < 0.004$), the onset of PF muscle EMG relative to that of deltoid did not differ with respect to direction of arm movement ($p = 0.70$). However, the onset of the postural response of the PF muscles differed between continent and incontinent women ($p = 0.002$). During both shoulder flexion and extension, the onset of the PF muscle postural response occurred prior to that of deltoid muscle for continent women, but after deltoid muscle in women with SUI. A novel finding was that in many women with SUI, background PF EMG decreased prior to the PF muscle postural response (flexion: $p = 0.004$, and extension: $p = 0.024$). Unexpectedly, amplitude of raw PF EMG associated with rapid arm movements was greater in women with SUI compared to continent women ($p = 0.010$).

Interpretation of results

Differences in the timing of the postural response of the PF muscles during rapid arm movements is similar to that previously reported among continent and incontinent women during coughing (1). Among continent women, PF EMG increases prior to that of the deltoid muscle, and this has been argued to be important for the maintenance of continence (2) in association with the increase in intra-abdominal pressure that is initiated prior to arm movement, and also important for lumbopelvic stability (3). However, among women with SUI, the postural response of the PF muscles is delayed, and in many women PF EMG actually decreased, rather than increased, prior to activation of deltoid muscle. This appears counterintuitive to the premise that the PF muscles are required to maintain continence in a situation of increased abdominal muscle activity and intra-abdominal pressure, and stabilise the spine and pelvis in preparation for movement. Interestingly, the amplitude of PF EMG following activation of deltoid was greater in women with SUI. This may represent a strategy to control continence and spinal stability, despite the delay and initial decrease in PF EMG.

Concluding message

This study has demonstrated that women with SUI have an altered postural response of the PF muscles during rapid arm movements that is characterised by delayed onset of PF muscle activity, an initial decrease in PF EMG and increased amplitude of PF EMG following activation of deltoid. This would be expected to have negative consequences for both continence and lumbopelvic stability. Findings from this study support the argument that timing of urethral closure and PF contraction may be important to consider in continence (2).

References

1. Journal of Urology, 1984;132:1275-8.
2. Journal of the American Geriatrics Society. 1998;46:870-4.
3. Clinical Biomechanics. 2004;19:564-71.

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