

THE USEFULNESS OF ULTRASOUND MEASUREMENTS OF TRANSVERSE ABDOMINAL MUSCLE THICKNESS IN PATIENTS WITH PELVIC ORGAN PROLAPSE

Hypothesis / aims of study

Weakness in the pelvic floor and transverse muscles correlates with muscle thickness, and it affects the development of stress urinary incontinence in women [1]. Physical therapy (e.g., pelvic floor muscle training and the drawing-in manoeuvre) can be helpful in women with stress urinary incontinence and is reportedly effective for targeting the transverse abdominal muscle [1]. However, no studies have examined the association of transverse abdominal muscle thickness with pelvic organ prolapse (POP) and urinary symptoms.

The current study examined the relationship of transverse abdominal muscle thickness with POP and urinary symptoms.

Study design, materials and methods

The subjects were divided into two groups: those with POP (P group) and those without POP, which were matched for age (control, C group). The transverse abdominal muscle thickness was measured using an ultrasound system (HI VISION Avius®, 7.5 MHz, B mode; Hitachi-Aloka Medical, Ltd.). Exclusion criteria were presence of simple rectocele and significant urination disorder such as neurogenic bladder. The subjects were supine, and the transverse abdominal muscle thickness was measured at a point midway between the costal margin and the iliac crest in the right anterior axillary line, as reported previously [2]. The measurements were performed at rest, maximal inspiration, maximal expiration, and maximal contraction of the transverse abdominal muscle. The relationship between POP and transverse abdominal muscle thickness was examined. In addition, the relationship between the transverse abdominal muscle thickness and urination disorder was investigated using questionnaires for the Core Lower urinary tract Symptom Score (CLSS) and the International Consultation on Incontinence Questionnaire-Short Form (ICIQ-SF).

Results

One hundred six patients were enrolled after obtaining informed consent (51 in the P group and 55 in the C group). The P group was evaluated using the Pelvic Organ Prolapse Quantification System (POP-Q): 10 patients were classified as stage 2, 25 as stage 3, and 16 as stage 4. Patient characteristics are shown in Table 1. The body mass index was higher in the P group. Regarding the CLSS, the P group had a significantly higher daytime frequency, nocturia, urgency incontinence, and stress incontinence, showing a significant decline in quality of life. The total scores of the ICIQ-SF were significantly higher in the P group. The ICIQ-SF sub-scores for incontinence frequency and the incontinence amount were also significantly higher in the P group. Transverse abdominal muscle thickness is shown in Table 2. The transverse abdominal muscle thickness was significantly greater in the C group during maximal expiration and maximal contraction. The transverse abdominal muscle of patients with stage 2, 3, or 4 were significantly thinner than that of the C group (C vs POP-Q2; $P=0.0073$, vs POP-Q3; $P=0.0002$, vs POP-Q4; $P=0.0164$). Regarding the prediction accuracy for POP by the transverse abdominal muscle thickness during maximal contraction, the area under the receiver operating characteristics curve was 0.774. The sensitivity was 72.5%, and the specificity was 71.0% with a cut-off value of 4.4 cm for transverse abdominal muscle thickness ($P<0.0001$). Transverse abdominal muscle thickness inversely correlated with daytime frequency in the CLSS and the amount of incontinence in the ICIQ-SF (daytime frequency; $P=0.0091$, $R=-0.2523$. amount of incontinence; $P=0.03$, $R=-0.2109$).

Interpretation of results

The transverse abdominal muscle works closely with the pelvic floor muscle and can be a major factor that affects continence. There is also an association between the transverse abdominal muscle and vulnerability of the pelvic floor muscle. Although the vulnerability of the pelvic floor muscle is a major cause of POP, few studies have examined the effects of the transverse abdominal muscle on POP. In the present study, the P group had a thinner transverse abdominal muscle compared to the C group, and the abdominal muscle thickness was significantly associated with storage symptoms and the amount of urinary incontinence. In addition, the measurement of transverse abdominal muscle thickness during maximal contraction had a high sensitivity and specificity for detecting POP, suggesting the usefulness of ultrasound for screening and evaluating the risk of those with mild storage symptoms and urinary incontinence. Ultrasound measurements of the transverse abdominal muscle thickness were reportedly useful for evaluating the effectiveness of muscle training using the drawing-in maneuver in patients with urinary incontinence. POP patients, even with mild symptoms, can benefit from rehabilitation, and ongoing ultrasound measurements of the transverse abdominal muscle thickness are useful for evaluating the effectiveness of treatment.

Concluding message

Ultrasound measurements of transverse abdominal muscle thickness are very feasible, and it is useful in patients with stress urinary incontinence and POP. This method can be useful for detecting POP early and for evaluating the effectiveness of rehabilitation in women with frequent urination and urinary incontinence.

Table 1 Patient characteristics

	Control Group	POP Group	P ratio
Number of Patients	51	55	-
Age	70.1±7.1	71.2±7.0	0.4684
Body Mass Index	22.0±3.5	24.0±3.3	0.0019
CLSS			
Daytime frequency	0.8±0.9	1.2±0.8	0.0057
Nocturia	1.2±0.8	1.5±0.8	0.0493
Urgency	0.8±1.0	1.2±1.0	0.0301
Urgency incontinence	0.6±0.9	1.1±1.1	0.0181
Stress incontinence	0.8±1.0	1.1±1.0	0.0441
Slow stream	1.3±1.1	1.1±1.1	0.3282
Strain	0.9±1.0	0.8±1.1	0.7419
Incomplete emptying	0.9±1.0	0.8±1.1	0.4549
Bladder pain	0.3±0.7	0.3±0.7	0.7714
Urethral pain	0.2±0.5	0.1±0.3	0.0892
QOL index	3.0±1.5	3.7±1.4	0.0108
ICIQ-SF			
Frequency	1.2±1.5	1.7±1.3	0.0084
Amount	1.5±1.6	2.3±1.4	0.0030
Impact	2.1±3.0	2,5±2.6	0.0918
Total	4.8±5.7	6.6±4.6	0.0045

Table 2 Comparison of transverse abdominal muscle thickness between the groups

	Control Group	POP Group	P ratio
Resting state	2.9±0.9	2.7±0.9	0.2222
Maximal inspiratory state	2.5±0.8	2.5±1.0	0.6879
Maximal expiratory state	4.2±1.2	3.6±1.2	0.0165
Maximal contraction of TA*	5.2±1.4	3.8±1.2	<0.0001

*TA: transverse abdominal muscle.

References

- 1J Phys Ther Sci 2014. 26:1161-1163
- 2J Phys Ther Sci 2011.23:45-48

Disclosures

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