259

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CAN WE 'FEEL' WITH OUR FINGERS AS WELL AS WE 'SEE' WITH ULTRASOUND?

Hypothesis / aims of study

It is becoming increasingly recognized that trauma to the levator ani (LA) ('avulsion' injury) is significantly associated with pelvic floor muscle dysfunction (1). Magnetic resonance imaging (MRI) and pelvic floor ultrasound (US) can visualise avulsion whereas manual palpation appears to require substantial training (2). Despite ultrasound being generally more accessible, it is still not available in all clinical settings and is operator dependent, increasing the need for a reliable digital means of assessment. Therefore the aim of this study was to assess the predictive value of the following four digital parameters to identify an avulsion injury: 1. direct palpation of a discontinuity of puborectalis where the muscle attaches to the pubic ramus. 2. palpation of the distance between the two muscle insertion sites, 3. palpation of LA strength, 4. palpation of LA tone. These would then be compared to the results obtained from tomographic ultrasound images of the levator ani complex.

Study design, materials and methods

Study design: This was an observational study imbedded in a larger quasi-experimental cohort study which characterized and compared the morphology and function of the female pelvic floor in continent and incontinent older women. Transperineal ultrasound using tomographic imaging during a maximum pelvic floor muscle contraction was used to determine the presence or absence of avulsion injury in a cohort of elderly women who had attended, or were going to attend, physiotherapy treatment for urinary incontinence (n=72). All participants were imaged supine after bladder emptying. Slices were obtained at 2.5mm intervals taken from 2.5mm below to 12.5mm above the plane of minimal dimensions as previously described (3), see Figure 1.

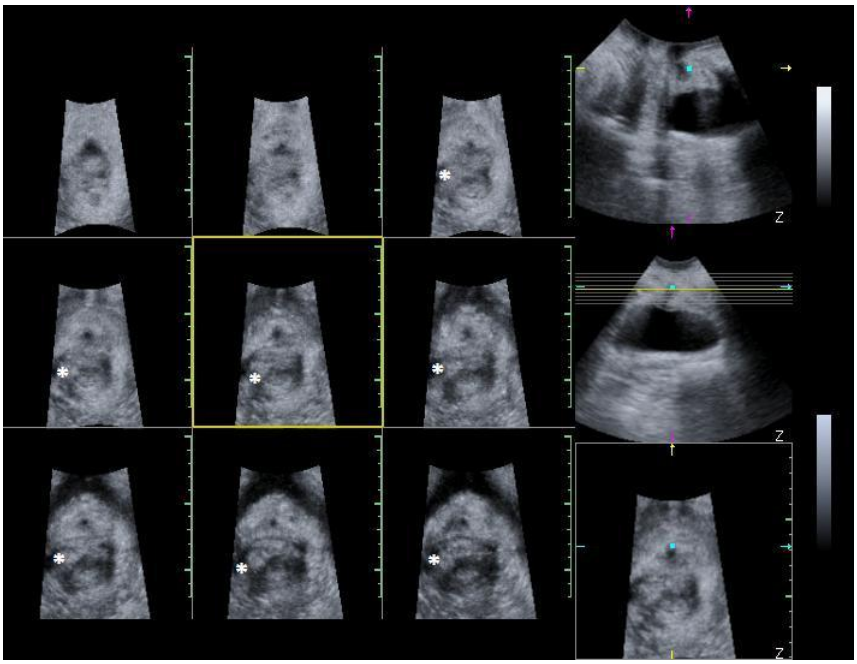

Figure 1: Tomographic ultrasound showing right sided defect, indicated by the asterisk at the insertion site of puborectalis in all 7 slices (slice interval 2.5mm)

Imaging was performed using an Acuson Antares ™ system (Siemens, USA Inc) with a 5-3MHz curvilinear probe. Post processing analysis was performed using ViewTool V3.1. An avulsion injury was rated positive if a defect could be seen in at least 3 of the central slices (Figure 1). Left and right sided avulsions were graded independently. Digital assessment of LA integrity included: 1. feeling for continuity of the puborectalis muscle at its insertion site on either side of the pubic bone 2. determining the distance between the insertion points of the puborectalis muscle, measured using finger widths (as with diastasis recti), 3. grading of LA strength using the standard Oxford grading scale and 4. grading of tone using a verified scale to assess tone at rest (2). The levator palpation was performed by an experienced physiotherapist who was blinded to the results from the ultrasound examination. All ultrasound images were verified remotely by an expert in ultrasound imaging of the pelvic floor muscles using tomographic ultrasound (PD). Statistical analysis was undertaken using SPSS V 18 (SPSS, Chicago, IL USA). Agreement between methods and ultrasound evaluators was assessed using Cohen's kappa.

Results

The mean age of 72 participants was 69 years (range 60-87). 22% of these were nulliparous (n=19), with the median number of vaginal deliveries being 1. Of the 72 women, 2 had invalid ultrasound images and 2 others were unable to be assessed digitally. Thus, 68 datasets were available for analysis, with 136 paired assessments of a right or left defect. As regards analysis of ultrasound volumes, there was agreement between the two assessors in 86% of cases (60/70), k=0.618. Seventeen (25%) women presented with either a partial or complete avulsion of the puborectalis muscle on either side as diagnosed with tomographic ultrasound. Eleven (16%) were complete avulsions, of which 1 was bilateral.

Palpation for continuity of the puborectalis muscle at its insertion site agreed moderately well with ultrasound diagnosis of avulsion, *k*=0.467. Palpating the distance between the two insertion sites at the level of the pubis and using a cut off of ≥ 3.5 fingers was able to predict 73% of complete avulsions (*k*=0.531). The grading of LA strength using an Oxford grading ≤3, and grading of resting tone ≤2, were less predictive. Agreement between palpation and ultrasound findings is shown in Table 1.

Digital parameter	Avulsion detected when present	No Avulsion detected when present	Avulsion detected when not present	*kappa (CI)*
Integrity of muscle at insertion site	7 (63%)	4 (36%)	9 (7%)	0.467 (0.23-0.71)
Width between insertions ≥3.5 (n=68)	7(70%)	3 (30%)	6 (10%)	0.531 (0.26-0.80)
Oxford scale ≤3	8 (73%)	3 (27%)	25 (20%)	0.277 (0.10-0.46)
Tone at rest ≤2	9 (82%)	2 (18%)	30 (24%)	0.269 (0.11-0.43)

Table 1: Prediction of complete avulsion injury using digital assessment of the levator-ani muscle, compared to tomographic ultrasound imaging diagnosis of avulsion (n=136).

Interpretation of results

Palpation for continuity of the puborectalis portion of the levator ani has been described as a method for diagnosing avulsion of the levator ani muscle. Our results suggest that the diagnosis of avulsion could be enhanced by using the simple measure of 'distance in finger widths between muscle insertion points'. This method is not intended to replace, but rather to add to those already in use, as it is unable to distinguish between unilateral and bilateral avulsion. However, 'distance in finger widths between muscle insertion points' may be of interest for older women where some muscle and vaginal atrophy is likely and it is often more difficult to palpate muscle insertion. An important limitation of our study is the low prevalence of avulsion amongst our study subjects as most suffered from urinary incontinence rather than prolapse. Further research with larger numbers may allow development of a model to show which combination of parameters will best predict defects using manual palpation.

Concluding message

Palpating the distance between muscle insertion points at the level of the pubis may enhance our ability to detect avulsion of the levator ani muscle by digital vaginal examination. Further work is needed to confirm these results.

References

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Specify Name of Ethics Committee	**Ethics committee for Centre de Recherche de Institute Universitaire de Geriatrie de Montreal**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**Yes**