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RELIABLE MEASURES OF THE PUBOVISCERAL MUSCLE CAN BE OBTAINED WITH 3D ULTRASOUND.

Hypothesis / aims of study

3-D ultrasound (US) imaging has been introduced in recent years as a clinical and research tool for the study of the pelvic floor. Our study aims were to: 1) standardize the 3-D US imaging technique of the pubovisceral (levator) hiatus, 2) assess the intra- and inter-rater reliability of different pubovisceral measurements and, 3) determine if there is measurable pubovisceral muscle (PVM) shortening with pelvic floor contraction, and 4) assess PVM symmetry at rest and with pelvic floor contraction.

Study design, materials and methods

In a prospective study, 21 nulliparous females (mean age 32, range 19 – 54 years) were evaluated with the 3D US systems (Voluson 730, GE Medical Systems, Milwaukee, WI or Phillips HD11, Phillips Medical Systems, Bothell, WA). The images were obtained at rest and during a sustained pelvic floor contraction using a 5-9 MHz (Voluson 730) or a 3-9 MHz (HD11) transducer placed on perineum and oriented cranially. The image analysis was performed with 4D View 5.0 (GE) and Q-Lab 4.2 (Phillips) software. All the 3D images were oriented in standard axial, coronal and sagittal planes. A standardized technique was used to rotate the volumes:

1) The coronal image was rotated in the plane of the PVM;
2) The symphysis pubis was identified and marked in the axial image;
3) The sagittal image was rotated to align the symphysis pubis and the anorectal angle.

The anterior-posterior (AP) length, the PVM length, the PVM area (inner and outer) and the PVM area (subtraction inner from outer area) were then measured on the axial image (see Fig.1). In addition, after the PVM inner area was bisected by the AP length line, the PVM area straddling the AP line was measured to assess symmetry of the PVM hiatus.

Two independent blinded observers completed the analysis three months apart and intra- and inter-rater reliability was calculated with the Spearman correlation coefficient. Single observer PVM measurements were compared with the paired t-test. The symmetry data was assessed with Mann-Whitney U test.

Results

Table 1: Measurements of PVM hiatus by one observer

	AP length (cm)	PVM length (cm)	Inner area (cm^2)	Outer area (cm^2)	PVM area (cm^2)
Rest (Mean±SD)	5.0 ±0.4	9.3 ±0.9	13.9 ±1.2	20.7 ±1.9	6.9 ±1.2
Squeeze (Mean±SD)	4.5 ±0.4	8.4 ±0.8	12.5 ±1.2	18.7 ±2.0	6.1 ±1.0
P-value	<0.001	< 0.001	< 0.001	0.001	< 0.001

The best inter-observer correlations were noted for AP length (r= 0.92 for rest and 0.90 for squeeze) and PVM length (r=0.86 for rest and r=0.78 for squeeze). Significant intra-observer correlations ranged between 0.65-0.97 for AP and PVM lengths. The curvilinear measurements of the area were less reliable; inter- and intra-observer correlation coefficients ranged between 0.1-0.6. The Mann-Whitney U test results for the two halves of PVM hiatus were p=0.84 at rest and p=0.92 with squeeze.

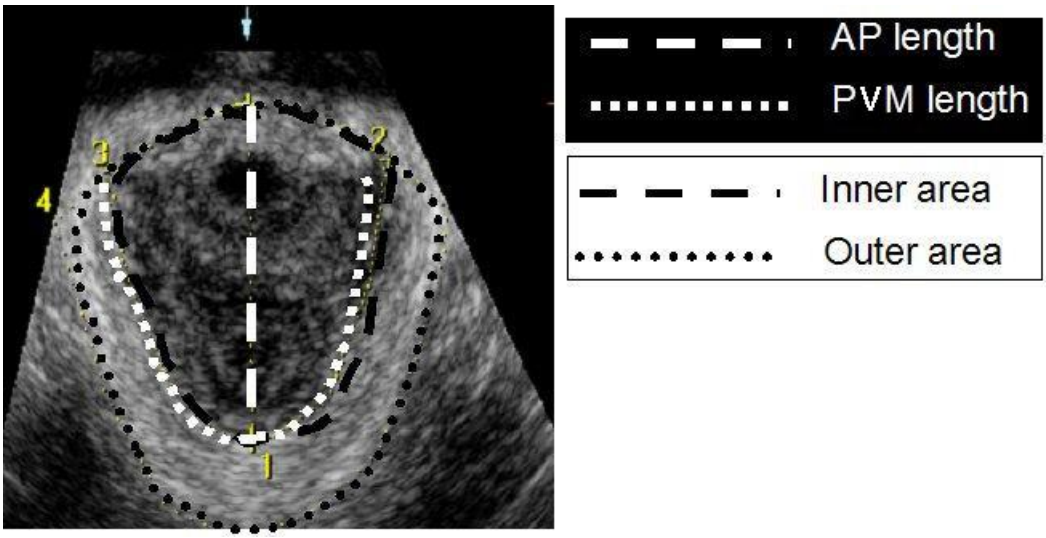

Fig. 1: Pubovisceral muscle measurements on an axial image.

Interpretation of results

All the measurements of the PVM demonstrated significant shortening with sustained squeeze. The intra- and inter-observer reliability calculations demonstrated high correlation between the linear measurements – the AP and PVM lengths. The area measurements were more inconsistently reproducible. The PVM hiatus was symmetric at rest and with a sustained pelvic floor contraction.

Concluding message

The 3-D ultrasound imaging technique can be used to reliably measure the PVM length, the PVM hiatus symmetry and functional shortening with squeeze. Standardized rotation techniques and anatomic landmark localization to image the PVM hiatus yield reliable measures of the AP and PVM lengths.

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