61

Majida M[1], Hoff Brækken I[2], Umek W[3], Bø K[2], Ellstrøm Engh M[1]

1. *Akershus University Hospital.Department of Obstetrics and Gynecology, Lørenskog, and University of Oslo, Norway,* ***2.*** *Norwegian school of Sport Sciences,department of Sports Medicine,Oslo,Norway.,* ***3.*** *Medical University Vienna, Department of Obstetrics and Gynaecology,Vienna, Austria.*

COMPARATIVE STUDY OF THE PUBOVISCERAL MUSCLE AT REST USING THREE DIMENSIONAL PERINEAL ULTRASOUND AND MAGNETIC RESONANCE IMAGING

Hypothesis /aims of study

While indirect information on the pubovisceral muscle can be obtained easily and cheaply, using two-dimensional (2D) ultrasound systems, direct demonstration of the pelvic floor muscle is improved by axial plane imaging. This has previously only been possible using magnet resonance imaging (MRI). There exists an extensive body of research using MRI to describe the anatomy and pathophysiology of the pelvic floor. MRI is therefore considered to be the gold standard in this field (1). With the technical improvement of three-dimensional (3D) perineal ultrasound, a new diagnostic tool has become available. Several studies have been published investigating pelvic floor anatomy and function (2). To our knowledge there are few studies comparing the two modalities. The aim of this study was to compare biometric measurements of the pubovisceral muscle obtained by 3D ultrasound and MRI.

Study design, materials and methods

In this prospective study 18 female volunteers participated. 3D ultrasound examinations were performed using a GE Kretz Voluson E_8 system (GE Medical Systems Norway) with 4-8 MHz curved array 3D/4D ultrasound transducer (RAB 4-8l/obstetric). Examinations were performed with an acquisition angle of 85 degrees .The MR images were obtained using a Siemens Magnetom Harmony 1.0T scanner. All subjects were examined at rest in the supine position with legs slightly abducted. All women were examined after voiding before the examinations. Analyses of the 3D ultrasound volumes were conducted offline on a laptop using the software “4D View v 6.2” (GE Healthcare, Norway). Analyses of the MRI images were performed using the software “Syngo fastview” and Syngo Leonardo syatems.(Siemens AG, Norway). One investigator performed all analyses. The recordings were analyzed three times in the plane of minimal hiatal dimensions. The investigator was blinded to clinical data and to previous results. Measurements analyzed were: area, anterior/posterior and transverse diameter of the levator hiatus (LH) (LHarea, LHap, LHrl). The area of the levator hiatus (LHarea) was defined and measured as the area bordered by the pubovisceral muscle, symphysis pubis (SP) and inferior pubic ramus in the axial plane of minimal hiatal dimensions. The anterior/posterior diameter was measured where the levator hiatus had the absolute minimal dimension in the anterior/posterior direction (LHap). The transverse diameter of levator hiatus from right to left (LHrl) was measured on the widest part, perpendicular to LHap.The thickness of the PVM was measured lateral to the vagina and rectum on the right and left side, perpendicular to the presumed PVM fibre direction (ThicknessRv, Thickness Lv, Thickness Rr, Thickness Lr). The average of three measurements obtained with 3D ultrasound and MRI were analyzed. The values for all parameters of interest were normally distributed. Results are presented as mean, range, ± SD and 95% confidence intervals (CI). Pearson’s correlation coefficients between the measurements obtained with 3D ultrasound and MRI were calculated.

Fig.1A Midsagittal MR image of minimal hiatal dimensions. B and C Measurements in axial plane for MRI and ultrasound images respectively.

Fig. 1A

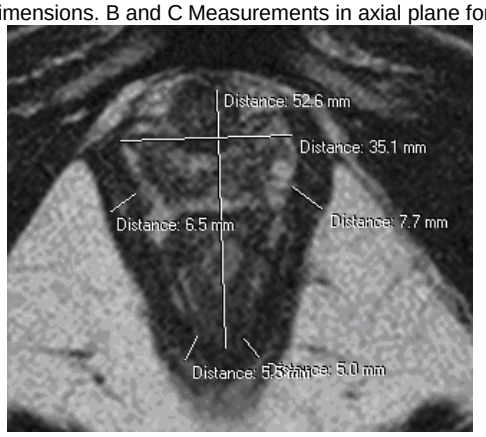

Fig. 1B

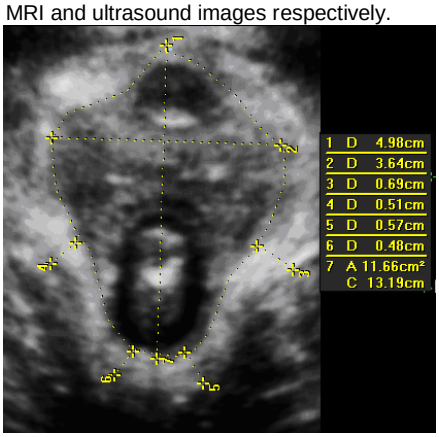

Fig. 1C

Table.1 Comparison of measurements of the PVM obtained by 3D ultrasound and MRI

Parameter	Ultrasound		MRI		Correlation	p-value
	Mean	95% CI	Mean	95% CI		
Lharea	14.29	(12.58; 15.99)	14.73	(12.69; 16.77)	0.867	<0.001
Lhap	53.15	(48.83; 57.47)	54.14	(50.25; 58.02)	0.914	<0.001
Lhrl	39.43	(34.54; 44.31)	39.33	(36.05; 42.61)	0.781	<0.001
Thickness Lv	6.61	(5.57; 7.65)	6.19	(5.35; 7.02)	0.821	<0.001
Thickness Rv*	7.30	(6.49; 8.11)	6.53	(5.77; 7.30)	0.663	0.003
Thickness Lr	5.73	(5.05; 6.41)	6.06	(5.49; 6.62)	0.796	<0.001
Thickness Rr	6.26	(5.61; 6.92)	6.25	(5.62; 6.89)	0.771	<0.001

* =Significant difference with between means (P=0.023).

LH= Levator hiatus, ap= anterior –posterior diameter, rl= right- left transverse diameter

L= left, R= right, v= assessed lateral of vagina, r= assessed lateral of rectum.

Results

One of the 18 women participating had some symptoms of prolapse. Mean age was 47.0 years (range 30.0-61.0, ±SD 8.3), mean BMI was 24.6(range19.3-36.1,±SD 4.1) and parity was 2.0 (range 0.0-3.0, ±SD 0.9)

There were no significant differences in mean values and corresponding confidence intervals for of measurements obtained with 3D ultrasound and MRI except for the observation of the pubovisceral muscle thickness on the right side of the vagina (Thickness Rv) (P =0.023) (Table .1). The correlations between measurements obtained by the two methods were strong and highly significant for the majority of data (Table 1). Thickness of the PVM muscle obtained to the right of vagina showed moderate but significant correlation P=0.003) Table 1.

Interpretation of results

The result of this study showed that measurements obtained with 3 D ultrasound correlated well with the golden standard, MRI. Due to the limitations of the MRI equipment only static images were obtained. There are however very few studies evaluating functional anatomy using MRI.

Concluding message

The results of the present study suggest that 3D ultrasound could be used instead of MRI when evaluating static pelvic floor anatomy in women without pelvic organ prolapse. More work has to be done to confirm these findings.

References

1. The Appearance of Levator Ani Muscle Abnormalities in Magnetic Resonance Images After Vaginal Delivery. Obsetet Gynecol.2003January; 101(1): 46-53
2. The Ultrasound Imaging of the pelvic floor. Part II; Three-dimensional or volume imaging. Ultrasound in Obstetrics & Gynecology 2004; 23(6): 615-25.

Specify source of funding or grant	**Research funds from the Department of Obstetrics and Gynecology, Akershus University Hospital in Lørenskog, Norway.**
Is this a clinical trial?	**Yes**
Is this study registered in a public clinical trials registry?	**Yes**
Specify Name of Public Registry, Registration Number	**Norwegian Social Science Data Services. Registration Number.16703** **Regional Committee for Ethics in Medical Research in Southern Norway. Registration number: 212-06078 1.2006.291**
What were the subjects in the study?	**HUMAN**
Was this study approved by an ethics committee?	**Yes**
Specify Name of Ethics Committee	**Regional Committee for Ethics in Medical Research in Southern Norway. Registration number: 212-06078 1.2006.291**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**Yes**