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INTERRATER RELIABILITY OF 3D ENDOVAGINAL ULTRASOUND ANATOMY OF ASYMPTOMATIC NULLIPAROUS WOMEN BASED ON DIRECT HISTOLOGIC COMPARISON: ANTERIOR AND POSTERIOR COMPARTMENTS

Hypothesis / aims of study
To establish the interrater reliability of 3D Endovaginal Ultrasonography (3D EVUS) of the urethra, bladder, and anal sphincter complex based on histologic comparison

Study design, materials and methods
The pelvic floor of a fresh nulliparous cadaveric specimen was harvested and fixed in 10% buffered formaldehyde while maintating the anatomic relationships. The relationships were confirmed in another 20 cadaveric dissections. The specimen was sectioned in a radial manner starting at the sagittal 12 o'clock position, and ending at the sagittal 0600 o'clock position at every 10 degrees. Histologic slides were prepared by taking 8-M thick radiall cuts. They were then stained with Mallory trichrome on glass slides and arranged to form large sections encompassing each plane.
31 healthy nulliparous women then underwent 3D EVUS with the BK Profocus 8848 transducer. 360 degrees high definition 3D cubes of pelvic floor were obtained.
Each histologic section was projected on a computer along with the matching ultrasound image (Fig. 1). Two investigators independently evaluated the sonographic images, looking anteriorly for the the vesical trigone (VT), trigonal ring (TR), trigonal plate (TP), rhabdomyosphincter (RMS), compressor urethra (CU), and the longitudinal and circular smooth muscle (LCM); posterior structures evaluated were the superficial external anal sphincter (EAS-sq), main external anal sphincter (EAS-m), the space between EAS-sq and EAS-m identified as anal sphincter notch (EAS-N), internal anal sphincter (IAS), and the rectovaginal septum (RVS). The investigators mutually viewed the images and calculated urethral and anal sphincter measurements.
Student t test was used for normally distributed populations. Agreement, Cohen's Kappa were determined to evaluate inter-rater reliability. Kappa values of 0.8 – 1.0 were considered excellent agreement, 0.6 – 0.8 good, 0.4 - 0.6 moderate, 0.2 – 0.4 fair, and less than 0.2 – 0.4 poor. Means and standard deviations were calculated were appropriate.

Results
The majority of the participants were Caucasian (77%). The mean age was 31.8 (SD±5.8). The mean BMI was 28.5 (SD±7.9). The mean urethral length was 36 mm (SD±5); the mean RMS and LCM areas were 0.6 cm2 (SD±0.16) and 1.1 cm2 (SD±0.4) respectively. The mean urethral sphincter (US) width was 14mm (SD±2); the average US area was 1.3 cm2 (SD±0.4). For the posterior compartment, the mean IAS length was 26 mm (SD±4); the mean IAS width was 3.2 mm (SD±0.8).
The agreement for visualization of structures is shown in Table 1.

Interpretation of results
Using detailed histological sections as a guide we found 3D EVUS to be highly reliable for visualization of anterior and posterior compartment structures in nulliparous women.

Concluding message
The reliability of 3D EVUS technique along with normal measurements of the identified structures in this nulliparous population can be used as a guide for investigation of pelvic floor structural abnormalities.

Figure 1. Histological section of posterior compartment used as a guide for identification of anal sphincter complex obtained by 3D EVUS.

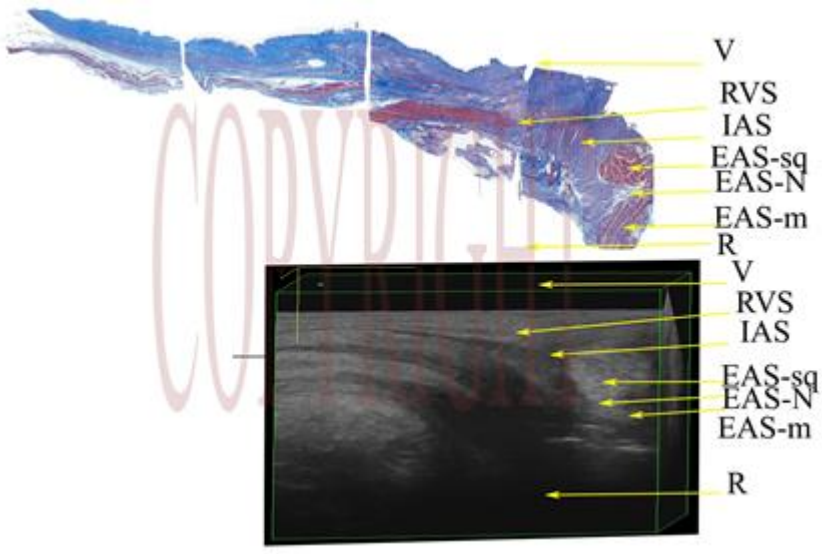

Table 1: Agreement and inter-rater reliability of the anterior and posterior structures

Structure	Agreement	K + SE
VT	26/27 (96%)	0.65 SE 0.18
TR	29/29 (100%)	1 SE 0.18
TP	26/28 (93%)	NA
LCM	31/31 (100%)	NA
SUG	30/31 (97%)	NA
CU	30/31 (97%)	NA
RVS	31/31 (100%)	1 SE 0.18
IAS	31/31 (100%)	NA
EAS-sq	31/31 (100%)	NA
EAS-N	30/31 (97%)	0.91 SE 0.179
EAS-m	31/31 (100%)	NA

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Is this a clinical trial?	**No**
What were the subjects in the study?	**HUMAN**
Was this study approved by an ethics committee?	**Yes**
Specify Name of Ethics Committee	**The University of Oklahoma Health Sciences Center Institutional Review Board. IRB# 13085.**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**Yes**