

INTER-RATER RELIABILITY OF PUBORECTALIS AND THE ANAL SPHINCTER MUSCLES IMAGING ABNORMALITIES WITH THE THREE-DIMENSIONAL ULTRASOUND

Hypothesis / aims of study

The anal continence is maintained by three muscles: the puborectalis (PRM), internal (IAS) and external (EAS) anal sphincters. The aim of this study was to 1) Develop a qualitative scoring system of the puborectalis muscle (PRM), internal (IAS) and external (EAS) anal sphincters assessment using three-dimensional ultrasound (3DUS); 2) Evaluate inter-rater reliability of the developed scoring system.

Study design, materials and methods

58 female participants: 33 without symptoms of urinary or anal incontinence (13 nulliparas and 20 vaginally parous) and 25 patients with anal incontinence (FISI>20)[1] were evaluated with transperineal 3DUS to visualize the puborectalis muscle, internal and external anal sphincters at rest and during a sustained pelvic floor contraction. Voluson 730 (General Electric Healthcare, Milwaukee, WI) and HD11 (Philips Medical Systems, Bothel, WA) with 5-9 MHz (Voluson) and 3-9 MHz (HD-11) endo-vaginal transducers were used in the study. The image analysis was performed with the use of proprietary software: 4D View (General Electric) and Q-lab 5.0 (Philips). The scoring system for the PRM was created by modifying a levator ani MR scoring system [2]. The two hemi-slings of the PRM were scored separately with 0=normal, 1=<50% abnormal and 2=>50% abnormal. The bilateral scores were added giving a maximum total score of 4. The assessment of the PRM was performed with the use of the 10mm 'thick slice' around the PRM plane. The PRM plane was defined along the straight line from the pubic symphysis to the anorectal angle. The anal sphincters were scored along the entire cranio-caudal length of the IAS and EAS. Both sphincters were assessed for abnormalities and scored: 0=normal, 1=<25% abnormal, 2= 25-50% abnormal, 3=50-75% abnormal, 4=>75% abnormal. To score the anal sphincters 10mm 'thick slice' across the sphincters as well as 1mm 'multi-slice' techniques were used to identify the abnormalities. Both scoring systems then were simplified by using a grading system: grade 0 = normal (score 0), grade 1 = minor abnormality (scores of 1 and 2) and grade 2 = major abnormality (scores of 3 and 4). Three blinded observers used this scoring system to evaluate the PRM, EAS and IAS. Two of the three observers were blinded to the participants parous or continence status; the third observer captured all the images and was aware of the participant's status. The statistical analysis was performed using Cronbach's alpha (SPSS 11.5).

Results

The representative examples of the PRM and anal sphincter normal images and imaging abnormalities presented in Figures 1 and 2.

Out of the 58 imaged subjects one subject was excluded from each of the muscles evaluated because of poor image quality. Out of three observers, one observer (a) scored images from 20 subjects; the others (b and c) completed 57.

Table I: Inter-rater reliability of the PRM, EAS, IAS scoring and grading systems to assess anatomic abnormalities (Cronbach's alpha).

Inter-rater reliability	PRM	EAS	IAS
Scoring system, two raters (n=57)	0.82	0.92	0.95
Scoring system, three raters (n=20)	0.91	0.90	0.89
Grading system, two raters (n=57)	0.80	0.93	0.93
Grading system, three raters (n=20)	0.86	0.91	0.88

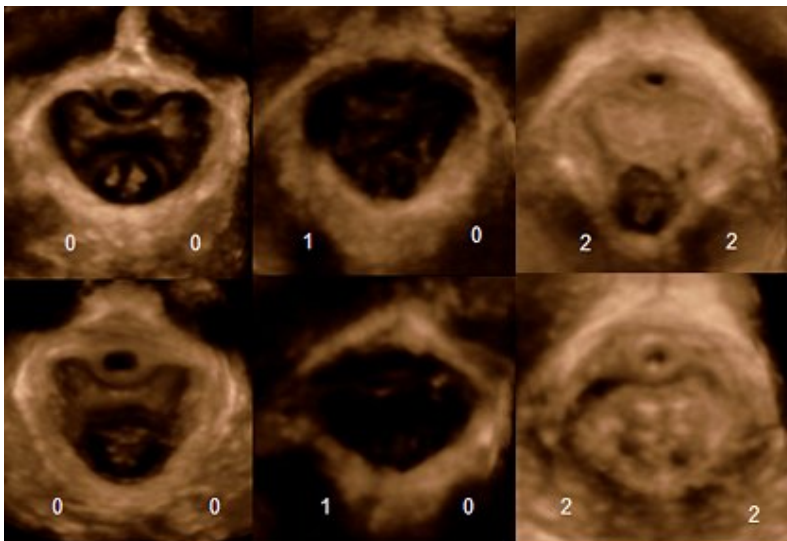


Figure 1: Examples of the PRM scoring system on 10mm 'thick slice' images of the PRM.

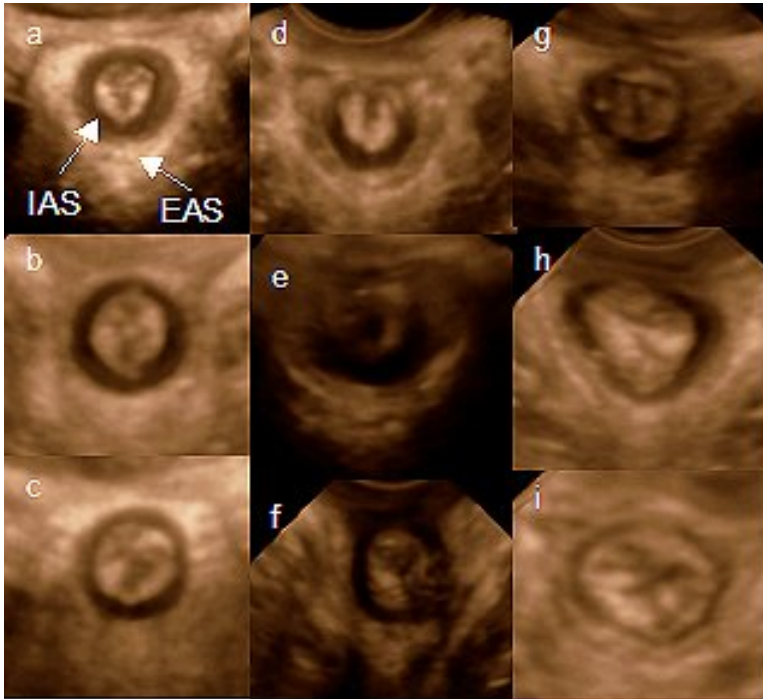


Figure 2: Examples of the 'thick slice' images of the anal canal with internal (IAS) and external (EAS) sphincters identified. Images a-c are examples of 'normal' anal sphincters images. Images d-i are examples of IAS and/or EAS abnormalities.

Interpretation of results

The 3DUS can be used for qualitative assessment of the pelvic floor muscles: the PRM and the anal sphincters. The developed scoring and grading assessment systems are reliable in evaluating these muscles for injury.

Concluding message

Reliable assessment of the PRM, IAS and EAS can be obtained with 3DUS.

References

1. Dis Colon Rectum 1999; 42:1525-32.
2. Int Urogynecol J October 17, 2006 [Epub ahead of print]

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HUMAN SUBJECTS: This study was approved by the Institutional Review Board, University of California, San Diego and followed the Declaration of Helsinki Informed consent was obtained from the patients.