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CAN 3D POWER DOPPLER IDENTIFY THE VASCULARISATION OF THE LEVATOR ANI AT ITS PUBIC INSERTION?

Hypothesis / aims of study

Major morphological abnormalities in the levator ani muscle, in the form of an avulsion of the puborectalis muscle from its insertion in the inferior pubic ramus, are common after vaginal childbirth (1). Some groups have suggested that avulsion may be an ultrasound artefact created by the translabial approach (2). It needs to be established whether the image we obtain is a fact or an artefact. It might be thought that the vascularisation of the puborectalis muscle at its pubic insertion changes when an avulsion appears, due to the formation of a scar. The parameters of vascularisation at this site are currently unknown, both in women with avulsion and in those without. For this reason we undertook a pilot study using 3D Power Doppler to identify the normal vascularisation of the puborectalis muscle at its insertion in nulliparous and premenopausal women and to assess its reproducibility as a first step to compare the results with those from women who have an avulsion.

Study design, materials and methods

Between February and March 2013, 40 nulliparous and premenopausal women were evaluated in a tertiary hospital. All women underwent a translabial ultrasound with 3D Power Doppler. We used a GE Voluson E8 BT09 with RAB 4–8 MHz transducer (acquisition angle 85◦). Data were analysed on a computer using proprietary software (4D View, Version 9.1) by two observers. The volume was acquired with the patient in the lithotomy position and with empty bladder. A sagittal section of the pubic symphysis, urethra, vagina, anal canal and the lower portion of the levator ani muscle was obtained on 2D ultrasonography. From this plane, Power Doppler (Pulse Repetition Frequency: 0.6 kHz) and 3D ultrasound were activated. The puborectalis muscle was assessed in the axial plane of minimal hiatal dimensions, defined as the distance between the hyperechogenic posterior aspect of the pubic symphysis and the hyperechogenic anterior border of the puborectalis muscle just posterior to the anorectal angle at rest.

The volumes were analysed off-line by two independent observers. From the axial plane of the puborectalis muscle to the axial plane of minimal hiatal dimensions, we applied the VOCAL program (GE) and we obtained two spherical volumes of 0.22cc (7.5mm diameter, puborectalis muscle thickness (3)) at the insertion zone of the puborectalis muscle to the pubis, one for each side of the muscle (Fig 2). VI (vascularisation index), FI (flow index) and VFI (vascularisation-flow index) were automatically calculated in these volumes.

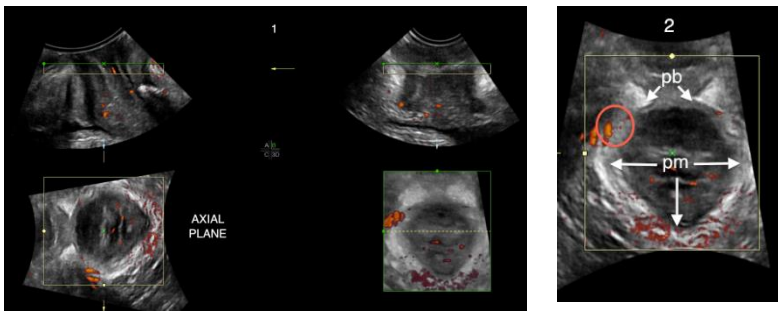

Fig 1*:*
-1- In the axial plane of minimal hiatal dimensions the VOCAL program was applied. -2- One spherical volume of 0.22cc per side was obtained.

pm: puborectalis muscle; pb: pubis bone.

Sonographic and demographic data were recorded in an Excel database and statistical analysis was performed with SPSS version 19.0. Continuous variables were described using means and standard deviation. The correlation studies between continuous variables were performed by means of Spearman's r test and Pearson's coefficient. Interrater agreement studies of continuous variables were performed through the determination of the intraclass correlation coefficient and its 95% confidence interval.

Results

Mean age was 31.8 years (SD 6.38) and mean BMI was 22.80 (SD 4.07). We analysed the degree of interrater agreement first with a regression study using Pearson's coefficient and Spearman's r test for each parameter (VI, FI, VFI) comparing each one on the same side and, second, with the intraclass correlation coefficient (ICC) for the same parameters. The Pearson's coefficient and Spearman's r test (Table 1) found a statistically significant correlation between observers.

	Spearman's test	**p**	**R^2 lineal**	**p**
VI right	0.605	<0.001	0.384	<0.001
VI left	0.647	<0.001	0.419	<0.001
FI right	0.618	<0.001	0.330	<0.001
FI left	0.559	<0.001	0.685	<0.001
VFI right	0.661	<0.001	0.289	<0.001
VFI left	0.696	<0.001	0.470	<0.001

Table 1*: Spearman's r test and Pearson's coefficient for each parameter and statistical significance.*

The ICC showed the agreement between observers for each side statistically significant. The intensity of the agreement was medium-excellent (Table 2).

	ICC	CI 95%	p
VI right	0.487	0,216-0.699	<0.001
VI left	0.512	0.247-0.707	<0.001
FI right	0.511	0.242-0.707	<0.001
FI left	0.830	0.701-0.906	<0.001
VFI right	0.423	0.142-0.643	0.002
VFI left	0.572	0.325-0.747	<0.001

***Table 2**: ICC between observers and their statistical significance.*

A high, statistically significant degree of correlation was found between the three ultrasound indices on each side. Therefore, all indices provided information on the vascularisation at the muscle puborectalis insertion. No correlation was found between the ultrasound index and either of the demographic parameters (BMI, p>0.241, or age, p>0.398). The degree of correlation between the same index on the different sides was not statistically significant.

Interpretation of results

The vascularisation of the puborectalis muscle at its insertion can be identified using 3D Doppler ultrasound but the values differ substantially from those of the contralateral side. The technique we describe is reproducible but is not useful in clinical practice to establish normal patterns.

Even so, further studies may shed new light on this issue: for instance, we propose a prospective study to analyse the behaviour of the more vascularised side compared to the contralateral one with regard to the risk of avulsion.

Concluding message

Ultrasound study of vascularisation at the pubic insertion of the puborectalis muscle is a reproducible measure but does not seem to be a useful parameter for diagnosing avulsions or for interpreting unclear images. The vascularisation distribution at this level is not symmetrical in women without lesions.

References

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