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PELVIC FLOOR MUSCLE TRAUMA – DOES VAGINAL PARITY MATTER?

Hypothesis / aims of study

Pelvic floor muscle trauma occurring during vaginal delivery is an important risk factor for pelvic organ prolapse, urinary and faecal incontinence later in life (1,2). Previous studies have found increasing prevalence of incontinence and prolapse symptoms associated to increasing parity (3). Our aim was to investigate the association between vaginal parity and injury to the levator ani muscle (LAM) and the anal sphincters.

Study design, materials and methods

We conducted a cross-sectional study in 2013-14 among women 847 who delivered their first child in 1990-97. Information about mode of delivery and parity was obtained from the National Birth Registry.

The women underwent a pelvic floor ultrasound scan with a GE Voluson S6 device, using the RAB 4-8 RS abdominal three-dimensional probe with an acquisition angle of 85º. Four dimensional ultrasound volumes were acquired at rest, contraction and Valsalva maneuvre. Off-line analysis of the ultrasound volumes was performed using the 4D View Version 14 Ext.0 software 6-32 months later, blinded to all clinical and obstetrical data. Tomographic ultrasound imaging was used for evaluation of the LAM. A significant LAM injury was defined as a unilateral or bilateral abnormal insertion of the most medial fibers of the LAM to the pubic bone present in the plane of minimal levator hiatal dimensions and the planes 2.5 and 5 mm cranial to this. Levator hiatal area at Valsalva was measured in the plane of minimal hiatal dimensions in a rendered volume of 1-2 cm thickness.

For the anal sphincters a set of eight slices was obtained on tomographic ultrasound imaging, where the entire external anal sphincter (EAS) was encompassed by placing the upper slice cranial to the EAS (at the level of the puborectalis muscle) and the lower caudal to the internal anal sphincter (IAS), at the level of the anal verge. The distance between each slice was adjusted depending on the length of the EAS, leaving six slices to delineate the entire muscle. The IAS was assessed with the first slice cranial to the IAS (at the level of the anorectal junction) and the most distal slice at the level of the subcutaneous portion of the EAS. Diagnosis of significant injury to the EAS or IAS was defined as ≥30° defect of the circumference in ≥4/6 planes on tomographic ultrasound imaging.

Then the proportion of women with LAM injury and significant EAS and IAS defect on ultrasound according to vaginal parity was calculated. Mean (SD) hiatal area at Valsalva was calculated. One vaginal delivery was used as reference, and Chi-squared test and Fisher's Exact test was used to compute odds ratios (OR) for comparison of the proportion of women with trauma after 0, 2, 3 and ≥4 vaginal deliveries compared to the reference group. Independent samples t-test was used to compare mean difference (MD) in levator hiatal area at Valsalva between the groups. $p<0.05$ was counted as statistically significant.

Results

A total of 608 women attended the clinical and transperineal ultrasound examination. Mean age was 48 years, mean total parity 2.2, mean BMI 25.8 kg/m^2. Hundred and one women had only delivered by caesarean section (vaginal parity 0). Of vaginal parous women 156 had forceps and 131 vacuum at first delivery and 217 had normal vaginal delivery and no subsequent forceps/ vacuum. Table 1 shows the proportion of women with muscle injury according to vaginal parity. Table 2 is a comparison between groups of women with different vaginal parity. The tables demonstrate increased risk of pelvic floor muscle trauma after one vaginal delivery, and no further increase after subsequent vaginal deliveries.

Interpretation of results

LAM injuries, EAS and IAS defects were not found among women delivered exclusively by caesarean section, with a marked step in prevalence from 0 to 1 vaginal delivery. A similar effect was found for levator hiatal area at Valsalva with increased hiatal area after 1 vaginal delivery. The only significant difference in prevalence of pelvic floor muscle trauma was found between women with vaginal parity 0 (caesarean section) and 1 vaginal delivery, with no significant effect of subsequent vaginal deliveries. This implicates that most muscle trauma of the pelvic floor occur during the first vaginal delivery. The effect of vaginal parity on symptomatic pelvic floor disorders was not part of this analysis and we cannot exclude an effect of increasing parity on prolapse and incontinence symptoms.

Strengths of this study are the large number of women included and the long follow up after first delivery. The National Birth Registry provides high quality of data regarding mode of delivery and parity. Furthermore, standardised criteria for the definition of significant LAM injury, EAS and IAS defects and levator hiatal area were used. We analysed four different variables of pelvic floor anatomy in relation to vaginal parity, which to our knowledge has not been performed previously.

A substantial part of the women in this study had forceps at first delivery. Forceps is an independent risk factor for pelvic floor muscle trauma. It is possible that the effect of subsequent deliveries could have been stronger in a population with lower proportion of operative vaginal deliveries at first childbirth.

Concluding message

Vaginal parity was strongly associated with pelvic floor muscle trauma. After the first vaginal delivery, no significant additional effect of subsequent deliveries was found. On a population level, there would probably be no benefit of performing a caesarean section for secondary prevention of pelvic floor muscle trauma for women who have had one vaginal delivery. This does not exclude that for some women, especially with sphincter defects and anal incontinence, a caesarean section in subsequent pregnancies could be beneficial in order to prevent worsening of incontinence symptoms.

Table 1. Pelvic floor muscle trauma according to vaginal parity

	0 N= 101	**1** N= 94	**2** N= 258	**3** N=127	**≥4** N=28
	n/N, %				
LAM injury N= 606	0/101 0%	22/94 23%	67/257 26%	19/126 15%	5/28 18%
EAS defect N= 563	0/98 0%	18/88 20%	51/236 22%	15/116 13%	1/24 4%
IAS defect N=563	0/98 0%	2/88 2%	12/236 5%	3/116 3%	0/24 0%
	Mean (SD)				
Hiatal area at Valsalva	26.5 (7.6)	35.7 (10.9)	36.6 (9.9)	34.3 (9.5)	36.5 (10.1)

Table 2. Comparison between women with 0, 2, 3 ≥4 vaginal deliveries vs 1 vaginal delivery.

	0 vs1	**2 vs 1**	**3 vs 1**	**≥4 vs 1**
	OR (95% CI), *p*			
LAM injury	0 (0-0.1), <0.01	1.2 (0.7-2.0), 0.61	0.6 (0.3-1.2), 0.12	0.7 (0.2-2.1), 0.53
EAS defect	0 (0-0.2), <0.01	1.1 (0.6-2.0), 0.82	0.6 (0.3-1.2), 0.15	0.2 (0.02-1.3), 0.06
	MD (95% CI), *p*			
Hiatal area at Valsalva	-9.1 (-11.9;-6.4), <0.01	1.0 (-1.5; 3.5), 0.45	-1.4 (-4.2; 1.5), 0.35	0.9 (-3.8; 5.6), 0.71

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