215

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FUNCTIONAL CHANGES OF THE PELVIC FLOOR MUSCLES FOLLOWING VAGINAL DELIVERY: THE EFFECT OF ETHNICITY AND AVULSION INJURY.

Hypothesis / aims of study

Childbirth induced injury (avulsion) to the levator ani muscle (LAM) is a significant risk factor for pelvic organ prolapse (1). Identification of antenatal risk factors for avulsion is a research priority (2). This study assessed objective measurements of change in ultrasound levator hiatal biometry and passive LAM stiffness in addition to subjective measurements of questionnaire scores, in two ethnically different groups. To date, there is no data on levator biometry for Maori and Pacific Island (M/PI) women in New Zealand, nor is there comparative data between women of European descent and this ethnic group. The aims of this study are to investigate the association between objective and subjective changes related to levator ani avulsion in primiparous women of two ethnic groups following vaginal delivery.

Study design, materials and methods

Primiparous women, >18 years, of European or M/PI descent were recruited and assessed between 34-38 weeks, as well as at 3 months postpartum. Patients who had caesarean sections were excluded. All participants underwent a transperineal ultrasound using Phillips IU22 (Philips Ultrasound, Bothwell, WA, USA). Stiffness was assessed using an elastometer with a predefined protocol (3). Participants completed questionnaires on pelvic floor dysfunction using the International Consultation on Incontinence Questionnaires (ICIQ) at both time points. Muscle stiffness was calculated from the steepest portion of the force versus displacement curve, while ultrasound analysis of levator hiatal biometry was undertaken at a later stage by a clinician blinded to delivery data using proprietary software (iSlice, QLAB version 8.1). Two independent sample t-tests were used to assess the statistical significance of changes in hiatal biometry, LAM stiffness and questionnaire scores, between avulsion and non-avulsion women, using R version 3.0.3. Antenatal to postnatal change (calculated as postnatal minus antenatal measurement) has been determined for each woman, with respect to ultrasound biometry, LAM stiffness and questionnaire scores. For example, a woman with a change of -0.2 N/m indicates that her LAM stiffness decreased by 0.2 N/m postnatally; an area change of 4 cm^2 indicates that her hiatal area increased by 4 cm^2 postnatally. Positive change indicates an increase in ultrasound measures and stiffness values and a worsening of symptoms for the questionnaires.

Results

166 women have been recruited, with 121 returning for their 3 month postnatal assessment. To date, ultrasound analysis has been performed on 75 postnatal returns, excluding 28 caesarean sections. The median age of the participants was 27 years (range 18 years to 42 years), and mean BMI was 28 kg/m^2 (±6 kg/m^2). The prevalence of avulsion and ethnic breakdown is shown in Table 1.

Table 1. Breakdown of participants recruited to date, including levator ani avulsion prevalence among European and M/PI women.

	Number of Participants				**Caesarean births**	**Avulsion (Prevalence)***
	Antenatal	**Postnatal**	**Current**	**Drop Out**		
European	105	88	6	11	20	16 (23.9%)
Maori/Pacific Island	61	33	2	26	8	3 (12.0%)
Total	**166**	**121**	**8**	**37**	**28**	**19 (20.7%)**

*excluding caesarean sections

The prevalence of avulsion in M/PI women is lower than in European women, but this is not statistically significantly different based on the data to date.

On average, the antenatal to postnatal change in LAM stiffness is greater for women without avulsion [n = 46, mean = 124.45 N/m, 95% CI (69.52, 179.38) N/m] than for women with avulsion [n = 9, mean = -30.72 N/m, 95% CI (–190.20, 128.76) N/m] (p = 0.065).

Antenatal to postnatal change in the coronal diameter and hiatal area on both contraction and valsalva are statistically significantly different between the avulsion and non-avulsion group. Change in the vaginal symptoms score (subcategory: total and quality of life), and urinary symptom score are significantly different between the two groups (Table 2).

Table 2. Differences in biometry and symptoms score changes (postnatal minus antenatal) between women with and without avulsion injury.

Measurements			Mean Change Non-Avulsion	Avulsion	95% CI of the Difference of the Mean Changes	*P-value*
			n = 60	**n = 15**		
Biometry	**Rest**	Area (cm^2)	-0.61	0.03	[-3.13, 1.85]	0.602
		AP (cm)	-0.19	-0.12	[-0.53, 0.38]	0.735
		Coronal (cm)	0.01	0.31	[-0.82, 0.22]	0.241
	Contraction	Area (cm^2)	-0.31	1.63	[-3.58, -0.30]	0.022*
		AP (cm)	-0.04	0.33	[-0.76, 0.02]	0.062
		Coronal (cm)	0.01	0.62	[-1.07, -0.15]	0.012*
	Valsalva	Area (cm^2)	0.13	5.70	[-10.52, -0.61]	0.030*
		AP (cm)	-0.16	0.14	[-0.98, 0.39]	0.378
		Coronal (cm)	0.19	0.94	[-1.30, -0.20]	0.011*
			n = 67	**n = 18**		
ICIQ Questionnaires	**Vaginal**	Total	-1.03	5.67	[-11.92, -1.47]	0.015*
		Quality of Life	-0.02	2.00	[-3.60, -0.43]	0.015*
	Urinary	Total	-0.96	2.44	[-6.36, -0.43]	0.027*
	Bowel	Pattern	-0.01	-0.50	[-0.77, 1.74]	0.431
		Control	-0.10	-0.17	[-1.09, 1.22]	0.910
		Quality of Life	0.28	-0.28	[-1.35, 2.46]	0.554

*Statistically significant at the 0.05 level. AP = Anterior-Posterior

Interpretation of results

From the preliminary data, there is evidence to suggest that the changes in hiatal biometry measurements from antenatal to postnatal are greater in women with avulsion injury, particularly in the coronal diameter and hiatal area which is consistent with what would be expected if there is muscle damage. The worsening ICIQ vaginal scores in the avulsion group are expected; however, the worsening of urinary symptoms may also be a consequence of the short follow-up period (3 months). LAM stiffness does not change as markedly postnatally in those who have had injury compared to those who have not. Lastly, although the effect of ethnicity is not statistically significant for the measured parameters, there are indications that women of Maori or Pacific Island descent have more elastic LAM and a lower prevalence of avulsion injury.

Concluding message

This study suggests that the functional changes in hiatal biometry following vaginal delivery are more significant in women with an avulsion injury and are associated with worsening of symptom scores. The effect of ethnic variation is still to be determined and further work is needed.

References

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