565

Kruger J[1], Wong V[2], Hayward L[3], Budgett S[4], Nielsen P[5]
1. *Auckland Bioengineering Institute,* ***2.*** *University of Sydney Medical School,* ***3.*** *Counties Manukau District Health Board,* ***4.*** *University of Auckland,* ***5.*** *Auckland Bioengineering Institute and Department of Engineering Science*

EFFECTS OF PREGNANCY AND ETHNICITY ON LEVATOR ANI MUSCLE STIFFNESS.

Hypothesis / aims of study

The Levator ani (LA) muscles are critical for childbirth, as well as female pelvic organ support. Avulsion of the LA muscle complex, defined as a detachment from its insertion on the inferior pubic ramus, occurs in approximately 20-30% of women following vaginal delivery (1). Consequences of LA injury, such as development of pelvic organ prolapse have been established (2), however predicting which women are most at risk of these injuries remains elusive. There is a lack of quantifiable evidence on the associations between ethnicity, the inherent ability of the LA muscle to stretch during parturition, and the likelihood of injury. We have developed a portable 'elastometer' to measure LA muscle stiffness, capable of executing a programmed measurement protocol and automated data collection. The device has proved repeatable for measurement of passive stiffness; a parameter which is highly likely to be associated to the ability of the LA muscle to stretch during vaginal birth (3). *The overall aim of this study is to characterise stiffness of the LA muscle ante- and postnatally as well as to investigate any association between levator avulsion, muscle stiffness, and ethnicity*.

Study design, materials and methods

This is an ongoing prospective quasi-experimental pre-test, post-test cohort study. Inclusion criteria are: Primigravid women at 36-38 weeks gestation, >18yrs of Caucasian or Pacific Island (PI) descent, with an uncomplicated pregnancy, planned vaginal delivery who consent to vaginal assessments. All participants are seen antenatally; at 37-38 weeks gestation and 3 to 5 months postpartum. At each visit the participants complete the ICIQ-UI,VS,BS questionnaires, undergo a vaginal elastometry assessment, levator morphobiometry and digital palpation using MOS grading. Levator avulsions are assessed using 3D transperineal, and tomographic ultrasound imaging. Demographic data and delivery outcomes such as length of 2nd stage labour, birth weight and mode of delivery are collected. Elastometry data of the pelvic floor muscle is obtained using a previously defined protocol (3), whereby the elastometer is programmed to open to a 50mm maximum displacement, over approximately 60 s. The measurement is repeated three times for each participant. The first is to allow for tissue pre-conditioning, and to familiarise the patient with the measurement procedure. A force/displacement curve is produced, from which passive stiffness (*k*) can be determined from the subsequent two cycles.
Statistical analysis was done using SPSS v 18 (Chicago; SPSS Inc) X^2,t-tests and Mann-Whitney tests for comparisons were used where appropriate.

Results

To date, 120 women have been recruited for the study. Data analysis is presented on 73 antenatal women and 42 postnatal women with elastometry data. Results from the ultrasound biometry and questionnaires are still being analysed. Demographic and delivery data outcomes are available and presented on 61 women (Table 1). The European group are significantly older, have lower BMI and are more likely to return for their follow up than PI women. 5 women (1 PI and 4 European) had a complete avulsion injury following vaginal delivery. There appears to be an association between age and stiffness but this may be skewed by outliers (Figure 1A). There is a significant difference in antenatal (p=0.03) and postnatal (p=0.01) elastometry measures between PI and European women (Figure 1). Postpartum stiffness increased in both groups; 12.4% in the PI women and 29.7% in European women.

Parameters	Pacific Island Ethnic group *n=21*	European Ethnic group *n=40*	*P value*
Age (years) Mean (±SD)	22.5 (2.6)	28.5 (5.5)	0.000*
BMI (kg/m^2) Mean (±SD)	31.2 (7.3)	26.9 (6.1)	0.02*
Birth weight (Kg) Mean (±SD)	3.572 (352)	3.516 (548)	N.S
Epidural analgesia	3 (14.3%)	20(48.8%)	0.02†
Mode of delivery			
Ventouse	1(4.8%)	6(14.6%)	N.S‡
Forceps	0	0	
Caesarean Section	3(4.3%)	8(19.5%)	N.S‡
2nd Stage; Median (range (minutes)	28(0-135)	51.6(0-263)	N.S‡

Table 1: Demographic data, and delivery outcomes for Pacific Island and European women.
* (t-test); † (chi-square)‡ (Mann-Whitney)

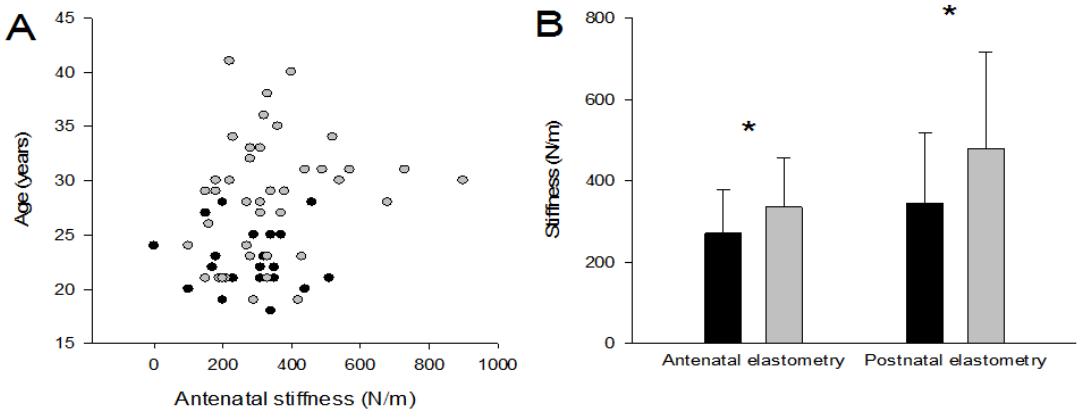

Figure 1: (A) Association between age and antenatal stiffness in PI women (black dots) and European women (grey dots).(B) Comparison of antenatal and postnatal stiffness in PI and European women.

Interpretation of results

Ethnicity and possibly age appear to have a significant effect on LA muscle stiffness as measured using a novel device, the 'elastometer'. The relationship between antenatal stiffness, length of second stage labour, mode of delivery, birth weight, and avulsion injury risk has not yet been established. This may be due to the small sample size at present. To address this we are still in the process of recruiting more participants.

Concluding message

To the author's knowledge, this is first time an attempt has been made to measure and characterise the biomechanical properties of the LA muscle pre and post pregnancy. The observed differences to date, due to age and ethnicity are likely to have a bearing on delivery outcomes. Stiffness of the levator ani muscle appears to be reliably quantifiable in this cohort of patients.

References

1. Obstetrics & Gynaecology 2005, 106(4): 707-12
2. Acta Obstet Gynecol. 2012 Feb; 91(2):211-4
3. Neurourology & Urodynamics 2011, 30(6):865-7

Disclosures

Funding: Jennifer Kruger is supported by Aotearoa Postdoctoral Fellowship **Clinical Trial:** No **Subjects:** HUMAN **Ethics Committee:** Lower South Regional Ethics committee LRS/10/07/029 **Helsinki:** Yes **Informed Consent:** Yes