

WHO AMONGST YOUR PATIENTS IS MOST LIKELY TO SUFFER FROM LEVATOR AVULSION?

Hypothesis / aims of study:

Avulsion of the puborectalis muscle from the pelvic sidewall is a common consequence of vaginal childbirth (1) and associated with abnormal muscle biometry and function as well as female pelvic organ prolapse (2). While this condition can be diagnosed by palpation, this requires substantial training. Diagnosis by magnetic resonance imaging and pelvic floor ultrasound is highly repeatable (3), but these modalities are not always available, especially not in the surgeon's office. The identification of levator trauma may be simplified if it was possible to describe the 'typical patient' – that is, the patient most likely to be found with levator avulsion on imaging. We therefore attempted to define the prior probability of such trauma based on patient history and simple gynaecological examination, in order to assist in the diagnosis of such trauma.

Study design, materials and methods:

This is a retrospective data review. Over a period of 3 years, 983 women had been seen at a tertiary urogynaecological unit, undergoing a standardized interview, a clinical examination including POP-Q assessment, digital evaluation of the levator ani, and pelvic floor ultrasound using a GE Kretz Voluson 730 expert system. We reviewed their records for the presence of a levator avulsion injury diagnosed on 3D ultrasound and analysed our database for predictors of trauma. All parameters that were predictive on univariate analysis were used to construct a regression model.

Results:

Mean age was 54.5 (17-89) years, and mean age at first delivery was 23.8 (range 15- 42). Patients presented with stress incontinence (74%), urge incontinence (70%), and symptoms of prolapse (40%). Levator defects were diagnosed on 3D ultrasound in 240 patients (24%). The following parameters were strongly associated with this diagnosis on univariate analysis: age at first vaginal delivery, the absence of stress incontinence, Forceps or Vacuum delivery, symptoms of prolapse, cystocele grade, uterine prolapse grade, minimum Oxford grading of muscle strength, and side differences in Oxford grading (all $P < 0.001$).

Factor	Adj. OR (95% CI)	p-value
Cystocele		<0.001
• 0-1	1.00	
• 2	3.94 (2.56, 6.09)	<0.001
• 3	8.43 (5.36, 13.28)	<0.001
Difference in Oxford grading	1.88 (1.29, 2.75)	0.001
Minimum Oxford grading	0.50 (0.42, 0.60)	<0.001
Age at first vaginal delivery	1.08 (1.04, 1.12)	<0.001
Forceps/ Vacuum delivery	1.58 (1.06, 2.36)	0.03
History of hysterectomy	1.64 (1.12, 2.42)	0.01
Stress incontinence	0.51 (0.34, 0.76)	0.001

Table 1: The best model for predicting avulsion injury in a urogynaecological population (Nagelkerke $r^2 = 37.2$, correct prediction in 81% of patients), using all available data.

The optimal model predicting levator avulsion from all available data had an adjusted r^2 of 37.2%, with most of the above parameters remaining significant, predicting 81% of cases correctly (see table 1). The regression equation for this model is

$$\text{Log odds (defect=1)} = -2.304 + -0.690 \cdot \text{minimum Oxford grading} + 0.518 \cdot \text{difference in oxford grading} + 0.076 \cdot \text{age at p1} + 1.206 \cdot (\text{if cystocele Grade 2}) + 2.291 \cdot (\text{if cystocele Grade 3}) - 0.645 \cdot (\text{if stress incontinent}) + 0.509 \cdot (\text{if vaginal operative deliveries}) + 0.509 \cdot (\text{if had hysterectomy}).$$

The probability of a defect can then be calculated as follows:

$$\text{Probability (defect=1)} = (e^{\text{equation A / values}}) / (1 + e^{\text{equation A / values}})$$

Other models were constructed for history only, and history plus gynaecological examination (excluding levator assessment for strength, see Table 2).

Factor	Adj. OR (95% CI)	p-value
Cystocele		<0.001
• 0-1	1.00	
• 2	3.77 (2.34, 6.07)	<0.001
• 3	6.51 (3.72, 11.38)	<0.001
Uterine prolapse		0.02
• 0	1.00	
• 1	1.63 (0.96, 2.77)	0.07
• 2-3	2.49 (1.27, 4.91)	0.008
Age at first vaginal delivery	2.10 (1.41, 3.11)	<0.001
Incontinence or prolapse surgery	2.30 (1.32, 3.98)	0.003
Forceps / Vacuum delivery	2.00 (1.31, 3.06)	0.001
Stress incontinence	0.49 (0.32, 0.77)	0.002

Table 2: The best model for predicting avulsion injury in a urogynaecological population when relying on history and simple clinical examination only (Nagelkerke $r^2= 29.5$, correct prediction in 80.5% of cases).

Interpretation of results

Levator defects are most likely to be found on ultrasound in women who had their first child by vaginal operative delivery over the age of 30 and who present with symptoms of prolapse without concomitant stress incontinence. Clinical findings that increase the likelihood of avulsion are cystocele and uterine prolapse as well as strength of a pelvic floor muscle contraction and side differences in contraction strength.

Concluding message

It is possible to predict the presence/ absence of levator avulsion in a given urogynaecological patient with a high likelihood of success. This should help clinicians in evaluating their findings when starting to diagnose levator avulsion clinically, especially if confirmation by imaging is unavailable.

References

1. Obstet Gynecol 2005; 106(4): 707-712
2. Ultrasound Obstet Gynecol 2005;25: 580-585.
3. Obstet Gynecol 2007;109(2):295-302.

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<i>What were the subjects in the study?</i>	HUMAN
<i>Was this study approved by an ethics committee?</i>	Yes
<i>Specify Name of Ethics Committee</i>	Sydney West Area HREC
<i>Was the Declaration of Helsinki followed?</i>	Yes
<i>Was informed consent obtained from the patients?</i>	No