

AVULSION INJURY AND LEVATOR HIATAL BALLOONING: TWO INDEPENDENT RISK FACTORS FOR PROLAPSE?

Hypothesis / aims of study

Increased levator hiatal area or 'ballooning' has is strongly associated with symptoms and clinical signs of prolapse [1]. Excessive hiatal distensibility, however, may be the result rather than the cause of prolapse. This is not true for levator avulsion injury. Women with levator avulsion defects are almost twice as likely to show pelvic organ prolapse of stage 2 or higher than those without [2]. It is not clear at present as to whether ballooning and avulsion injury constitute independent risk factors. Our null hypothesis for this study was that the risk of prolapse conveyed by levator avulsion injury is exclusively due to its effect on the hiatus, i.e., that levator avulsion confers NO independent risk of female pelvic organ prolapse.

Study design, materials and methods

We retrospectively analysed the datasets of 761 women who presented with symptoms of pelvic floor dysfunction to a tertiary urogynaecological unit. Each patient underwent an interview, a vaginal examination, and translabial ultrasound to examine the pelvic floor. For a description of our ultrasound methodology see [3]. Symptoms of prolapse were defined as a 'sensation of a lump' or a 'dragging sensation in the vagina'. On vaginal examination, prolapse was graded using the ICS POP-Q grading, and levator strength and integrity were also assessed by palpation. Ultrasound imaging analysis was done offline using proprietary software on a PC while blinded against clinical data.

Hiatal coronal and anteroposterior diameters and the area at maximum Valsalva were measured at the plane of minimal hiatal dimension using a technique published previously. This plane is identified in the mid-sagittal plane as the minimal distance between the symphysis pubis and the anterior margin of the central aspect of the puborectalis muscle. Levator avulsion was identified using multi-slice imaging (TUITM, tomographic ultrasound imaging). A set of eight tomographic slices was obtained in the axial plane at intervals of 2.5 mm, from 5 mm caudad to 12.5 mm cephalad of the plane of minimal hiatal dimensions. Statistical analysis was performed with SPSS v14 and Minitab v13 using logistic regression. This study was approved by the Institutional Human Research Ethics Committee.

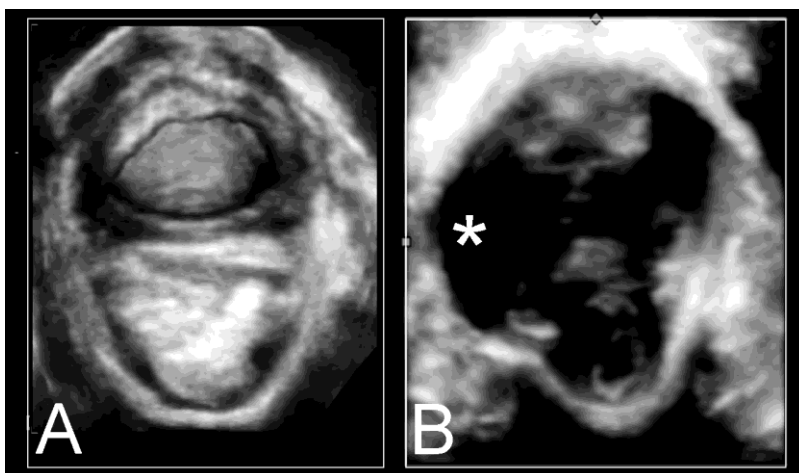


Figure 1: Three-dimensional pelvic floor ultrasound image in the axial plane showing (A) hiatal ballooning on Valsalva in a patient with intact puborectalis muscle, and (B) ballooning in a patient with right-sided avulsion injury (indicated by *).

Results

Of the original 761 patients, 156 were excluded due to previous anti-incontinence or prolapse surgery, leaving 605 datasets. All subsequent analysis relates to these 605 patients. The mean age at assessment was 53 (range 18–88) years, mean vaginal parity 2 (range 0-9). Forty-three percent (n=258) complained of prolapse symptoms. A significant prolapse was defined as ICS POP-Q grade 2 or higher. A significant cystocele was diagnosed in 222 women (37%), 159 (27%) had a significant rectocele, and 40 (8%) significant central compartment prolapse. Avulsion was diagnosed in 110 patients (18%): unilaterally in 10% and bilaterally in 8%. On univariate analysis the number of vaginal deliveries and patient age were significant risk factors for symptoms of prolapse and significant objective prolapse in any compartment, both on clinical and on ultrasound examination. However, in this dataset a history of instrumental delivery or hysterectomy did not convey an increased risk of symptoms or signs of prolapse. There was strong evidence of an association between both avulsion and ballooning and symptoms and signs of prolapse (both $p < 0.001$).

Multivariate backwards stepwise logistic regression revealed that levator avulsion significantly increased the risk of both symptoms and signs of prolapse (except for rectocele), even after allowing for the degree of levator ballooning (see Table 1). The presence of an avulsion did not modify the relationship between hiatal area and symptoms of prolapse (*i.e.* there was no evidence of an interaction between avulsion and hiatal area).

	Symptoms of prolapse	Cystocele	Uterine/vault prolapse	Rectocele	Any prolapse
	OR (95%CI)				

Hiatal area on Valsalva	1.06* (1.03-1.08)	1.09* (1.06-1.12)	1.09* (1.04-1.13)	1.09* (1.07-1.13)	1.11* (1.08-1.14)
No avulsion	1***	1*	1**	NS	1*
Unilateral avulsion	1.88 (1.06-3.35)	2.66 (1.46-4.85)	2.87 (1.11-7.41)		2.76 (1.42-5.37)
Bilateral avulsion	2.22 (1.15-4.27)	5.31 (2.49-11.32)	5.3 (2.17-12.92)		4.01 (1.77-9.10)
Presence of any defect	1.98*** (1.24-3.14)	3.44* (2.1-5.62)	3.46** (1.64-7.28)	NS	

Table 1. Multivariate analysis of the effect of 'ballooning' and avulsion on symptoms and clinical signs of prolapse. * $p < 0.0001$, ** $p = 0.001$, *** $p < 0.01$

Interpretation of results

Levator avulsion injury and levator hiatal ballooning are largely independent risk factors for female pelvic organ prolapse. This is true for both subjective symptoms and objective signs of prolapse. As shown in Table 1, for each cm^2 of hiatal area on Valsalva there is a 6-11% increase in the risk in symptoms and signs of prolapse, after adjusting for other risk factors. In addition to this effect, unilateral avulsion conveys an odds ratio between 1.88 and 2.87 for symptoms and signs of prolapse, and for bilateral avulsion this additional risk is substantially higher (OR of between 2.22 and 5.31). This implies that there is strong evidence against the null hypothesis. The role of levator avulsion in the pathogenesis of female pelvic organ prolapse, mainly cystocele and uterine prolapse, is not fully explained by its effect on hiatal dimensions. It is likely that avulsion implies not just obvious muscular trauma but additional (occult) damage to structures that are currently impossible to assess clinically or by imaging, i.e. myofascial and connective tissue.

Concluding message

Our data has shown that levator avulsion and hiatal ballooning are independent risk factors for female pelvic organ prolapse. Levator injury conveys a substantial risk for symptoms and signs of prolapse which is in addition to its effect on hiatal dimensions.

References

1. Ultrasound Obstet Gynecol 2008; 31: 676-680
2. Br J Obstet Gynaecol 2008; 115: 979-984
3. Ultrasound Obstet Gynecol 2004; 23: 615-625

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Was this study approved by an ethics committee?	Yes
Specify Name of Ethics Committee	SWAHS HREC
Was the Declaration of Helsinki followed?	Yes
Was informed consent obtained from the patients?	No