

DOES CHILDBIRTH ALTER ANTERIOR COMPARTMENT FASCIAL SUPPORTS?

Hypothesis / aims of study

Major morphological abnormalities of the levator ani muscle in the form of an avulsion of the puborectalis muscle from its insertion on the inferior pubic ramus, are common after vaginal childbirth(1). Such trauma is likely to be an etiological factor in the development of female pelvic organ prolapse(1). Fascial trauma in the anterior compartment, i.e. 'paravaginal defects', are difficult to diagnose clinically(2), and it is not clear whether such fascial abnormalities can be diagnosed on imaging. For this reason we undertook a study utilising 4D ultrasound volume datasets encompassing the anterior vaginal wall to document the appearance of vaginal fornices before and after childbirth.

Study design, materials and methods

This study was performed by re-analysing datasets obtained in a previously published studies involving ante- and postpartum pelvic floor assessment by pelvic floor ultrasound. Between November 2006 and October 2008, 202 nulliparous women carrying a singleton pregnancy had been seen at a mean gestation of 37.2 weeks (range 36-38.3 weeks) at two tertiary hospitals. All were invited for a 2nd assessment at least 3 months postpartum, and 163 (81%) returned. All participants underwent an interview and 4D translabial ultrasound (Voluson 730 expert with RAB 8-4 Mhz transducer), after voiding, in the supine position as previously described(3) at both antepartum and postpartum appointments. Analysis for forniceal appearance was undertaken at a later stage by the first author, blinded against all clinical data. The fornices were assessed by tomographic ultrasound, with 8 slices obtained from the plane of minimal hiatal dimensions to 12.5 mm above this plane, encompassing the area immediately caudal to the bladder neck. The best view of the fornices was usually obtained either at rest or on submaximal Valsalva, which tends to put intact fornices under stretch, making them more prominent. The puborectalis muscle, in contrast, was assessed on maximal pelvic floor muscle contraction. A complete avulsion was diagnosed if the plane of minimal dimensions, and the two slices at 2.5 and 5 mm cranial to that, were abnormal(3).

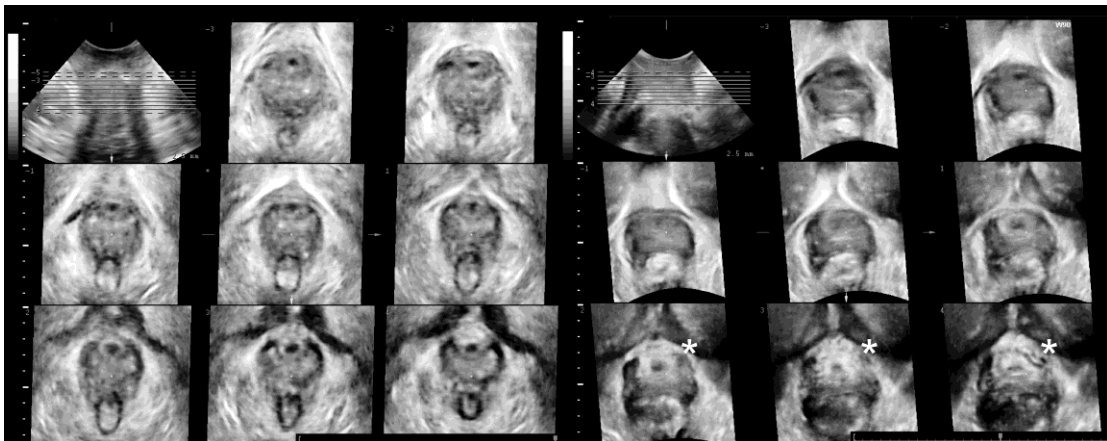


Figure: Forniceal imaging antepartum (left) and postpartum (right) in a patient with substantial changes after vaginal delivery. There was no evidence of partial or complete avulsion of the puborectalis muscle.

The fornix was rated normal or abnormal in all 8 slices, bilaterally. Forniceal tenting was rated as present or absent (1 or 0), with a total score ranging from 0-16 for individual patients, before and after childbirth. We used Minitab V. 13 (Minitab Inc., State College, PA, USA) and SPSS V 17 (SPSS Inc., Chicago IL, USA) for statistical analysis. Cohen's kappa was used to compare the scoring of slices before and after childbirth. Pearson's correlations were used to test for any association between forniceal scores and bladder neck descent. Comparisons between ante- and postpartum scores were undertaken using paired t-tests.

Results

A test-retest series of forniceal scoring was carried out in 21 cases, showing agreement between observers in 297/336 observations (88.4%); the kappa was 0.63 (CI 0.52- 0.73). All 202 patients were nulliparous; 92% were Caucasian. They were seen at an average gestation of 37.2 weeks. Mean age was 26.2 (18.1-45) years, mean BMI 31.6 (22.1-56.5). 36% (72/202) reported symptoms of stress incontinence, 11% urge incontinence and 1.5% symptoms of prolapse. Mean BND was 23.3 mm, mean lowest bladder position on Valsalva was +6.8 mm, mean area on Valsalva was 22.6 cm².

Participants had delivered between 36+6 and 42+4 gestation (mean 40+0); 14 (7%) by prelabour Caesarean Section (CS), 37 (18%) by CS in 1st stage, 11 (5%) by CS in 2nd stage, 107 (53%) by normal vaginal delivery (NVD), 23 (11%) by Vacuum and 11 (5%) by Forceps. Ninety (45%) had used an epidural, and the episiotomy rate was 19% (n=38). First stage was 60-1465 (mean 456) minutes, 2nd stage was 0- 330 minutes (median 54), birthweight 2010- 4850 (mean 3483)g. All data except 2nd stage were normally distributed.

One hundred and sixty three women (81%) attended postnatal follow-up, on average 4.5 (2.7- 12.1) months after the birth. Symptoms of pelvic floor dysfunction were reported as stress incontinence (n=37, 23%), urge incontinence (n=15, 7%) and symptoms of prolapse (lump or dragging sensation, n= 4; 2%). Mean postpartum BND was 27.3 (0.1- 55.7) mm, mean cystocele descent to 2.2 mm above the symphysis pubis (+28.4 - -33.3), mean area on Valsalva 22.7 (10.5- 52.9) cm². This equated to a change in BND of 4 mm, and a change in cystocele descent of 4.7 mm. On tomographic US, we diagnosed a

complete avulsion in 6 patients; partial trauma (any abnormal slice in slices 3-8) was observed in 24. The fornices were assessed both in ante- and postnatal volumes, and loss of forniceal tenting was found in 85 patients (52%). This affected on average 7 slices (range, 1-16).

On univariable analysis, newly absent forniceal tenting postpartum was associated with increased postpartum bladder neck descent (t- test, $P= 0.023$) and increased maximum bladder descent ($P= 0.018$). Loss of tenting was associated with vaginal delivery ($P= 0.021$) and 2nd stage of labour (Spearman's correlation, $r 0.256$, $P= 0.031$). Vacuum delivery did not convey an increased risk, and the number for Forceps was deemed too low for analysis. On multivariable analysis controlling for potential confounders such as age, BMI, vaginal operative delivery, levator avulsion (partial or complete), birthweight and breastfeeding status, loss of forniceal tenting remained independently associated with increased cystocele descent ($P= 0.005$), but not with bladder neck descent.

Interpretation of results

In this study we have shown that forniceal tenting can be reproducibly imaged on 4D pelvic floor ultrasound. In a series of 163 women seen before and after their first delivery, vaginal childbirth and length of second stage were associated with alterations in the appearance of the vaginal fornices on tomographic 3D pelvic floor ultrasound. Such alterations in forniceal 'tenting' were associated with increased descent of the bladder after childbirth, even after controlling for any visible alteration in the appearance of the levator ani.

We have identified a form of morphological alteration caused by childbirth that is independently associated with impaired anterior compartment support. We postulate that the disappearance of forniceal tenting may imply trauma to anterior vaginal wall fascia, constituting what has been termed a 'paravaginal defect'.

Concluding message

Vaginal childbirth is associated with loss of tenting of the vaginal fornices, independent of levator trauma, and also with impaired anterior vaginal wall support. This is evidence for the existence of paravaginal defects and a role for such defects in the causation of anterior vaginal wall prolapse.

References

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Disclosures

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