Paravaginal defects: a comparison of clinical examination and 2D/3D ultrasound imaging

Hans Peter DIETZ,1 Selina PANG,2 Andrew KORDA3 and Christopher BENNESS3
1University of Sydney, Western Clinical School, Penrith, 2Prince of Wales Hospital, Hong Kong SAR, China, and 3Royal Prince Alfred Hospital, Sydney, Australia

Abstract

Background: Paravaginal defects are often assumed to be the underlying anatomical abnormality in anterior compartment descent. Neither clinical examination nor ultrasound assessment are generally accepted diagnostic modalities.

Aims: To compare clinical examination and translabial 3D ultrasound in the detection of such defects.

Methods: Fifty-nine women without previous prolapse or incontinence surgery were seen prospectively. Clinical and ultrasound assessments were carried out in blinded fashion. 3D translabial ultrasound was undertaken after voiding and supine. Volumes were acquired at rest, on Valsalva and on levator contraction. Loss of paravaginal support (‘tenting’) in the axial plane was taken to signify paravaginal defects.

Results: Paravaginal defects were reported clinically in 14 cases on the left (24%), 19 times on the right (32%). Two 3D ultrasound examinations did not yield satisfactory volumes, leaving 57 for analysis. Neither midsagittal nor coronal views yielded data that correlated with clinical assessments. In the axial plane there was absence of tenting at rest in 32/57 (57%) patients, but this did not correlate with clinical findings. Loss of tenting on Valsalva was observed less often (21/57, 37%) and was weakly associated with clinically observed lateral defects (P = 0.036).

Conclusions: Pelvic floor ultrasound in midsagittal, axial or coronal planes does not correlate well with clinical assessment for paravaginal defects. This could be due to poor clinical assessment technique or limitations of the ultrasound method. On the other hand, paravaginal defects may be uncommon or clinically irrelevant. On present knowledge, the paravaginal defect has to be regarded as an unproven concept.

Key words: 3D ultrasound, incontinence, paravaginal defects, prolapse, translabial ultrasound.

Introduction

Paravaginal defects, that is, gaps in the endopelvic fascia, have been postulated as the underlying anatomical abnormality in anterior vaginal wall descent.1–3 Cystocele and stress urinary incontinence is thought to be due to defects in the endopelvic fascia, supposedly as a result of traumatic childbirth.4 Two main types of defect have been hypothesised- the lateral paravaginal defect, due to separation of the endopelvic fascia from the arcus tendineus fasciae pelvis, and the central defect due to development of a central gap in the endopelvic fascia supporting bladder neck, trigone and posterior bladder wall. The integrity of pelvic fascial structures is notoriously difficult to assess however, even at surgery, and there is no agreement at present regarding the validity of the concept.4 Usually, assessment is undertaken by clinical examination, evaluating the depth of the vaginal fornices and the presence/absence of vaginal rugae. To date, this technique has never been fully validated. In order to make detection of paravaginal defects more objective, some authors have used transabdominal ultrasound, with conflicting results.1–8 Paravaginal defects are supposed to be present when an asymmetry of the caudal contour of the bladder is observed in an oblique coronal view. However, as both uterine position and size as well as rectal filling can influence results and as it is impossible to standardise the assessment plane due to an absence of landmarks in the coronal plane, it is not surprising that the method has been found unreliable.7 Furthermore, while one would expect defects to become more pronounced and more easily identifiable on Valsalva, transabdominal ultrasound does not allow imaging on Valsalva due to dislodgement of the transducer on contraction of the abdominal muscles.
The authors hypothesised that translabial ultrasound should, in theory, be able to detect paravaginal defects much better, either in the coronal plane by demonstrating asymmetrical bladder descent, or in the axial plane by showing a loss of paravaginal support structures, both at rest and on Valsalva. These structures have been demonstrated both on Magnetic Resonance Imaging and on 3D pelvic floor ultrasound with intact structures being evident as ‘tenting’ of the vaginal fornices towards the pelvic sidewall.

In this prospective clinical study the authors aimed to compare a clinical assessment for defects of the endopelvic fascia (both central and paravaginal) and translabial 2D and 3D ultrasound in an attempt to evaluate the relative usefulness of all three methods.

**Methods**

Fifty-nine women without previous prolapse or incontinence surgery were seen in the context of a prospective study of 3D pelvic floor ultrasound for the assessment of paravaginal defects. They all attended urogynaecological clinics for symptoms of bladder dysfunction. The clinical assessment was performed by AK, CB and SP while the ultrasound was performed by HPD who was blinded against clinical findings. Paravaginal defects and central defects of fascial supports of the anterior vaginal wall were rated as absent, mild, moderate or severe. Cystoceles were rated as Grade 1 (reaching to 1 cm above the hymen), Grade 2 (reaching to between 1 cm above and 1 cm below the hymen) or Grade 3 (reaching to more than 1 cm below the hymen on Valsalva).

3D translabial ultrasound was undertaken after voiding and in the supine position, using GE Kretz Voluson 730 (GE Medical Australia, Rydalmere, New South Wales, Australia) and Medison SA 8000 systems (Excelray Australia, Artarmon, New South Wales, Australia) with 7–4 MHz 3D US transducers with automatic image acquisition. The sweep angle was 70–75 degrees. Image acquisition took 3–4 s, and the main transducer axis was orientated in the midsagittal plane. Volumes were acquired at rest, on Valsalva and on levator contraction, after the efficacy of both manoeuvres had been ascertained by 2D imaging. B Mode images were obtained in the mid-sagittal plane and evaluated at the time of assessment. In order to distinguish between bladder neck descent with and without proximal urethral rotation and with and without loss of the retrovesical angle, the classification first suggested by Green for radiological imaging was employed as the appearances of Green Type III have been claimed to be due to a central defect. A detailed description of the methodology for evaluation of images obtained in the midsagittal plane has been published elsewhere.

The 3D analysis was undertaken separately with the help of the software 4D View 2000 (Kretztechnik, Zipf, Austria) on a desktop computer. Assessment of the paravaginal spaces for ‘tenting’ was performed in the axial plane at approximately 2, 4 and 6 cm from the introitus. Oblique coronal planes were used to assess urethra and bladder base for asymmetry of support and descent (see Fig. 1). Axial views of tenting at rest and on Valsalva are shown in Figure 2. Figure 3 illustrates a case of loss of tenting on the right as shown in the axial plane on Valsalva.

The study had been approved by the local Research Ethics Committee (CSAHS EC X02–0156). Statistical analysis was performed after Normality testing (histogram analysis and/or Kolmogorov–Smirnov testing), using Minitab Version 13 (Minitab Inc., State College, PA, USA). Student’s t-test and X² table statistics were used for comparative statistics. P < 0.05 was considered statistically significant.

**Results**

The average age was 51.5 years (range 31–79 years). Median parity was 2 (range 0–7). Forty-five of the 59 women (76%)
suffered from stress incontinence, 44/59 (75%) of urge incontinence, 39 (66%) of frequency, 34 (58%) of nocturia and 32 (54%) of symptoms of voiding dysfunction. 19 (32%) reported symptoms of prolapse. Clinically, cystocele was reported as Grade 1 ($n = 31, 52\%$), Grade 2 ($n = 9, 15\%$) and Grade 3 ($n = 2$). Paravaginal defects were reported in 14 cases on the left (24%), and 19 times on the right (32%). Most were rated mild (12 on the left, 14 on the right), a few moderate (one and two) or severe (two and three). Central defects of the endopelvic fascia were detected clinically in 31 women (53%) and rated mild ($n = 20$), moderate ($n = 8$) and severe ($n = 3$).

Figure 2 Imaging of the paravaginal fornices in the axial plane at 3–4 cm from the introitus. Left: at rest, right: Valsalva. Tenting (arrows) is clearly visible, both at rest (left) and on Valsalva (right).

On 2D ultrasound, average bladder neck descent was 28.6 mm (range 8.8–52.7 mm). There was no significant or near-significant association between this parameter and the clinical detection of paravaginal defects, neither for central nor for lateral defects, and this also held true when moderate or severe defects were assessed separately. Significant bladder neck descent with an intact retrovesical angle (Green Type III bladder descent or ‘isolated cystoceles’) was found in 10 women, and while central defects were more often detected clinically in those women, the association was not quite significant on $X^2$ test ($P = 0.056$).

3D ultrasound was obtained in all 59 women although eight of the 59 volumes could not be assessed for all required planes at rest and on Valsalva due to technical limitations (poor image quality, marked prolapse, operator errors on acquisition). However, only two examinations did not yield any satisfactory volume datasets, leaving 57 patients for analysis of imaging in the coronal and axial plane. In 32/57 (57%), there was an absence of tenting in one of the axial
levels assessed at rest, but this did not correlate with clinical assessment or 2D ultrasound findings. A loss of tenting in volumes obtained on Valsalva manoeuvre was observed less often (21/57, 37%), and this finding was weakly but significantly associated with clinically elicited lateral paravaginal defects: loss of tenting was found more often in those with a clinically detected defect (4/21) than in those with clinically normal lateral fornices (1/36), P = 0.036. In the coronal plane, asymmetry of bladder base support was not associated with clinical findings.

Conclusions

With current technology, it appears that translabial ultrasound imaging, both in the midsagittal plane as well as in the axial or coronal plane, does not correlate well with a clinical assessment for central or lateral defects of the endopelvic fascia. The only observed significant association between lateral paravaginal defects and a loss of tenting (i.e. paravaginal support in the axial plane) on Valsalva is so weak as to be clinically irrelevant. As significant trauma to the puborectalis/pubococcygeus complex in the sense of a partial or complete avulsion off the arcus tendineus levator ani would usually result in a loss of tenting and cystocele, it is possible that this weak association is due to the detection of much more significant levator trauma rather than trauma to ‘just’ the endopelvic fascia. Figure 3 shows such a case: there clearly is absence of tenting, but this is associated with an anteromedial defect of the puborectalis/pubococcygeus complex.

There are several potential explanations for the findings demonstrated by this study. It might well be that the clinical assessment carried out by three different clinicians was insufficiently sensitive to detect paravaginal or central fascial defects. On the other hand, the 3D ultrasound imaging technique used in this study may have provided inadequate resolution to reliably pick up paravaginal tenting. However, it might also be prudent to consider whether the ‘paravaginal defect’ does in fact exist in a significant number of women presenting with anterior vaginal wall descent. Put another way, lack of bladder base support might not necessarily imply disruption of supporting structures as has been assumed in the past. From recent data obtained in young nulliparous women, and from 2D ultrasound data obtained before and after childbirth, one would suspect that significant anterior vaginal wall descent is common in young nulliparous women and at least partly determined by genetic factors, and even if there is an increase in bladder neck mobility after childbirth, this might be due to stretching rather than actual disruption of fascial structures.

This implies that many women with cystocele would not be expected to show a defect because their cystocele is non-traumatic, probably congenital in origin. Furthermore, if stretching rather than disruption of structures was responsible for anterior vaginal wall descent, one would not expect to find well-defined defects. Even if there were such defects, they might be of the pattern observed with striae gravidarum rather than present as a single tear or gap.

This study has not found any evidence supportive of the concept of paravaginal fascial defects. It might well be that the reality of anterior vaginal wall support failure is much more complex than assumed to date.

References