Ultrasound in the quantification of female pelvic organ prolapse

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ABSTRACT

Objectives To evaluate the use of ultrasound in the quantification of prolapse and compare findings with clinical assessments obtained in a blind study.

Methods In a prospective comparative clinical study, 145 patients referred for urogynecological assessment were examined clinically by one operator and by translabial ultrasound by another operator.

Results Clinical staging and International Continence Society coordinates were obtained for all 145 patients, as were ultrasound coordinates for descent of the anterior and posterior vaginal walls. Eighteen percent of the uteri of those women who had not had a hysterectomy in the past could not be seen; none of these women suffered from uterine prolapse clinically. Correlation with the prolapse assessment system recently endorsed by the International Continence Society was good ($r = 0.77$ for uterine prolapse, $r = 0.72$ for anterior vaginal wall and $r = 0.53$ for posterior vaginal wall descent).

Conclusions This study demonstrates that translabial ultrasound can be used to quantify female pelvic organ prolapse. Correlation with the International Continence Society prolapse assessment system is good. The method may be particularly suitable for objective outcome assessment after surgical intervention.

INTRODUCTION

For more than 10 years translabial ultrasound has been used to assess the lower urinary tract in urinary incontinence and prolapse. Descent of the urethra and bladder outlet can be quantified against the inferoposterior margin of the symphysis pubis. However, little attention has so far been paid to descent of the uterus, vaginal vault and posterior vaginal wall. The cervix, cul de sac and rectum can usually be visualized with translabial ultrasound. We aimed to compare the data obtained by ultrasound quantification of prolapse with the results of clinical assessments carried out according to the recently introduced International Continence Society (ICS) pelvic organ prolapse classification system and traditional clinical prolapse staging.

METHODS

One hundred and forty-five patients referred for urogynecological assessment were examined clinically by one operator (B.T.H.) and by translabial ultrasound by another operator (H.P.D.). For the pilot study ($n = 41$), the clinical examiner was blinded against the ultrasound result. Subsequently, all examiners were blinded against each other’s results. As results did not differ significantly, both groups were merged for analysis.

The pelvic organ prolapse classification system of the ICS involves the identification of points on the anterior and posterior vaginal walls as well as the vault or cervix and the measurement of their descent with straining, with the hymen serving as the reference point. The examination was carried out with the patient in the supine position after voiding.

Ultrasound was also performed with the woman in the supine position and with her bladder nearly empty to maximize pelvic organ descent, using 3.5–5-MHz curved array probes on several commercially available ultrasound systems (Acuson 128XP, Mountain View, CA, USA; ATL HDI 3000, Bothell, WA, USA; Aloka SSD 500, Tokyo, Japan). The probe was covered with a glove and placed on the perineum in a sagittal direction. The patient was asked to cough and strain. On obtaining maximum descent, images were taken and the position of the bladder neck, leading edge of a cystocele, the cervix, cul de sac and rectum were determined relative to the inferoposterior margin of the symphysis pubis (Figure 1).

Care was taken to minimize probe pressure so as not to reduce maximal descent. Numerical findings for descent of the anterior and posterior vaginal walls as well as for the cervix were compared. The findings were also correlated with a traditional graded organ prolapse assessment (grades I–III).

Interobserver variability has been found to be 20% for maximal descent of a cystocele or cystourethrocele in an unrelated...
series by the authors (unpublished results). No data is yet available for interobserver variability of the other ultrasound parameters determined in this study.

We used Spearman’s rank correlation coefficient to test ICS prolapse quantification data against ultrasound measurements. For comparing the results obtained with both methods and clinical staging we employed percentage of variation analysis through the use of multinomial logistic regression models.

**RESULTS**

Clinical staging and ICS coordinates were obtained for all 145 patients, as were ultrasound coordinates for descent of the anterior and posterior vaginal walls.

Sixty-two patients had undergone a hysterectomy. In 15 of the remaining 83 patients, the uterus was not clearly imaged (18%). Twelve of these occurred in the initial unblinded phase; only three uteri could not be imaged amongst the 104 patients of the blinded phase. All women in whom the uterus could not be clearly seen had values of ≥ -5 documented for point C on ICS assessment. In seven patients, ICS grading of central compartment descent was unavailable.

Posterior vaginal wall prolapse was defined as an ultrasound coordinate describing the lowest point reached by either rectocele or enterocele. Three times an enterocele obscured the rectal ampulla. In all other 142 patients it was possible to image the rectum. Descent of the cul de sac (i.e. an enterocele) was more prominent than descent of the rectal ampulla in 21 of 145 patients (14.5%), and in these patients the coordinates of the leading edge of the enterocele were used to describe maximum posterior vaginal wall prolapse. Figures 2–5 illustrate the ultrasound appearances of anterior, central and posterior compartment descent.

**Figure 1** Quantification of female pelvic organ prolapse by translabial ultrasound (mid-sagittal view).

**Figure 2** Anterior vaginal wall prolapse (cystourethrocele, arrow), at rest (a) and on Valsalva maneuver (b). The calipers measure the bladder neck position.

**Figure 3** Uterine prolapse after Burch colposuspension, at rest (a) and on Valsalva maneuver (b).

**Figure 4** Posterior vaginal wall prolapse: rectocele (arrows), coexisting with large cystocele, at rest (a) and on Valsalva maneuver (b).

**Figure 5** Posterior vaginal wall prolapse: enterocele (arrows), outlined by fluid in pouch of Douglas, at rest (a) and on Valsalva maneuver (b).
Clinical staging and ICS system

Table 1 summarizes comparisons between traditional clinical staging and both ICS system and ultrasound assessment of uterine, anterior, and posterior vaginal wall descent. The percentage of variation analysis (Table 2) gives an impression of the discriminatory power of both ICS prolapse assessment and ultrasound quantification as regards clinical staging. For anterior vaginal wall prolapse, both the ICS system and ultrasound measurements distinguished reasonably well between clinical stages. For central compartment prolapse, ultrasound distinguished better than the ICS measurement, and for posterior vaginal wall prolapse the reverse was true.

ICS system and ultrasound quantification of prolapse

Fair to good correlations were obtained between the ICS system and ultrasound quantification of prolapse. The position of the anterior vaginal wall (point Ba) on straining correlated well ($r = 0.72$) with maximum descent of the bladder on ultrasound, with ultrasound coordinates generally being more than 1 cm higher (more distal) than the ICS system estimate. Uterine descent correlated even better ($r = 0.77$), with ultrasound yielding coordinates more than 2 cm higher on average. The poorest correlation was seen for the posterior vaginal wall ($r = 0.53$), and again ultrasound coordinates were more than 1 cm higher on average (Table 3).

### Table 1: Correlation between clinical staging and ICS ultrasound quantification of anterior vaginal wall prolapse, of uterine or vault descent, and of posterior vaginal wall prolapse

<table>
<thead>
<tr>
<th>Clinical stage</th>
<th>ICS/Ultrasound</th>
<th>0</th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cystocele ($n = 145$)</td>
<td>n</td>
<td>55</td>
<td>60</td>
<td>17</td>
<td>13</td>
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<tr>
<td>ICS point Ba</td>
<td>$-2.4$ (0.7)</td>
<td>$-1.2$ (0.9)</td>
<td>$0.6$ (1.2)</td>
<td>$2.5$ (1.1)</td>
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<tr>
<td>US coordinates</td>
<td>$-1.4$ (1.1)</td>
<td>$-0.2$ (1.2)</td>
<td>$1.6$ (1.2)</td>
<td>$3.5$ (1.3)</td>
<td></td>
</tr>
<tr>
<td>Central compartment descent ($n = 138^{*}$)</td>
<td>n</td>
<td>99</td>
<td>28</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>ICS point C</td>
<td>$-4.6$ (2.5)</td>
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<td>$3.0$ (1.7)</td>
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<tr>
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<td>$1.0$ (1.6)</td>
<td>$2.5$ (0.6)</td>
<td></td>
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<tr>
<td>Rectoenterocele ($n = 145$)</td>
<td>n</td>
<td>63</td>
<td>62</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>ICS point Bp</td>
<td>$-2.4$ (0.5)</td>
<td>$-1.1$ (0.9)</td>
<td>$0.4$ (0.9)</td>
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<td>US coordinates</td>
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</table>

Table 2: Variation between clinical stages 0–III for ICS and ultrasound measurements

<table>
<thead>
<tr>
<th>Cystocele (%)</th>
<th>Uterine/vault descent (%)</th>
<th>Rectoenterocele (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICS measurements</td>
<td>48.2</td>
<td>15.4</td>
</tr>
<tr>
<td>Ultrasound measurements</td>
<td>37.2</td>
<td>47.1</td>
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</table>

ICS, International Continence Society.
although ultrasound coordinates tended to be more distal numerically due to the different point of reference. The best correlations were obtained for uterine prolapse, followed by the anterior vaginal wall. The lowest correlation coefficient was calculated for the posterior vaginal wall. Percentage of variation analysis confirmed that the correlation between clinical staging and ultrasound measurements was best for central compartment prolapse and poorest for posterior vaginal wall descent.

Discrepancies between the clinical/ICS assessment and ultrasound data may be due to a number of different factors. Firstly, for purposes of comparison it has been assumed that the ICS points Ba and Bp are equivalent to the internal urethral meatus (or the leading edge of a cystocele) and the rectal ampulla as seen on transperineal ultrasound. This may not in fact be true as the ICS system uses vaginal surface landmarks that do not always correlate well with the actual position of viscerae. A recent study comparing fluoroscopic landmarks that do not always correlate well with the actual position of viscerae. A recent study comparing fluoroscopic findings with the ICS prolapse quantification yielded correlations that were substantially poorer than those reported here10.

Secondly, the clinical examination requires the presence of a speculum, which necessarily introduces a degree of distortion and does not describe the normal situation in vivo. This does not necessarily imply, however, that the ‘artificial’ situation of a speculum examination is irrelevant. A rectocele normally masked by a uterine prolapse might be unmasked after the introduction of a speculum.

Thirdly, the presence of a speculum is likely to influence the patient’s cough or valsalva efforts. A speculum may make it harder (or more uncomfortable) for the patient to follow instructions. There may also be activation of the levator ani resulting in false-negative findings.

Fourthly, measurements for the ICS system are obtained against the hymen as opposed to ultrasound coordinates being determined against the inferior margin of the symphysis pubis. It is therefore not surprising that ultrasound measurements on valsalva maneuver were generally numerically higher (i.e. more distal). It may be debated as to whether the hymen (as relating to the clinical sign of prolapse) or the pelvic girdle (as relating to the cause of prolapse, i.e. detachment of fascial/ligamentous structures from their bony attachments) is a more appropriate point of reference.

Certain disadvantages of the ultrasound method used in this study may also have contributed to the observed discrepancies. A large bowel-filled prolapse, i.e. an enterocoele or rectocele, may result in incomplete imaging of the cervix and vault, especially if these structures remain high. Furthermore, transducer pressure may result in an underestimation of severe prolapse. However, none of these disadvantages would impact on the most likely application of the new method, which is the clinical audit of procedures designed to cure female pelvic organ prolapse.

CONCLUSION

We believe this study has demonstrated for the first time that translabial ultrasound can be used to quantify uterovaginal prolapse. Ultrasound measurements tend to be higher numerically due to the different point of reference. Correlation with the prolapse assessment system recently endorsed by the ICS and with clinical staging is good, especially for anterior and central compartment prolapse. The bony point of reference and the use of clearly defined anatomical landmarks are advantages of the method, making it particularly suitable for outcome assessment after surgical intervention.

ACKNOWLEDGMENT

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REFERENCES

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