Defecation proctography and translabial ultrasound in the investigation of defecatory disorders

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ABSTRACT

Objectives Defecation proctography is the standard method used in the investigation of obstructed defecation. Translabial ultrasound has recently been shown to demonstrate rectocele, enterocele and rectal intussusception. We performed a comparative clinical study to determine agreement between the two methods.

Methods Thirty-seven women booked for defecation proctography for obstructed defecation were recruited.

Using both methods, we determined the anorectal angle, presence of a rectocele and rectocele depth, rectal intussusception and prolapse. Measurements were obtained by operators blinded to all other data. All patients rated discomfort on a scale of 0–10.

Results Six women did not attend defecation proctography, leaving 31 cases for comparison. The mean age of the women was 53 years. Patients rated discomfort on a scale of 0–10.

For ultrasound these results were highly predictive of findings on defecation proctography. Copyright © 2008 ISUOG. Published by John Wiley & Sons, Ltd.

INTRODUCTION

Obstructed defecation is a common complaint in women and one of the three main causes of functional constipation, the other two being slow-transit constipation and constipation-predominant irritable bowel syndrome. A number of structural and functional abnormalities have been associated with this condition such as rectocele, rectal intussusception/prolapse, anismus and colpocoele (compression of the rectal ampulla by mild uterine prolapse)1,2. Any of these conditions can lead to straining at stool owing to a sensation of incomplete emptying. The anatomical abnormality leads to behavioral change, which in turn exacerbates the original abnormality, leading to worsened symptoms and more straining.

The assessment of patients with defecation disorders includes a history, physical examination and imaging investigations, which may significantly contribute to the diagnosis3. Defecography has been the gold standard to date. When it is performed in conjunction with a standard barium enema, it provides anatomical and functional information on disorders of defecation4. This investigation is also used in cases of multiple pelvic floor disorders, when it is combined with opacification of the small bowel, bladder and vagina5. More recently, dynamic magnetic resonance imaging (MRI) has been shown to have the advantage of demonstrating all compartments of the pelvis and their interaction during...
straining and evacuation, but the method is expensive\textsuperscript{5–7}. We have recently shown that translabial ultrasound can demonstrate rectocele, enterocele and inappropriate levator activation\textsuperscript{8}. The aim of this comparative study was to determine agreement between translabial ultrasound and defecation proctography findings.

METHODS

Thirty-seven women booked for defecation proctography for the clinical diagnosis of obstructed defecation were offered participation in the study. In 34 women, this involved an additional ultrasound examination; three patients authorized us to use previously acquired ultrasound data. In most cases the defecation proctogram was carried out first. In four patients the order was reversed. Written informed consent was obtained, and the study was approved by the local Human Research Ethics Committee (reference SWAHS 05/044).

All the patients were seen in tertiary urogynecological clinics. They were interviewed regarding bowel function including questions on frequent straining at stool, chronic constipation, vaginal digitation, the sensation of incomplete bowel emptying and fecal incontinence. They were also asked to describe average stool quality according to the Bristol stool chart\textsuperscript{9}.

Multiple fluoroscopic images were acquired using a Philips MD3 digital C-arm X-ray machine. Thin Barium or Liquid Polybar Plus was instilled into the rectum in the first pass followed by a Liquid Polybar/starch mixture. Images were acquired at rest, during straining, defecation and coughing, and the procedure was videotaped. Translabial ultrasound was performed using a GE Kretz Voluson 730 expert system (GE medical, Sydney, Australia), after voiding, supine, at rest and on maximal Valsalva maneuver, as previously described\textsuperscript{10}. The procedure was noninvasive, as we did not use a contrast medium. Volume data were archived and analyzed at a later date by an operator blinded to all clinical data and defecation proctography results. After undergoing the second procedure, all the patients rated the inconvenience and discomfort associated with each of the two methods on a scale of 0–10.

Using both methods, we determined the anorectal angle at rest and on Valsalva, presence/absence of a rectocele and its maximum depth (Figure 1), as well as the presence/absence of rectal intussusception or prolapse (Figure 2). Measurements were obtained by different operators blinded to all clinical and imaging data; i.e., the person evaluating the ultrasound scan was unaware of the findings of the clinician reporting on the defecation proctogram, and vice versa. On ultrasound a rectocele was defined as a discontinuity in the anterior anorectal muscularis, resulting in a herniation of rectal contents into the vagina of at least 10 mm in depth, as previously described\textsuperscript{8}. This cut-off was used as it is the only published cut-off for the diagnosis of rectocele on ultrasound\textsuperscript{3,8}. Rectocele depth was measured perpendicular to the expected contour of the anterior rectal wall both on defecography (lateral projection) and ultrasound (midsagittal plane). On ultrasound a rectal intussusception was defined as a full thickness invagination of the rectal wall into the anal canal. The anorectal angle was measured by placing lines through the hypoechoic band representing the posterior internal anal sphincter and through the posterior wall of the rectal ampulla, at rest and at maximal Valsava maneuver.

Statistical evaluation was undertaken using SPSS 12 for Windows (Chicago, IL, USA) and Minitab V13.

\begin{figure}
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\includegraphics[width=\textwidth]{figure1}
\caption{Rectocele on defecation proctography (a) and translabial ultrasound (b). The rectocele measured 15 mm both on fluoroscopic X-ray and ultrasound imaging, which was an unusual degree of agreement.}
\end{figure}
for PC. In order to analyze concordance between methods for the diagnosis of rectocele and rectal intussusception/prolapse we used Cohen’s kappa as well as positive and negative predictive values (comparing ultrasound diagnoses to defecation proctography as the definitive test). Normality of continuous parameters was tested using Kolmogorov–Smirnov analysis. In cases of non-normal distribution, as for the discomfort scores, we used the Mann–Whitney U-test. Intraclass correlation statistics (single measures, absolute agreement definition) were employed to analyze agreement between the two methods in the measurement of anorectal angle and rectocele depth. $P < 0.05$ was considered statistically significant.

**RESULTS**

Thirty-seven consecutive patients with obstructed defecation were recruited from October 2005 to March 2007. Six women (16%) did not attend their defecation proctography. One patient was found to be pregnant and five others cancelled repeatedly, leaving 31 cases for comparison. One of these had an incomplete proctogram owing to inability to defecate, allowing only assessment for rectocele. All underwent four-dimensional pelvic floor ultrasound examination. The median interval between the two tests was 28 (range, 0–198) days.

The average age of the patients was 53 (range, 26–80) years. Median vaginal parity was 2 (range, 0–6). The mean age at first delivery was 24 (range, 17–39) years. Six patients out of 37 were nulliparous. Ten women (27%) had had a previous hysterectomy, and four (11%) repair of a vaginal prolapse. Two had previously undergone surgery for obstructed defecation. Table 1 shows the symptoms of obstructed defecation and prolapse reported by patients. Median Bristol Stool Chart score was four (range, 1–6.5). Discomfort caused by the examination was rated once both tests had been concluded and was reported at a median of one (interquartile range 0–2, range 0–10) for ultrasound and seven (interquartile range 3–9, range 0–10) for defecation proctography ($P < 0.001$ on Mann–Whitney U-test).

The mean hiatal area at rest was 20.9 (range, 10.5–35.4) cm$^2$. The average hiatal area on Valsava was 34.5 (range, 16.1–48.7) cm$^2$. On ultrasound, we diagnosed 18/37 (49%) rectoceles and 10/37 (27%) rectal intussusceptions, and the measurements of the anorectal angle gave a mean of 119 ($SD$ 16)$^\circ$ at rest and 115 ($SD$ 17)$^\circ$ on Valsalva maneuver. On defecation proctography there were 22/31 (71%) rectoceles and 23/30 (77%) rectal intussusceptions or rectal prolapse. Measurement of the anorectal angle gave a mean of 100 ($SD$ 21)$^\circ$ at rest and 134 ($SD$ 15)$^\circ$ on Valsalva maneuver. Mean rectocele depth on defecation proctography was 18 mm ($SD$ 7). On comparing the methods, Cohen’s kappa was 0.26 for rectocele and 0.09 for rectal intussusception/prolapse, for an overall agreement of 64% for rectocele and 43% for rectal intussusception. The positive predictive value of ultrasound was 0.82 (CI, 0.68–0.93) for rectocele and 0.88 (CI, 0.61–0.98) for intussusception (implying that, in patients with a diagnosis of rectocele or intussusception/prolapse on ultrasound, the defecation proctography was very likely to show the same diagnosis). The negative predictive value of ultrasound was much lower, at 0.43 for...

**Table 1** Symptoms of the study group ($n=37$)

<table>
<thead>
<tr>
<th>Symptom</th>
<th>n (%)</th>
</tr>
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<tbody>
<tr>
<td>Constipation</td>
<td></td>
</tr>
<tr>
<td>Straining at stool</td>
<td>26 (70)</td>
</tr>
<tr>
<td>Vaginal digitation</td>
<td>31 (84)</td>
</tr>
<tr>
<td>Sensation of incomplete emptying</td>
<td>15 (41)</td>
</tr>
<tr>
<td>Fecal incontinence</td>
<td>30 (81)</td>
</tr>
<tr>
<td>Vaginal lump</td>
<td>10 (27)</td>
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</table>

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rectocele and 0.27 for rectal intussusception/prolapse, implying that when ultrasound did not show rectocele or rectal intussusception, defecation proctography did in fact frequently show such an abnormality (Tables 2 and 3). Measurements of rectocele depth and anorectal angle showed very poor agreement, with intraclass correlations between 0 and 0.256. Mean differences between measurements were 15 (SD 21)° for anorectal angle at rest, 20 (SD 24)° for anorectal angle on Valsalva and 4 (SD 9) mm for rectocele depth.

**DISCUSSION**

In this study comparing defecation proctography and translabial ultrasound in women with evacuation disorders we found relatively poor agreement between the methods. However, when ultrasound showed a rectocele or rectal intussusception, there was a high likelihood of this diagnosis being confirmed on proctography. The positive predictive value of ultrasound was 0.82 for rectocele and 0.88 for intussusception/prolapse. On the other hand, proctography often diagnosed an abnormality in patients with a normal ultrasound scan. It is unclear whether this implies over-diagnosis on fluoroscopy or insufficient sensitivity, i.e. under-diagnosis on ultrasound, and this study is not adequately powered to assess associations between imaging findings and specific symptoms. Agreement for quantitative findings such as anorectal angle and rectocele depth was very poor. It is unclear whether measurement of the anorectal angle conveys important clinical information, but we have recently shown that rectocele depth is strongly associated with symptoms of obstructed defecation.

There are a number of potential explanations for the limited agreement between the two techniques. Owing to the study design there was a substantial time lag between the two examinations, which may have introduced bias. Furthermore, as both methods are highly operator dependent, the experience of the assessor is very likely to play a role. There are also substantial methodological differences. Ultrasound examination is performed with the woman in a supine position, and the abnormality in question is made visible by performing a Valsalva maneuver. Defecation proctography is undertaken in the sitting position, and the test involves actual defecation in a semi-private setting. For this method, patient cooperation is crucial, and it has been argued that defecation proctography is unlikely to replicate normal evacuation owing to stress and embarrassment. A previous study suggested that defecography over-diagnoses rectocele, which would be consistent with our findings. A recent paper from Italy, using translabial ultrasound without contrast, found poor agreement between defecography and ultrasound, with a very high prevalence of rectocele on defecation proctography (90%) compared to ultrasound (27%).

On the other hand, it could be argued that ultrasound in the supine position may under-diagnose abnormalities that are more likely to manifest in the seated patient. Contrast medium may also improve the detection of rectocele. Beer-Gabel et al. reported higher agreement between methods in the diagnosis of rectocele and intussusception, which may be because they attempted to more closely mimic defecation proctography by filling the rectum with ultrasound contrast medium.

Both anorectal angle measurements and measurements of rectocele depth showed poor agreement in our study. In this regard Beer-Gabel et al. reported similar findings. While a recently published study from Italy showed good concordance between ultrasound and fluoroscopic determination of the anorectal angle, agreement for rectocele depth seems to have been more limited. Lack of agreement regarding measurements has also been reported in studies comparing defecography and conventional dynamic MRI in the diagnosis of posterior pelvic floor dysfunction, raising questions on the repeatability of findings regardless of the method used. Clearly, future work will have to focus on the test–retest reliability of measures proposed for clinical use, and the association between individual symptoms and imaging findings.

Over the last two decades, proctography has been the standard diagnostic technique for conditions such as rectocele, enterocele, anismus and perineal descent. The literature on defecography claims good validity and reproducibility. On the other hand some authors have criticized defecography as being of limited clinical relevance and not representative of physiological defecation. Ultrasound, first described as a diagnostic method in this field in 1992, is clearly becoming more and more popular in the investigation of anorectal dysfunction. One reason for this development is the much better patient acceptance of ultrasound, which was
confirmed in our study, although it is recognized that recall bias may have confounded these results. The non-invasive nature and lower cost of the technique will allow investigations into the prevalence of morphological abnormalities in asymptomatic women and the repeatability of findings, both research topics that are difficult to approach by defecation proctography owing to its invasive nature. Enhanced patient acceptance will also allow for easier postoperative evaluation of surgical outcomes and help in the assessment of new procedures. However, it is recognized that defecation proctography better reflects the process of defecation than does the use of a Valsava maneuver on ultrasound, and for this reason it would be inappropriate for us to suggest that ultrasound can replace defecation proctography in clinical practice.

In conclusion, translabial ultrasound may be a cheap and well-tolerated alternative to defecation proctography in the diagnostic work-up of patients with symptoms of obstructed defecation, but agreement with findings on defecation proctography is limited. Ultrasound findings show high positive but low negative predictive value in detecting rectocele and rectal intussusception/prolapse, when compared with defecation proctography as the definitive test. This implies that ultrasound may be useful as an initial test or screening method in patients with defecatory disorders, avoiding more invasive tests when findings are positive. However, negative findings on ultrasound may require confirmation by defecation proctography.

ACKNOWLEDGMENTS
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