

# The 'sliding sign' in conjunction with sonovaginography: is this the optimal approach for the diagnosis of Pouch of Douglas obliteration and posterior compartment deep infiltrating endometriosis?

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## Abstract

*Introduction:* Endometriosis is a chronic peritoneal disease that may progress as a deep infiltrating lesion involving the posterior compartment of the pelvis. Efforts to improve pre-operative knowledge of the location and extent of these lesions have resulted in the development of Transvaginal ultrasound (TVS) as the first-line imaging modality for extra-ovarian endometriosis. However, various techniques of TVS have been described in the literature for this purpose.

*Methods:* In this review we will detail the evolution of TVS as the primary imaging modality in the pre-operative diagnosis of posterior compartment deep infiltrating endometriosis (DIE). We will also discuss the potential of an emerging new real-time diagnostic ultrasound-based technique known as the 'sliding sign' in combination with office gel sonovaginography for the pre-operative diagnosis of Pouch of Douglas obliteration and posterior compartment DIE.

*Conclusion:* Implementation of the new real-time dynamic, reproducible and simple 'sliding sign' in conjunction with SVG has the potential to challenge the current concept that traditional laparoscopy is the 'gold standard' modality for the diagnosis of women with posterior compartment DIE.

*Keywords:* endometriosis, Pouch of Douglas, sliding sign, sonovaginography, transvaginal scan.

## Introduction

Endometriosis is a heterogeneous chronic disease characterised at laparoscopy by typical and atypical peritoneal lesions ranging from a single 1 mm peritoneal implant to > 10 cm ovarian endometrioma and cul-de-sac obliteration.<sup>1</sup> In women with endometriosis involving the cul de sac, the disease may progress as a deep infiltrating lesion involving the ureter, vagina and/or bowel. In fact, one third of women with endometriosis will have deep infiltrating endometriotic (DIE) disease.<sup>2,3</sup> Such lesions could result in partial or complete obliteration of the Pouch of Douglas (POD) and may cause debilitating chronic pelvic pain.

Diagnostic delays of up to eight years have been reported with endometriosis.<sup>4,5</sup> This delay is not only due to suboptimal clinical assessment of patients<sup>6</sup> and the consideration of other differential diagnosis of chronic pelvic pain but also because of the surgico-pathologic requirement for a definitive diagnosis of endometriosis.<sup>7</sup> Such delay pervades several

aspects of a woman's quality of life and may lead to long-term impairment of organ function, particularly in cases of DIE of the bowel or ureter.<sup>6,7</sup>

In a recent consensus statement following the World Endometriosis Society Montpellier Consortium, there was no mention of the use of transvaginal ultrasound (TVS) in the work up of women with potential endometriosis.<sup>8</sup> In a statement which delineated a consensus on the management of endometriosis, we believe that the omission of ultrasound in the diagnosis of both endometriomata and/or DIE was a serious oversight. Although there is a growing body of evidence for the routine use of pre-operative TVS in the work up of women with chronic pelvic pain,<sup>7,9-22</sup> there seems to be a delay in the uptake of these approaches in day to day clinical practice as demonstrated by the recent consensus statement. High quality ultrasound is critical in the diagnosis and planning of surgical management of women with underlying endometriosis. Having said that, none of the governing bodies for ultrasound including ASUM, COGU, ISUOG, AIUM or

WFUMB have published practice guidelines on the use of ultrasound in women with endometriosis.

In an attempt to reduce the diagnostic delays associated with endometriosis, studies have investigated the diagnostic accuracy of several non-invasive imaging modalities such as magnetic resonance imaging (MRI), computed tomography, trans-rectal and TVS in the pre-operative assessment of women with endometriosis. These studies have established the value of TVS as a first line pre-operative imaging modality for endometriosis.<sup>7</sup> While traditional TVS evaluation of the pelvis is an excellent diagnostic tool for unilateral or bilateral endometriomata,<sup>9,10</sup> its role in the pre-operative diagnosis of extra-ovarian endometriosis has continued to evolve. This review aims to detail the progress made in the evolution of TVS as the primary imaging modality in the pre-operative diagnosis of extra-ovarian endometriosis. It will also discuss the potential of an emerging new real-time diagnostic ultrasound-based technique known as the 'sliding sign' in combination with sonovaginography (SVG) as a non-invasive method for the pre-operative diagnosis of POD obliteration and posterior compartment DIE.

### Evolution of transvaginal scan for diagnosis of extra-ovarian endometriosis

Many years ago, the sonographic diagnosis of endometriosis was reserved for women with obvious endometriomata, thus missing the cause of pelvic pain in a large number of cases.<sup>11,24,25</sup> In the past decade, several studies have compared different imaging modalities for a role in the pre-operative diagnosis of extra-ovarian endometriosis. Abrao, *et al.* compared TVS and MRI for the detection of recto-sigmoid DIE and found that TVS had a sensitivity, specificity, and accuracy of 98%, 100%, and 99%, respectively, compared to MRI's sensitivity, specificity, and accuracy of 83%, 98%, and 90%.<sup>13</sup> Although MRI may have slightly higher sensitivity for uterosacral disease, TVS performs similarly to MRI in the diagnosis of intestinal endometriosis.<sup>14</sup> Other investigators have shown that introital 3-dimensional sonography was highly effective in detecting endometriosis of the recto-vaginal septum.<sup>15</sup> Bazot, *et al.* compared the accuracy of TVS and rectal endoscopic sonography (RES) for the diagnosis of DIE and concluded that TVS is apparently more accurate than is RES for predicting DIE in specific locations, and should thus be the first-line imaging technique in this setting.<sup>16</sup> Its low cost, availability and patient acceptability are also significant added advantages.<sup>23</sup>

A recent systematic review and meta-analysis of 10 studies have confirmed the accuracy of TVS in the pre-operative diagnosis of bowel endometriosis, with pooled estimates of sensitivities and specificities being 91% and 98% respectively with a positive likelihood ratio of 30.36 and a negative likelihood ratio of 0.09.<sup>17</sup> Indeed, the accuracy of TVS has greatly improved over recent years as knowledge has increased regarding the various sonographic aspects of extra-ovarian endometriosis.<sup>23</sup> Studies have described the sonologic features characteristic of endometriotic nodules as regular/irregular hypoechogenic nodular or cystic structures affecting the urinary bladder, vaginal wall, recto-sigmoid, utero-sacral ligament and recto-vaginal septum.<sup>16,24,25</sup> These lesions generate site specific tenderness on probe palpation<sup>18,19,26</sup> and could result in uterine

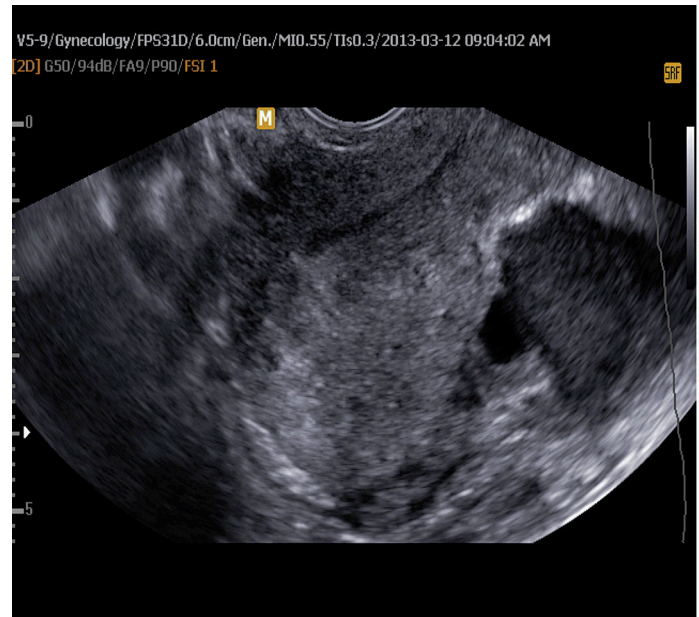


Figure 1: An anteverted retroflexed uterus.

malposition with tethering of the uterus to surrounding pelvic structures.<sup>11,20</sup> Indeed, uterine position has been described as a predictor of posterior compartment DIE. Recent findings from our Endogynaecology unit suggest that in women undergoing laparoscopy for chronic pelvic pain, uterine retroversion vs. anteversion is significantly associated with the presence vs. absence of POD obliteration at laparoscopy, respectively ( $P = 0.0015$ )<sup>27</sup> (Figure 1).

### Evolution of sonovaginography

One of the weaknesses of TVS is the low sensitivity (29%) in the detection of nodules in the recto-vaginal septum and vaginal wall.<sup>21</sup> Attempts to improve the detection of DIE involving the recto-vaginal septum has led to the introduction of SVG. This technique uses TVS and is based on the insertion of a negative contrast agent such as saline or ultrasound gel which then creates an acoustic window between the transvaginal probe and the surrounding vaginal structures i.e. the bladder, cervix and rectum. SVG was first described by Dessole, *et al.* in 2003, where saline was infused into the vagina to create an acoustic window, thereby improving visualisation of the recto-vaginal septum. In the first description of SVG the technique was quite cumbersome and involved the woman being scanned intra-operatively (just prior to their laparoscopy), having had a urinary catheter inserted into the vagina and the balloon inflated in order to reduce the backflow of saline out of the vagina. Furthermore, a second operator was needed to keep the labia majora closed with his or her hands. The results were very encouraging with SVG outperforming TVS alone in the prediction of recto-vaginal endometriosis with a sensitivity and specificity of 90.6% and 85.7%, respectively.<sup>22</sup> However, because of the 'messy' nature of this technique, its poor applicability in an office setting and the fact that this was performed intra-operatively (when in an ideal world pre-operative mapping of disease location and extent is critical to surgical planning), saline infusion SVG did not take off as a new modality in the diagnosis of extra-ovarian endometriosis.<sup>25</sup>

In 2005, our unit modified the intra-operative saline SVG technique and a condom attached to a saline giving set was inserted into the posterior fornix of the vagina.<sup>28</sup> The transvaginal probe was then inserted into the vagina superior to the condom which was resting against the posterior vaginal wall. Once the transvaginal probe was in situ, the condom was then filled with 200–400 mL of normal saline to enhance the visualisation of the retro cervical area, the posterior fornix, the posterior vaginal wall and the recto-vaginal septum. Although this technique required only one operator, the main limitation was that the vagina adopted the contour of the ovoid filled condom. Thus unlike in the first paper by Dessole, it was not possible to clearly see the anterior and posterior fornices, cervical outline and vaginal walls.<sup>17</sup>

More recently, Guerriero, *et al.* (2007) modified the SVG technique by placing gel within the probe cover to create a 'stand-off' effect which also improved the sensitivity and specificity for DIE in these locations.<sup>29</sup> In their modified tenderness-guided transvaginal approach they introduced 12 mL of ultrasound transmission gel (instead of the usual 4 mL) into the probe cover to create a stand-off effect that enhanced the visualisation of the near-field area. However, the main limitation of this technique was that again the vaginal fornices (both anterior and posterior) tended to adopt the outline of the filled condom, thus negating anatomical contours of the inner vagina.<sup>30</sup> Others have advocated using bowel preparation or water contrast in the rectum for better visualisation of the bowel wall.<sup>17,32</sup> A major disadvantage of these latter techniques is a requirement for multiple clinic visits.

### Office gel sonovaginography

Another practical outpatient based approach that has been described is the office gel SVG.<sup>30</sup> This technique requires the introduction of 10–20 mL of ultrasound gel into the posterior fornix of the vagina prior to imaging. This newly described office based technique does not require bowel preparation or a second operator to keep the labia majora closed. It is well tolerated in an outpatient setting and can be performed at a single consultation. The ultrasound gel distends the vagina allowing the anatomical contours of the inner vagina to be clearly visualised. Importantly, the ultrasound gel forms an acoustic window between the

transvaginal probe and the surrounding vaginal structures, namely the anterior and posterior vaginal fornices, anterior and posterior vaginal walls, retro cervical area, uterosacral ligaments, POD, rectovaginal septum, anterior rectum and recto-sigmoid colon. The preliminary assessment (n = 100) of this technique for the prediction of midline (rectovaginal, retro cervical, recto sigmoid nodules) vs. lateral (uterosacral ligament nodules) DIE reported a sensitivity, specificity, NPV and PPV of 78.3%, 90.9%, 72.0% and 93.3% respectively, vs. 40.0%, 95.6%, 50.0% and 93.5%, respectively<sup>31</sup> among women referred to our tertiary Endogynaecological ultrasound units based at Nepean public Hospital and OMNI Gynaecological Care. Thus, office gel SVG is a useful imaging technique for mapping the location and spread of posterior compartment disease. It offers significant advantages over other imaging techniques whilst maintaining a competitive ability to detect posterior compartment DIE. It is therefore a critical tool in the pre-operative workup of women planning potentially complex laparoscopic surgery.

### The real-time dynamic 'sliding sign'

To date the literature has overlooked the benefit of concurrent assessment of the POD when evaluating the pelvis with potential posterior compartment DIE. This is especially important as more than 60% of women with obliterated POD will have evidence of bowel endometriosis.<sup>27,32</sup> Furthermore, laparoscopic surgery will be more difficult and of longer duration in a woman with both posterior compartment DIE and POD obliteration compared to one with posterior compartment DIE alone. Therefore, pre-operative knowledge of an obliterated POD can help to further streamline our surgical planning for women with posterior compartment DIE.

The new real-time dynamic ultrasound based 'sliding sign' can predict POD obliteration.<sup>27</sup> In order to assess the real-time ultrasound-based 'sliding sign', gentle pressure is placed against the cervix with the transvaginal probe to establish whether the anterior rectum glided freely across the posterior aspect of the cervix (retro-cervical region) and posterior vaginal wall. If the anterior rectal wall glided smoothly over the posterior cervix and posterior vaginal wall the 'sliding sign' was considered positive for this location (Video 1a). The examiner then placed the left hand over the woman's lower anterior abdominal wall

## Videos 1a and 1b



**Video 1a:** <http://youtu.be/EF0w7rY597E> – Demonstrates a positive sliding sign with the anterior rectal wall gliding smoothly over the posterior cervix and posterior vaginal wall during TVS.



**Video 1b:** <http://youtu.be/ipkugE5mE6A> – Demonstrates a positive sliding sign with the recto-sigmoid wall gliding smoothly over the posterior upper uterus / fundus during TVS.

## Videos 2a and 2b



**Video 2a:** <http://youtu.be/TI9Xkkтуq4E> – Demonstrates a negative sliding sign with the anterior rectal wall not gliding smoothly over the retro-cervix during TVS.



**Video 2b:** [http://youtu.be/CPV4d8y1\\_4I](http://youtu.be/CPV4d8y1_4I) – Demonstrates a negative sliding sign with the recto sigmoid not gliding smoothly over the posterior uterine fundus during TVS.

in order to ballot the uterus between the palpating hand and transvaginal probe (being held in the right hand) to determine whether the recto-sigmoid glided freely over the posterior aspect of the upper uterus / fundus. If the anterior recto-sigmoid wall glides smoothly over the posterior upper uterus / fundus during TVS, the 'sliding sign' in this region was also considered positive. (See Video 1b).

As long as the 'sliding sign' was found to be positive in both of these anatomical regions (retro-cervix and posterior upper uterus), the POD was recorded as not obliterated. If either of these anatomical regions demonstrated that the anterior rectal wall or recto-sigmoid did NOT glide smoothly over the retro-cervix (Video 2a) or posterior uterine fundus (see Video 2b), the 'sliding sign' was considered negative, and the POD was recorded as obliterated. This technique of testing the mobility of the organs was first introduced to determine whether there were adhesions between the bowel and peri umbilical areas before placing a trocar for laparoscopy.<sup>33</sup>

In our analysis of data from 100 women who underwent laparoscopic surgery for diagnosis and surgical treatment of endometriosis, this new technique gave an accuracy, sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio and negative likelihood ratio of 93.0%, 83.3%, 97.1%, 92.6%, 93.2%, 29.2 and 0.17, respectively when using the 'sliding sign' ultrasound technique to predict POD obliteration.<sup>27</sup> We have recently demonstrated the high reproducibility of the 'sliding sign', both intra- and inter-observer, in a recent publication.<sup>36</sup> One important limitation of this technique however is the difficulty in classifying partial or complete obliteration of the POD.

In 2013, Hudelist, *et al.* demonstrated the value of the 'sliding sign' as a predictor of the presence of DIE involving the rectum as well as a 'red flag sign' for triaging patients for tertiary referral centres and specialised clinics for detailed investigation.<sup>39</sup> We agree that this simple ultrasound-based test is a good way to triage women to tertiary referral units for a detailed assessment for co-existing posterior compartment DIE. However we do not believe that the 'sliding sign' is a specific ultrasound-based test for bowel endometriosis as suggested by Hudelist, *et al.*, as bowel endometriosis can occur with or without POD obliteration and

vice versa. It is our view that the authors of that study have missed an important step, i.e. the 'sliding sign' specifically predicts POD obliteration rather than rectal DIE. A negative 'sliding sign' using TVS correlates well with POD obliteration at laparoscopy.<sup>30</sup> The 'sliding sign' is simple to demonstrate and does not require advanced sonologic skills. Conversely, the high diagnostic accuracy of 2D grey scale TVS for posterior compartment DIE is dependent on the experience of the operator.<sup>30</sup>

The 'sliding sign' should therefore be the first line test to predict POD obliteration and not posterior compartment DIE per se. If the 'sliding sign' is negative, it suggests the presence of an underlying posterior compartment DIE as there is a three times increased likelihood of co-existing bowel endometriosis.<sup>32</sup> The gynaecological sonographer/sonologist should then systematically evaluate the posterior compartment in particular the anterior rectal muscularis propria for a DIE nodule. However, where the gynaecological sonographer/sonologist is not experienced in pattern recognition of posterior compartment DIE nodules, a referral to an advanced endogynaecological ultrasound unit is indicated. Such tertiary endogynaecological ultrasound units should then use office gel SVG to evaluate the posterior compartment and exclude or confirm the presence of DIE, in particular looking for anterior rectal, rectovaginal and/or anterior recto-sigmoid disease.

### Conclusion

The 'sliding sign' in combination with gel SVG can improve the pre-operative assessment of women with suspected extra-ovarian endometriosis. These ultrasound techniques provide a stepwise approach to the diagnosis of posterior compartment disease giving valuable pre-operative information. With the failure of laparoscopy to sometimes correctly estimate the extent of bowel endometriotic disease in the posterior compartment and incompletely excise 'skip' lesions,<sup>34</sup> these combined imaging techniques enables the laparoscopic surgeon to plan the surgical procedure within the context of a multidisciplinary team approach. This will ensure maximal surgical cytoreduction at a single procedure.

The combined value of the 'sliding sign' and SVG in the pre-operative ultrasound assessment of posterior compartment



extra-ovarian endometriosis cannot therefore be understated. Not only will these techniques potentially reduce diagnostic delays associated with endometriosis, they also have the potential to facilitate the triaging of women to the appropriate multi-disciplinary tertiary referral endogynaecological units.<sup>32,35</sup> We now believe implementation of the new real-time dynamic, reproducible and simple 'sliding sign' in conjunction with SVG has the potential to challenge the current concept that traditional laparoscopy is the 'gold standard' modality for the diagnosis of women with posterior compartment DIE.

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