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The use of intra-operative saline sonovaginography to define the rectovaginal septum in women with suspected rectovaginal endometriosis: a pilot study

Abstract

Objectives: The aim of this study was to perform saline sonovaginography (SVG) in women with suspected rectovaginal endometriosis (RVE) in order to establish the thickness of the rectovaginal septum (RVS) in this population and to predict the presence or absence of RVE.

Methods: Prospective observational pilot study. Women undergoing laparoscopy for possible endometriosis on the basis of history or clinical examination were offered to participate in the study. All women underwent saline SVG during general anesthesia just prior to their laparoscopy. RVS nodules were visualised as hypoechoic lesions of various shapes. The sonologist predicted whether or not a nodule was present in the retrocervical area or in the RVS. The thickness of the posterior vaginal wall ± RVS was then taken at three points in the mid-sagittal plane: at the posterior fornix (retrocervical area), at the middle third of the vagina (upper RVS) and just above the perineal body (lower RVS). The diagnosis of RVE was established using the gold standards of laparoscopy and histological confirmation. The RVS thickness was then compared between women with RVE and the absence of RVE.

Results: Twenty-three women were enrolled in the study. Mean age was 38 years (33–44 years). A history of endometriosis was present in 72.7% (8/11). RVE was confirmed in 17.4% (4/23). Visualisation of a hypoechoic nodule at saline SVG demonstrated sensitivity and specificity of 75% and 95%, respectively. All rectovaginal nodules were located in the retrocervical region. Mean diameter (SD) of RVE nodules was 27.3 (± 9.4) mm. Mean thickness of vaginal wall ± RVS at the posterior fornix, at the middle third of the vagina and just above the perineal body was 5.1, 1.4 and 4.0 mm, respectively. These measurements were not significantly different in the presence of a rectovaginal nodule.

Conclusions: Using saline SVG, we have established the mean RVS thickness in a small group of women with suspected RVE. Although the numbers are small, there was no correlation between RVS thickness and presence of RVE. The visualisation of hypoechoic lesions at saline SVG seems to be the best ultrasonographic predictor for RVE. SVG is a valuable pre-operative tool for the assessment of RVS and for the prediction of RVE, which allows for the mapping and planning of advanced endometriosis surgery.

Keywords: laparoscopy, rectovaginal endometriosis, rectovaginal septum, sonovaginography, transvaginal ultrasound

Introduction

Anatomically, the rectovaginal septum (RVS) begins at the base of the rectovaginal pouch, and extends caudally to the level of the perineum. In 93% of women, the base of the rectovaginal pouch reaches the level of the middle third of the vagina (Fig. 1). Deeply infiltrating endometriosis (DIE) is estimated to affect 10–15% of women with endometriosis, with the most commonly affected areas being: uterosacral ligaments, cul-de-sac, apex of vagina, rectovaginal septum, rectosigmoid colon, and bladder. Rectovaginal endometriosis (RVE) is most commonly located in the upper 1/5 of the posterior vagina[1] (or retrocervical area) with only 10% of lesions forming in the RVS, between the posterior wall of the vagina and the anterior wall of the rectal muscularis[2]. Rectovaginal septum endometriosis (RVSE) occurs when the disease extends into the lower 1/2 to 1/3 length of the vagina[3].

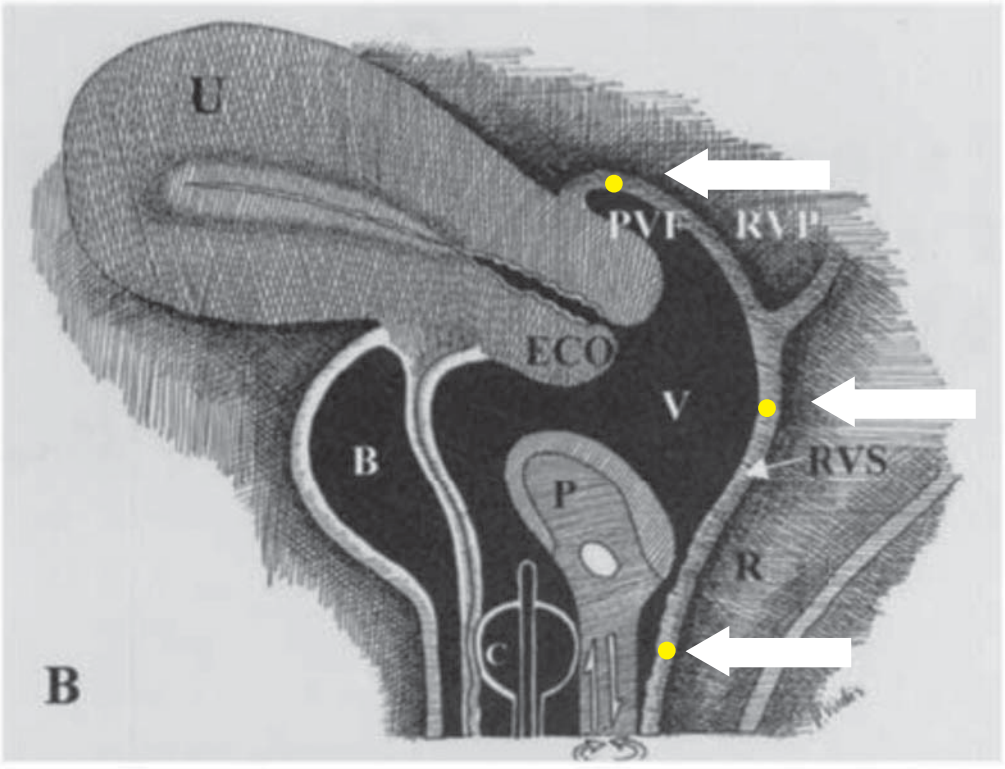

Figure 1: Measurement of thickness of the vaginal wall and rectovaginal-septum at the three points (arrows) (From Dessole S, Farina M, Rubttu G, Cosmi E, Ambrosini G, Nardelli GB. Sonovaginography is a new technique for assessing rectovaginal endometriosis. Fertil Steril 2003; 79: 1023–7, modified).

Debate continues regarding the origin and pathogenesis of RVSE. Currently, there are two non-mutually exclusive hypotheses. The first is that RVSE may be a disease of the deepest portion of the pouch of Douglas, which has been buried and excluded from the remaining pelvis by adhesions between the posterior wall of the uterus and the rectum[4]. The second hypothesis is that RVSE lesions originate from a metaplasia of mullerian remnants located in the RVS[5]. Other reports in the literature contend that DIE does not actually originate from the RVS[6,7].

DIE involving the RVS is rare and can be difficult to diagnose both pre-operatively and during laparoscopy. The aim of this pilot study was to use saline sonovaginography (SVG) to establish the mean thickness of the RVS in women with suspected rectovaginal endometriosis, and to predict the presence or absence of RVE in relation to the RVS.

Materials and methods

This prospective pilot study was conducted between April 2005 and June 2006 at the Centre for Advanced Reproductive Endosurgery (CARE), Royal North Shore Hospital, University of Sydney. Ethics approval was granted by both local committees. Inclusion criteria were women with possible RVE on the basis of history (dysmenorrhoea, deep dyspareunia, dyschezia and/or rectal bleeding) and/or clinical examination (nodules or tenderness on palpation of posterior fornix, utero-sacral ligaments and posterior vaginal wall). Exclusion criteria were menopause, hormonal treatments in the previous three months, pregnancy or malignancy.

All women enrolled in this pilot study underwent bi-dimensional grayscale transvaginal ultrasound (TVS) followed by saline SVG, performed by the same operator (George Condous) using a GE LOGIQ e (General Electric Co, WI, USA) ultrasound machine during general anesthesia just prior to laparoscopy. All women had a urinary catheter inserted and the bladder was emptied before ultrasound. Saline SVG was performed using the technique similar to that described by Dessole, *et al*[8]. The women were slightly tilted in anti-Trendelenburg position. A condom attached to a saline giving set was inserted into the posterior fornix of the vagina. 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 retrocervical area, the posterior fornix, the posterior vaginal wall and the RVS. Measurements of the vaginal wall + RVS were taken at three points in the mid-sagittal plane: at the posterior fornix (retrocervical area), at the middle third of the vagina (upper rectovaginal septum) and just above the perineal body (lower rectovaginal septum) (Figs. 1, 2a, 2b, 2c). These measurements aimed to represent the thickness of the posterior vaginal wall plus fascial connective tissue of the rectovaginal septum where present. The thickness of the RVS was compared to those with and without disease. A nodule was defined as a hypoechoic lesion of any shape and contour (Fig. 3). The sonologist (George Condous) predicted whether or not a nodule was present in the above-mentioned areas.

All women underwent laparoscopy either by Alan Lam or George Condous using the Hasson technique. In addition to the 10 mm trocar for the laparoscope in the umbilical region, two or three trocars were used: two 5 mm trocars for both inner sides of the iliac spine and one optional suprapubic trocar. The uterus was anteverted using a uterine manipulator.

Partial or complete obliteration of the cul-de-sac was diagnosed according to the American Society for Reproductive Medicine classification, by causing bulging of the posterior vaginal

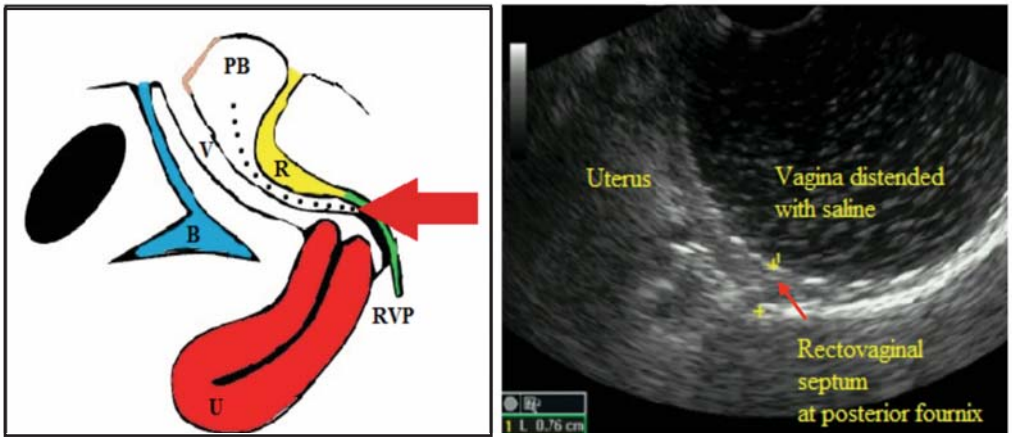

Figure 2a: The rectovaginal septum measured (mm) at the level of the posterior fornix during SVG (mid-sagittal plane). U = Uterus, RVP = Rectovaginal Pouch, V = Vagina, PB = Perineal Body, R = Rectum, B = Bladder, Dotted line = Rectovaginal Septum.

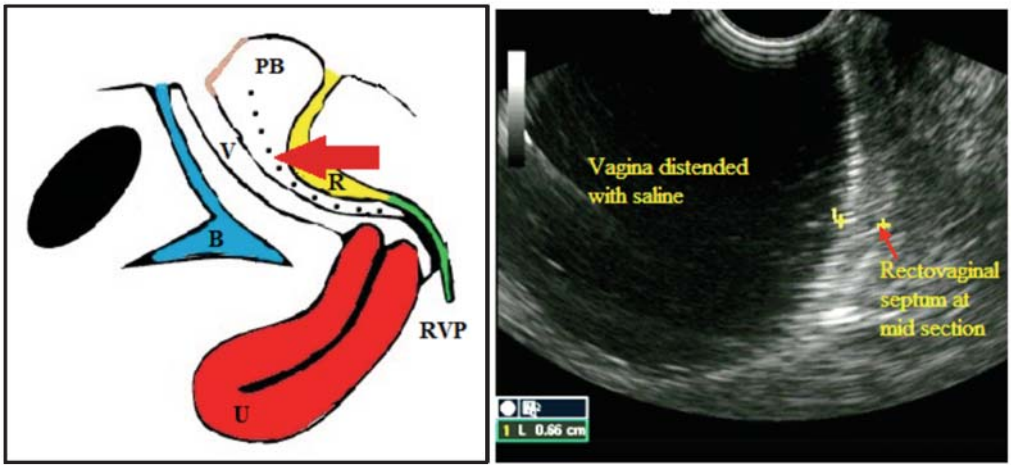

Figure 2b: The rectovaginal septum measured (mm) at the mid-section during SVG (mid-sagittal plane). U = Uterus, RVP = Rectovaginal Pouch, V = Vagina, PB = Perineal Body, R = Rectum, B = Bladder, Dotted line = Rectovaginal Septum.

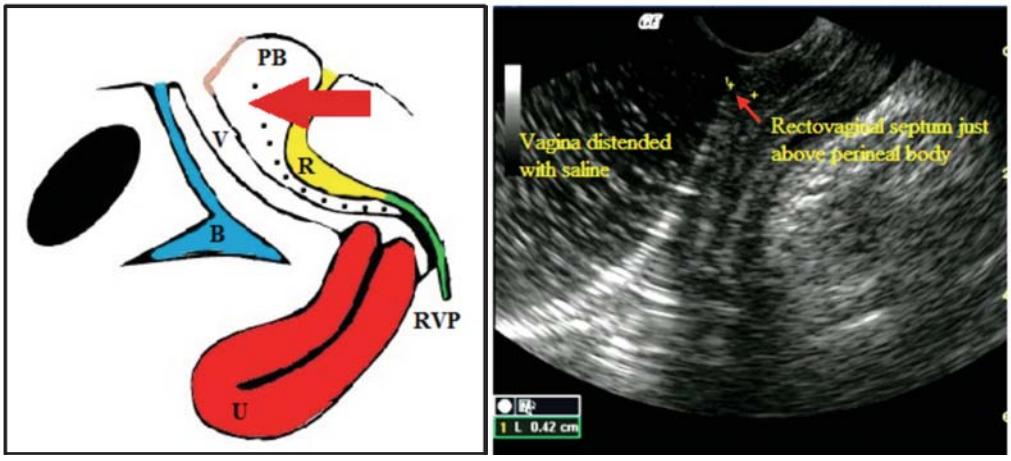

Figure 2c: The rectovaginal septum measured (mm) at the level of the perineal body during SVG (mid-sagittal plane). U = Uterus, RVP = Rectovaginal Pouch, V = Vagina, PB = Perineal Body, R = Rectum, B = Bladder, Dotted line = Rectovaginal Septum.

fornix with ring forceps introduced in the vagina[9]. The uterus was anteverted using the uterine manipulator and the anterior wall of the rectum was dislocated cranially with gentle grasping forceps. In the case of obliteration of cul-de-sac, the ureters were identified and mobilised laterally to the obliterated cul-de-sac by performing ureterolysis to minimise potential injury. Having visualised the ureters, the pararectal spaces were opened bilaterally, medial to the uterosacral ligaments, in order to isolate the recto-vaginal septum area. This enabled safe opening of the cul-de-sac, in order to visualise or confirm with blunt palpation deep lesions in the retrocervical area, in the recto-vaginal septum and lesions adhering to the anterior wall of the rectum. The interface between the vagina and the rectum was carefully opened using Laparosonic Coagulating Shears (LCS) or Harmonic Scalpel (Harmonic Scalpel®, Ethicon Endo-Surgery, Johnson and Johnson, NJ, USA), until the bulge of the posterior fornix was clearly visualised. Then the lesions were excised using the Harmonic Scalpel. The lesions dissected were examined histologically for the presence of endometrial glands and stroma.

As done by Bazot, *et al.*, the final surgical diagnosis of RVE was made if any of the following criteria was satisfied: 1) histological confirmation of endometriosis in at least one resected sub-peritoneal nodule; 2) visualisation and palpation of a sub-peritoneal nodule without biopsy and another histologically proved location of endometriosis; 3) visualisation of complete obliteration of cul-de-sac[10]. In the latter case, we assumed that

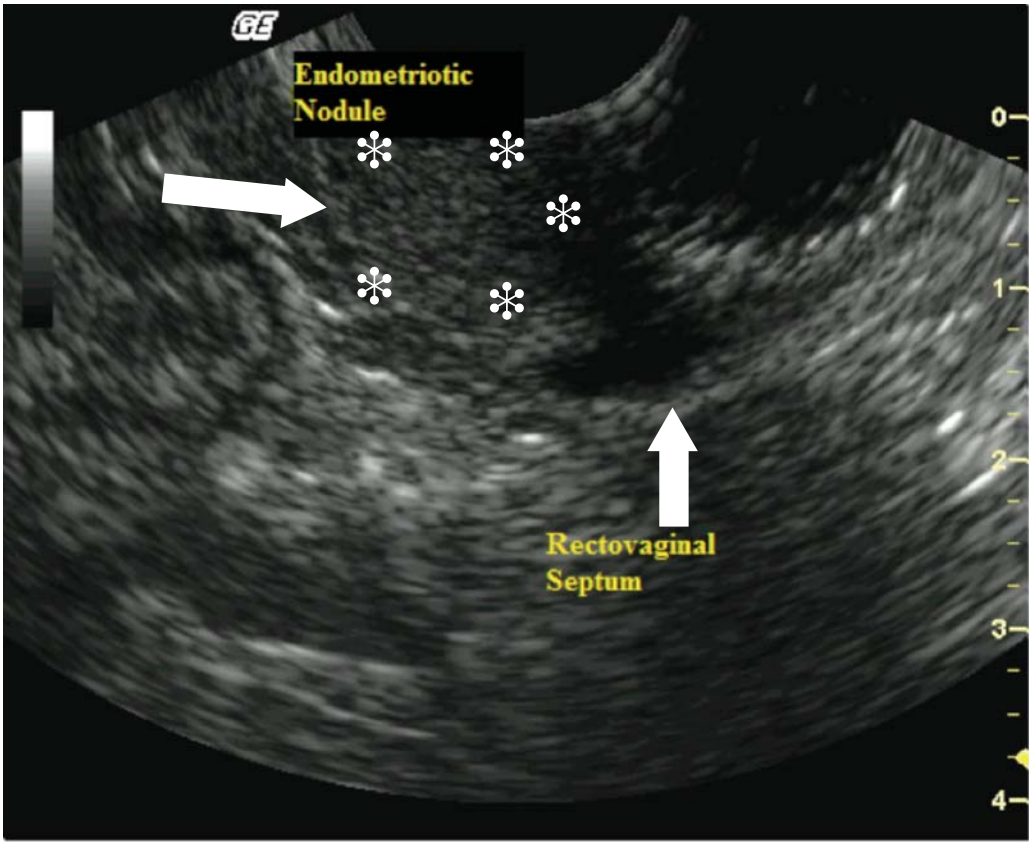

Figure 3: An endometriotic nodule visualised in the rectovaginal septum during SVG (nodule outlined with ❇).

Table 1: Frequency table for presenting complaints before surgery.

Present complaints	Endometriotic nodule present	Endometriotic nodule absent
Dysmenorrhoea	2 (50.0%)	11 (57.9%)
Dyspareunia	4 (100.0%)	7 (36.8%)
Dyschezia	1 (25.0%)	2 (10.5%)
Others	1 (25.0%)	14 (73.7%)

Table 2: Prediction of RVE by presence of a nodule at sonovaginography.

Diagnosis after surgery SVG Prediction	Rectovaginal nodule present	Rectovaginal nodule absent
Present	3	1
Absent	1	18

a retrocervical lesion was present[11]. SVG findings were then compared with the gold standard results of surgical exploration and histological examination.

Results

Twenty-three women with suspected endometriosis were enrolled in this pilot study. The age range was 33–44 years (median age 38.8 years). The distribution of presenting complaints are reported in Table 1.

All women underwent saline SVG immediately prior to laparoscopic surgery. RVE was confirmed surgically in 4/23 women (17.4%) using the criteria described in the Methods section. All four women with a surgical diagnosis of RVE had resection of nodules and histological confirmation (first criteria). No posterior colpectomy, colpotomy or intestinal resections were required, as all nodules were retrocervical. 19/23 women (83%) had no endometriotic nodules at laparoscopy, 1/23 (4.3%) had superficial endometriosis only and 5/23 (21.7%) had associated ovarian sites.

The presence of a nodule at SVG was associated with the presence of RVE in three (75%) of four women with surgical confirmation of disease. In 18 (94.7%) of 19 cases, RVE was excluded at SVG (Table 2). The sensitivity, specificity, positive predictive value and negative predictive value for SVG in the prediction of rectovaginal endometriotic nodules were 75%, 94.7%, 75% and 94.7%. The mean diameter of RVE nodules at SVG was 27.3 ± 9.4 mm.

The mean thickness of the vaginal wall ±RVS at the posterior fornix, at the middle third of the vagina and just above the perineal body was 5.1, 1.4 and 4.0 mm, respectively. These measurements were not significantly different in the presence of an RVS nodule (Table 3).

Table 3: Mean thickness at the three points in the presence and absence of a nodule.

	Rectovaginal nodule present (*n* = 4) Mean (SD)	Rectovaginal nodule absent (*n* =19) Mean (SD)	t-test *P*-value
Posterior fornix	5.07 (2.06)	5.36 (1.68)	0.83
Upper RVS	1.35 (0.93)	1.24 (1.48)	0.39
Lower RVS	3.95 (0.62)	4.17 (1.58)	0.70
Max of three measurements	5.43 (1.01)	5.75 (1.41)	0.60
Mean of three measurements	4.26 (0.75)	4.42 (1.21)	0.74

Discussion

This is the first study to use the technique of saline SVG to attempt to define the thickness of the RVS. Previous studies have utilised the following imaging modalities predict the presence of RVE: TVS[7,10,12,13], 3D TVS[14,15], ano-rectal endosonography (ARES)[16,17], TVS with water contrast in the rectum[18,19], SVG[7], transrectal ultrasound (TRUS)[12], sonorectovaginography[20] and MRI[6,7,14,15,21]. However, there is no published data on the expected thickness of the different components of the RVS in women with or without RVE.

All of the women in this study with RVE had nodules located in the retrocervical area (which likely did not infiltrate the RVS) which supports the previous finding by Martin, *et al.* that RVE is most commonly located in the upper 1/5 th of the posterior vagina. Our results did not indicate a significant difference between the RVS thickness of women with or without RVE. This lack of significance may be attributable to the small numbers in this study and larger numbers are required to validate or refute this finding. The accuracy of the RVS measurements may also have been improved with the use of enema prior to SVG. Although we were able to establish a mean RVS thickness in this group of women with suspected endometriosis, we are unable to comment on the normal range of RVS thickness in the general population.

TVS is known to have a poor detection rate for rectovaginal endometriosis in particular locations, with a sensitivity of 29% for the detection of nodules in the RVS and vaginal wall[22]. RVS lesions are usually visualised as nodules or an irregular thickening of the RVS at TVS or magnetic resonance imaging (MRI)[7]. In a recent study by Grasso, *et al.* 3D transvaginal ultrasound and MRI were compared in the detection of RVSE and found that 3D TVS had similar findings to MRI, with a sensitivity and specificity of 76.9% and 100% *vs.* 76.4% and 100%, respectively[14]. Pascual, *et al.* also used 3D TVS to predict RVSE pre-operatively, and found the specificity, sensitivity, positive likelihood ratio, and negative likelihood ratio to be 94.7% (95% CI, 78.6–99.7%), 89.5% (95% CI, 73.3–94.5%), 17.2 (95% CI, 2.51–115), and 0.11 (95% CI, 0.03–0.41), respectively[15].

The pre-operative detection of DIE is of paramount importance in the mapping and planning of endometriosis surgery, and all women should undergo vaginal examination prior to surgery to rule out vaginal/rectovaginal endometriosis. In a study of 150 women with suspected endometriosis, Hudelist, *et al.* compared clinical vaginal examination to TVS for the preoperative detection of rectovaginal space endometriosis. Vaginal examination showed similar results (PPV 78%, NPV 98%, LR + 46.67 and LR - 0.23) to TVS for the detection of rectovaginal space endometriosis[23].

Dessole, *et al.* were the first to describe the ultrasound technique of SVG, where TVS was performed concurrently with the introduction of saline solution into the vagina. The saline creates an acoustic window between the TV probe and the surrounding vaginal wall, thus allowing for better visualisation of the posterior compartment, i.e. the vaginal walls and fornices, retrocervical area and RVS, which are pushed away from the tip of the probe. SVG was more accurate than TVS, with a sensitivity, specificity, positive predictive value, and negative predictive value of 90.6%, 85.7%, 93.5% and 80.0%, respectively[8]. SVG improves the visualisation of the anterior and posterior vaginal fornices, and is an especially useful technique for those who are learning to image the posterior compartment.

In our study, the saline SVG technique differed in that the acoustic window was created by placing saline into a condom situated in the posterior fornix of the vagina prior to insertion of the TV probe. SVG was able to detect RVE with a sensitivity of 75%, specificity of 95%, positive likelihood ratio of 14 (95% CI 1.95–104), negative likelihood ratio of 0.26 (95% CI 0.05–1.45). These results are encouraging, and our centre has recently progressed the SVG technique by using 10–20 mL of ultrasound gel only, into posterior fornix to create an acoustic window, in the office setting[24]. All women referred to our unit with suspected endometriosis undergo clinical vaginal examination and office SVG prior to surgery, in order to allow for accurate pre-operative mapping and appropriate tertiary referral to an advanced endoscopic centre, if necessary. Our preliminary results using the "gel only" SVG technique to predict midline posterior compartment DIE (i.e. RVE) in women prior to endometriosis surgery have been promising, with a sensitivity, specificity, NPV and PPV of 100%, 91.7%, 70% and 100%, respectively[25].

We acknowledge that our study has several limitations. As previously mentioned, the small numbers likely resulted in the lack of significance of the statistical tests. Potential pitfalls related to the final diagnosis of endometriosis laparoscopically must also be considered. The visual diagnosis of endometriosis may fail in women with subtle or atypical forms of peritoneal endometriosis[26,27] or in some patients with DIE not associated with peritoneal or ovarian lesions. As with Bazot, *et al.*[10], we have used a combination of visual and histological criteria for the diagnosis of deep endometriotic lesions[10]. A diagnosis based on histological examination also has potential limitations, as it may give negative results in the presence of endometriotic lesions with fibrosis. Since progressing to the "gel only" SVG technique, we note a possible downfall of the saline SVG method may be that the saline-filled condom does not accurately delineate the natural contour of the vagina, and probably causes the vagina take on the shape of the distended condom.

In our study, SVG accurately excluded the infiltration of vaginal and rectal wall. However, the final diagnosis of absence of infiltration was based only on the fact that no intestinal or vaginal

resection procedures were required at surgery. This method of diagnosis is subjective to the surgeon's diagnostic suspicion and may have excluded cases of a superficial infiltration of the rectal or vaginal wall, undoubtedly difficult to recognise if a dissection only is performed.

Conclusion

The results of this pilot study provide further support for the use of pre-operative SVG in the prediction of RVE and for the measurement of RVS thickness in women with suspected endometriosis. The absolute thickness of the RVS measured in three different anatomical sites was not significantly different for women with or without RVE. We acknowledge that the numbers are indeed small, but it is also possible that the measurement of the RVS thickness is not useful in the detection of deep infiltrating endometriosis. The best ultrasonographic predictor of RVE seems to be the visualisation of a hypoechoic lesion. SVG is an important tool for the pre-operative detection and planning of endometriosis surgery, especially in the case of RVE. Further studies with larger numbers are required to compare the thickness of the RVS in women with and without RVE, and to determine whether this difference is significant in the prediction of RVE.

Acknowledgements

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