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Transvaginal sonography of the uterine cavity with hysteroscopic correlation in the investigation of infertility

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ABSTRACT

This report describes the correlation of hysteroscopic findings with preoperative transvaginal sonography in 200 patients being investigated for infertility. Real-time ultrasound examination was performed on days 7, 14 and 21 in spontaneous ovulatory cycles. Diagnostic hysteroscopy was performed in the subsequent cycle. The abnormalities detected using transvaginal sonography were intrauterine adhesions, submucous fibroids, endometrial polyps, endometritis and a non-specific irregular endometrium. A total of 182 patients were diagnosed correctly to have an abnormality by transvaginal sonography giving a false-positive rate of 5.5%. The sensitivity of transvaginal sonography in detecting endometrial pathology was 98.9% with a positive predictive value of 94.3%. The positive predictive values for specific abnormalities were 98.5% for intrauterine adhesions, 91.7% for submucous fibroids, 91.4% for endometrial polyps, 85.7% for endometritis and 85.7% for irregular endometrium. These data show a strong correlation between findings from transvaginal sonography and hysteroscopy. Transvaginal sonography may be used to detect intrauterine pathology and identify patients in whom hysteroscopy and hysteroscopic surgery are indicated.

INTRODUCTION

Transvaginal sonography has become increasingly popular in the investigation and treatment of infertility. Its role in the diagnosis of pelvic pathology, especially endometriosis and the significantly reduced morbidity associated with transvaginal sonography-directed oocyte recovery has been described by other workers[1–3]. Transvaginal sonography has been found to be superior to transabdominal sonography as an imaging technique[4,5] and the criteria for normal appearance of the endometrium have been described previously[2,6–9].

Transvaginal sonography has been used by previous workers to study the endometrium[5,10–14] and compare transvaginal sonography findings with hysteroscopy in postmenopausal women[13–15].

Hysteroscopy is a valuable tool in the investigation of infertility[16,17] but its invasive nature and expense preclude its use as a routine procedure in all patients being investigated for subfertility. To our knowledge, there are no reports in the literature comparing the findings from transvaginal sonography with those from hysteroscopy in patients being investigated for subfertility.

This report describes the correlation of hysteroscopic findings with those of transvaginal sonography performed preoperatively as part of an investigation into failure of conception despite previous assisted conception treatments.

METHODOLOGY

All patients were examined using transvaginal sonography with a Siemens SL2 ultrasound machine (Siemens, Middlesex, UK) with a real-time mechanical sector transvaginal probe using imaging frequencies of 5 MHz and 7.5 MHz. Ultrasound examinations were performed on days 7, 14 and 21 (approximately) in natural cycles. The endometrial cavity contours were inspected for irregularities and echo patterns at the myometrium–endometrium interphase in the long axis (Figure 1) and in the transverse plane (Figure 2). The mid-line endometrial echo was studied from the internal os to the fundus and any discontinuity was noted. Longitudinal and oblique scans were performed to study the region of the tubal ostia for 'beaking' (Figure 3).

Diagnostic hysteroscopy was performed using either a rigid Storz hysteroscope (Storz Endoscopy, Tuttlingen, Germany) with a 5 mm diameter diagnostic sheath and

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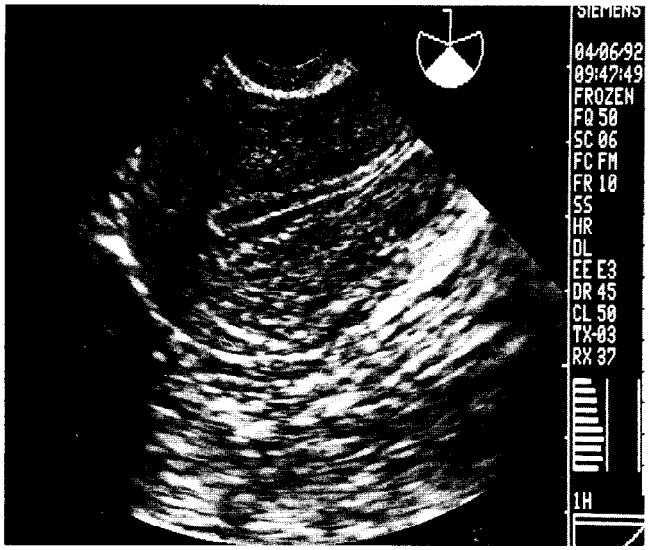

Figure 1 Transvaginal scan of the uterus in its long axis

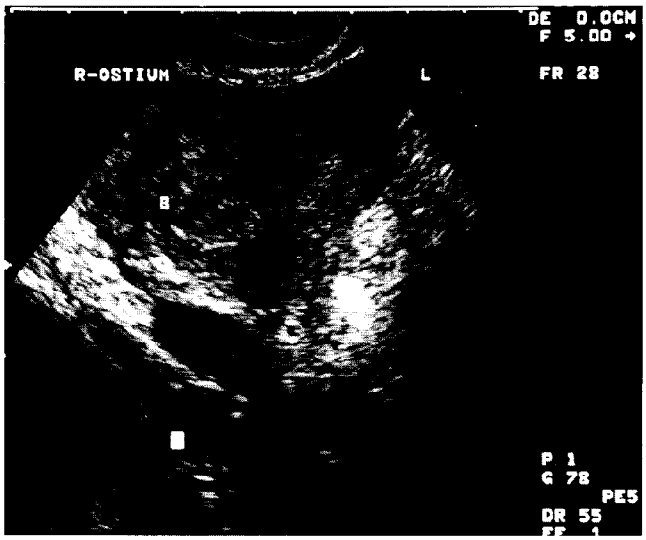

Figure 3 Transvaginal scan of the uterus showing tubal ostial 'beaking'

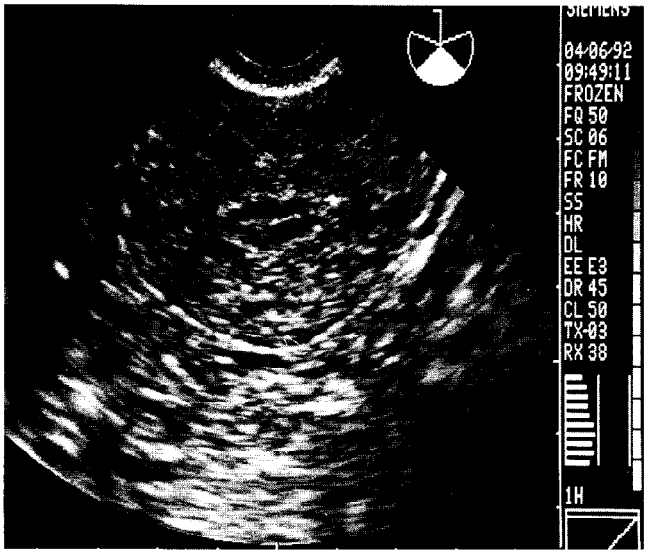

Figure 2 Transvaginal scan of the uterus in its transverse axis

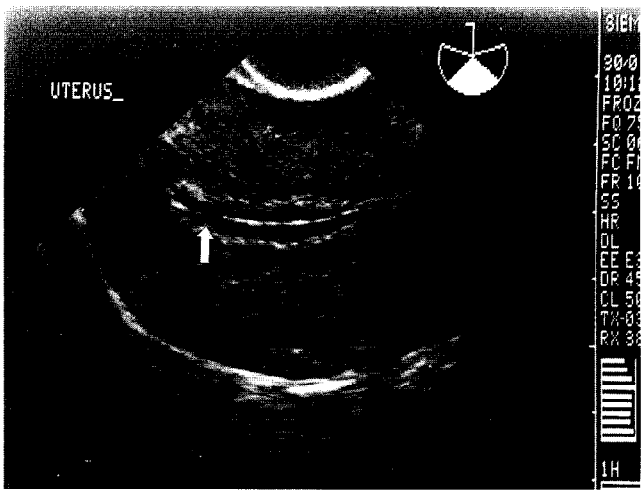

Figure 4 Transvaginal scan of the uterus showing intrauterine adhesions

a 30° fore–oblique view or a Olympus hystero-resectoscope (Olympus Optical, Tokyo, Japan) with a 30° fore–oblique view and a 7 mm outer sheath. Distension of the uterine cavity was achieved with the use of CO_2 gas insufflation at a constant pressure (75 mmHg) when diagnostic hysteroscopy was performed. Glycine (1.5%) was used during operative hysteroscopy with the Olympus hystero-resectoscope. Three patients in whom the hysteroscopy was abandoned due to severe cervical stenosis or perforation of the uterus were excluded from this study.

The distribution of abnormalities of the endometrial cavity on transvaginal sonography is shown in Table 1. The numbers of these abnormalities are at variance because some patients had more than one abnormality noted at hysteroscopy. Table 2 indicates the positive predictive value of transvaginal sonographic findings, taking note only of true- and false-positive findings for each abnormality. Any polyps or fibroids removed at hysteroscopy were sent for histological examination to confirm the diagnosis.

Intrauterine adhesions were diagnosed when interruptions in the mid-line echo were noted in the periovulatory phase (Figure 4).

Submucous fibroids were diagnosed when well-defined hypoechoic areas were seen arising from the myometrial layer causing attenuation of the ultrasound beam and distal shadowing. The submucous nature of these fibroids was best seen in the periovulatory scan when the mid-line echo was seen to be displaced (Figure 5).

Endometrial polyps appeared as persistent hyperechogenic areas with variable cystic spaces and distortion of the endometrial contours. They were best seen in mid-cycle and not seen clearly in the mid-luteal scan when the endometrial layers were thick (Figure 6).

Endometritis was diagnosed when the endometrium appeared grainy in the periovulatory scan and the endometrium–myometrial interface was diffuse and illdefined (Figure 7).

Uterine septae were diagnosed best in the transverse plane when myometrial echoes divided the fundal endo-

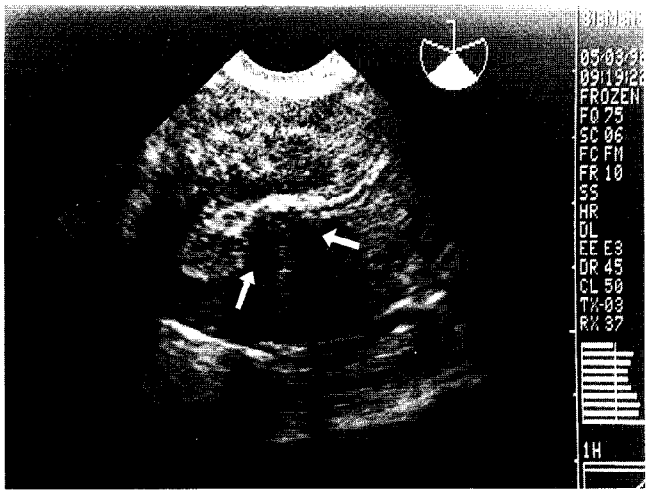

Figure 5 Transvaginal scan of the uterus showing submucous fibroids

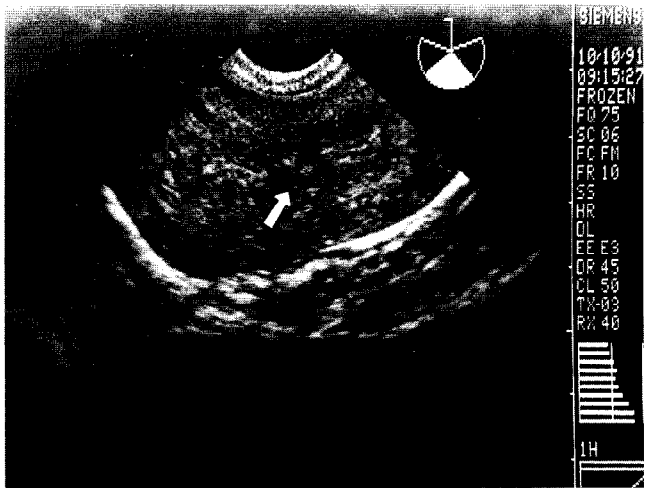

Figure 8 Transvaginal scan of the uterus showing uterine septum

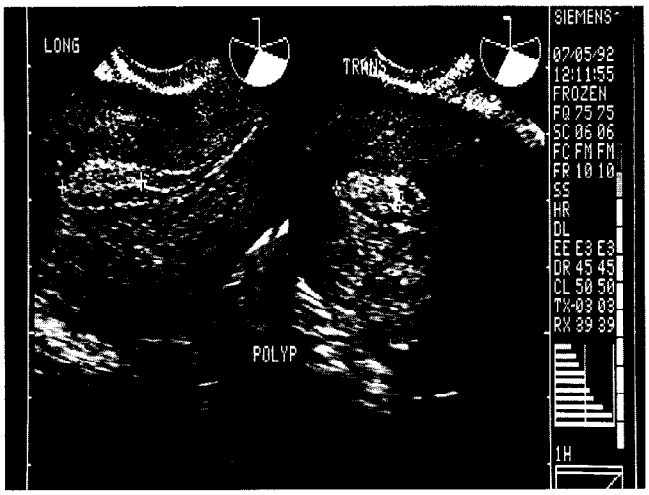

Figure 6 Transvaginal scan of the uterus showing endometrial polyps

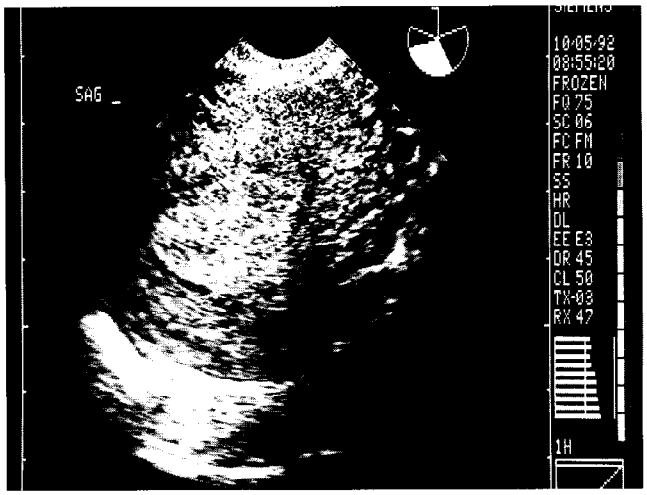

Figure 9 Transvaginal scan of the uterus showing irregular endometrium (confirmed as endometrial polyps on hysteroscopy)

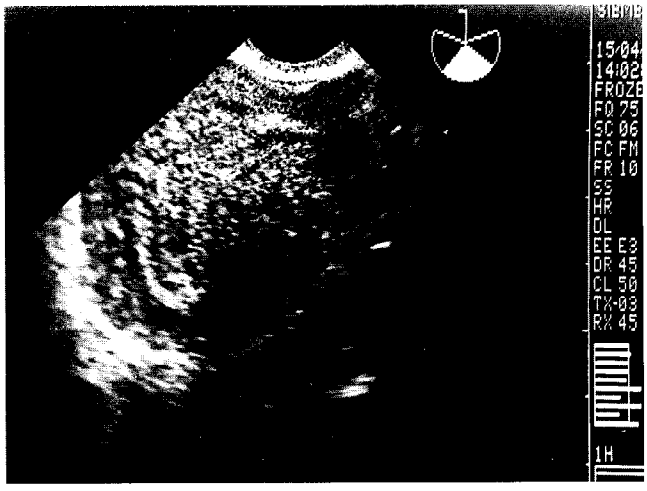

Figure 7 Transvaginal scan of the uterus showing endometritis

metrial image (Figure 8). This could be differentiated from intrauterine adhesions by its isoechoic nature with the surrounding myometrium.

When the endometrial image was irregular but did not belong to any of the above-mentioned categories, it was classified as 'irregular' endometrium (Figure 9).

RESULTS

A total of 200 patients were investigated. Of these, 193 patients with abnormal transvaginal sonography findings and seven patients with normal transvaginal sonography findings had hysteroscopy to verify ultrasound findings. Eleven patients with abnormal transvaginal sonography findings were noted to have normal uterine cavities on hysteroscopy, and two patients with normal transvaginal sonography findings had abnormalities in the endometrial cavity on hysteroscopy. The false-positive rate was 5.5%.

The sensitivity of transvaginal sonography in detecting all abnormalities was 98.9% and the positive predictive value was 94.3%. The specificity calculated from the small number of patients with normal findings at transvaginal sonography was 31.3% and the negative predictive value was 71.4%.

The distribution of various abnormalities detected on transvaginal sonography and hysteroscopy and the positive predictive value for specific abnormalities is given in Table 1. The predictive value was highest for intrauterine

Table 1 Distribution of abnormalities of the endometrial cavity and the positive predictive values of transvaginal sonography findings

Diagnosis	*Transvaginal sonography*	*Hysteroscopy*	*Positive predictive value* (%)
Adhesions	71	76	98.5
Fibroids	51	44	91.7
Polyps	43	46	91.4
Endometritis	9	12	85.7
Septum	5	6	100.0
Irregular	14	—	85.7

septa and 98.5% of intrauterine adhesions were diagnosed on transvaginal sonography.

There were 14 patients with irregular endometrium on transvaginal sonography. An endometrial pathology was detected on hysteroscopy in 12 (86%). These were found to be endometrial polyps (36%), intrauterine adhesions (21%), endometritis (21%) or a uterine septum (8%).

Cavity contours were best demonstrated in the periovulatory phase when the endometrium was thick enough to appear more echogenic than the myometrium and not too thick to obscure the mid-line echo and tubal ostial beaking. When the endometrial cavity was studied in the luteal phase, the mid-line echo was not seen clearly. Intrauterine adhesions and polyps were obscured and the submucous nature of fibroids could not be reliably assessed in the luteal phase.

DISCUSSION

Fedele and colleagues[15] compared transvaginal sonography and hysteroscopic findings in patients with submucous fibroids and reported 100% sensitivity for both techniques. They obtained positive predictive values of 81% and 87% for transvaginal sonography and hysteroscopy, respectively. They also reported that transvaginal sonography was less effective in distinguishing polyps from submucous fibroids than hysteroscopy with 4.2% misdiagnoses.

This study described the ultrasound criteria for diagnosis of endometrial abnormalities in patients with subfertility and correlates these findings with those at hysteroscopy.

Transvaginal sonography was found to predict an abnormality correctly in 98.9% of cases with positive predictive values for these abnormalities ranging from 85.7% to 100%. Only seven patients with normal transvaginal sonography findings also had hysteroscopy. The specificity of 31.3% and a negative predictive value of 71.4% need further evaluation. A prospective study to assess the negative predictive value of transvaginal sonography is ongoing, where transvaginal sonography is performed routinely on all patients and hysteroscopy is performed concurrently with laparoscopy and dye hydrotubation.

Intrauterine adhesions, submucous fibroids and endometrial polyps could be detected with significant reliability with positive predictive values of 98.5%, 91.7% and 91.4%, respectively.

The positive predictive value of fibroids suggests that ultrasound characteristics such as distortion of the mid-line echo and attenuation of the ultrasound beam with shadowing may obviate the need for the initial diagnostic hysteroscopy.

The diagnosis of endometritis with transvaginal sonography was less specific, although 85.7% of these patients showed evidence of endometritis on hysteroscopy. Treatment of this group of patients with a short course of antibiotics and corticosteroids may clear the inflammation. A clear endometrial image on transvaginal sonography in a subsequent cycle may obviate the need for diagnostic hysteroscopy.

Intrauterine adhesions and endometrial polyps can be diagnosed with significant accuracy on transvaginal sonography and hysteroscopic surgery is indicated for their removal. Transvaginal sonography can help the gynecologist to proceed directly to operative hysteroscopy without the need for a separate diagnostic procedure.

There was a strong correlation between transvaginal sonography diagnosis of uterine septae and hysteroscopy. Hysteroscopic resection may be planned with or without pretreatment of the endometrium in these cases.

Fedele's study[15] failed to distinguish between endometrial polyps and submucous fibroids in three out of 71 patients (4.2%). Our study confirms their findings in that a misdiagnosis was made in six out of 193 patients (3.1%).

CONCLUSION

The sensitivity of transvaginal sonography in detecting endometrial pathology in infertile patients has been demonstrated in this study. Transvaginal sonography should be used to assess whether hysteroscopic evaluation of the endometrial cavity is indicated.

Whether the treatment of these abnormalities affects the outcome of infertility is the subject of another report (in preparation).

The patients included in this study had prolonged subfertility and the results are specifically applicable to this group of women. Further study is needed before the data can be applied to the general population.

Transvaginal sonography is a non-invasive, painless and acceptable investigation for use in subfertility. It is less expensive than diagnostic hysteroscopy and the positive predictive value of transvaginal sonography warrants its use as a primary tool in the investigation of subfertility. The negative predictive value of transvaginal sonography needs further evaluation.

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