Research Article

Detection of Uterine Cavity Pathology in Subfertile Women Prior to In Vitro Fertilization Using Transvaginal Sonography and Office Hysteroscopy

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Abstract

Objective: To compare transvaginal sonography (TVS) and office hysteroscopy in detecting uterine cavity pathology in subfertile women prior to in vitro fertilization (IVF).

Methods: This retrospective cross-sectional study included 104 subfertile women who underwent both TVS and office hysteroscopy at the Yasmin IVF Clinic, Dr. Cipto Mangunkusumo Kencana Hospital, Jakarta. Findings from TVS and hysteroscopy were compared with histopathological results for chronic endometritis, endometrial polyps, submucosal fibroids, and endometrial hyperplasia. Findings of uterine septum and intrauterine synechiae on TVS were compared with hysteroscopy as the reference standard.

Results: Office hysteroscopy detected chronic endometritis in 16.3% of subjects, with a sensitivity of 33% and specificity of 68%, whereas TVS did not identify any cases. Submucosal fibroids were detected by both modalities with identical specificity (100%) and sensitivity (75%). Endometrial polyps were identified in 47.1% of cases by hysteroscopy and 15.4% by TVS. TVS demonstrated higher specificity (88% vs. 35%), although both modalities showed low sensitivity (15% for TVS vs. 50% for hysteroscopy). Both methods accurately detected endometrial hyperplasia, showing high specificity (97%). Uterine septum and intrauterine synechiae were detected exclusively by hysteroscopy.

Conclusion: Both TVS and office hysteroscopy are effective in detecting submucosal fibroids and endometrial hyperplasia. However, only hysteroscopy can identify chronic endometritis, uterine septum, and intrauterine synechiae, while TVS demonstrates higher specificity for detecting endometrial polyps. Histopathology remains the gold standard, and office hysteroscopy provides important complementary diagnostic value prior to IVF.

Keywords: in vitro fertilization, office hysteroscopy, sub-fertility, transvaginal sonography.

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INTRODUCTION

The outcomes of assisted reproductive technology (ART) programs, including in vitro fertilization (IVF), are influenced by multiple factors. Embryo quality and endometrial receptivity are two key determinants of successful embryo implantation and pregnancy.[1,2] The presence of uterine and intrauterine pathology is thought to impair endometrial receptivity and reduce pregnancy rates in IVF. Uterine cavity and myometrial abnormalities have been reported in approximately 50% of women with subfertility.[3]

The most common uterine pathologies identified during screening include uterine fibroids, endometrial polyps, intrauterine synechiae, and congenital uterine anomalies. These abnormalities are believed to negatively affect ART outcomes by reducing implantation rates and increasing the risk of spontaneous abortion.[3,4]

Transvaginal Sonography (TVS) is widely regarded as a reliable and noninvasive method for evaluating uterine abnormalities. However, certain intrauterine pathologies, such as chronic endometritis or intrauterine synechiae, may not be adequately detected by TVS. Office hysteroscopy is a diagnostic modality that allows direct visualization of the uterine cavity and enables the detection and treatment of various intrauterine disorders.[5] Unlike operative hysteroscopy, office hysteroscopy does not require a dedicated operating room or general anesthesia, making it suitable for outpatient settings and reducing patient-related costs.

Given these advantages, office hysteroscopy has been increasingly utilized for the evaluation of uterine cavity abnormalities in subfertile women. Nevertheless, the comparative effectiveness of TVS and office hysteroscopy in detecting uterine cavity pathology prior to IVF remains unclear. Therefore, this study aimed to compare the diagnostic performance of TVS and office hysteroscopy in identifying uterine cavity pathology in subfertile women before undergoing IVF.

METHODS

This retrospective cross-sectional study was conducted and reported in accordance with the STROBE guidelines and included a total of 104 sub-fertile women treated at the Yasmin IVF Clinic, Dr. Cipto Mangunkusumo Kencana Hospital, Jakarta, Indonesia. Data were obtained from the medical records of women who underwent both Transvaginal Sonography (TVS) and office hysteroscopy prior to in Vitro Fertilization (IVF).

The study received ethical approval from the Medical Research Ethics Committee of the Faculty of Medicine, Universitas Indonesia Dr. Cipto Mangunkusumo Hospital (FKUI–RSCM), under protocol number 17-07-0798, and was conducted in accordance with the principles of the Declaration of Helsinki (revised in 2008).

Findings from TVS and office hysteroscopy were retrieved and validated against histopathological examination, which served as the gold standard for detecting uterine abnormalities, excluding uterine septum and intrauterine synechiae. The evaluated pathologies included chronic endometritis, endometrial polyps, submucosal fibroids, and endometrial hyperplasia.

Bivariate analysis was performed to assess the association between intrauterine histopathology results and findings from both diagnostic modalities (TVS and office hysteroscopy). The diagnostic performance of each modality was evaluated by calculating sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio, and negative likelihood ratio, using histopathology as the reference standard. Statistical analyses were performed using SPSS version 26.0.

RESULTS

All 104 participants data were collected and analysed. Most of the participants in this study (78.8%) were aged 23-40 years, while 21.2% were over 40 years (average 36.4 ± 4.9 years). The intrauterine pathologies found by TVS and office hysteroscopy are presented in Table 1. Uterine cavity pathologies, such as chronic endometritis, submucosal fibroids, endometrial polyps and endometrial hyperplasia, were found by both modalities, and then comparisons were made with histopathology as the gold standard (Table 2). For uterine synechiae and uterine septum, office hysteroscopy findings were used as the gold standard since the diagnosis was not based on histopathology examination but rather on pathologic visualization (Table 3).

Table 1. Intrauterine Pathology Detected by TVS and Office Hysteroscopy

Findings	TVS		Office hysteroscopy	
	Number	%	Number	%
Endometrial polyps	16	15.4	49	47.1
Chronic endometritis			17	16.3
Submucosal fibroids	2	1.9	4	3.8
Uterine septum			2	1.9
Uterine synechiae			2	1.9
Endometrial hyperplasia	1	1.0	1	1.0

*TVS, transvaginal sonography

Chronic endometritis was found in 17 subjects (16.3%) with office hysteroscopy (sensitivity 33%, specificity 68%, positive predictive value/PPV 8.3% and negative predictive value/NPV 92%), while no cases were detected with TVS. Submucosal fibroids were detected in 2 patients (1.9%) through TVS examination, and 4 patients (3.8%) were diagnosed through office hysteroscopy. Both modalities had the same specificity, sensitivity, PPV and NPV (100%, 75%, 100% and 97%, respectively) for detecting submucosal fibroids. Endometrial polyps were detected in 16 subjects (15.4%) via TVS and 49 subjects (47.1%) by office hysteroscopy. TVS had a greater specificity (88%) than office hysteroscopy (35%) for detecting endometrial polyps, while both had lower sensitivities (15% and 50%). Endometrial hyperplasia was found in 1 subject (1.0%) by both TVS and office hysteroscopy. Endometrial hyperplasia was detected in 1 subject each (1.0%) by TVS and office hysteroscopy, with similarly high sensitivity and specificity (infinite and 97%). Uterine synechiae and the uterine septum were found only by office hysteroscopy in 2 subjects each (1.9%), with a specificity of 100% but indeterminate sensitivity.

Table 2. Sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio, and negative likelihood ratio of TVS and office hysteroscopy in detecting uterine cavity pathology compared to histopathology results

	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Positive likelihood ratio	Negative likelihood ratio
Chronic endometritis						
TVS	Indeterminate	100	Infinite	92	Infinite	1
OH	33	68	8.3	92	1.03	0.98
Submucosal fibroids						
TVS	75	100	100	97	Infinite	0.25
OH	75	100	100	97	Infinite	0.25
Endometrial polyps						
TVS	15	88	60%	47	1.25	0.96
OH	50	35	48%	38	0.77	1.43
Endometrial hyperplasia						
TVS	Infinite	97	Indeterminate	100	0	1.03
OH	Infinite	97	Indeterminate	100	0	1.03

*TVS, transvaginal sonography; OH, office hysteroscopy

Table 3. Sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio, and negative likelihood ratio of TVS in detecting uterine cavity pathology compared to office hysteroscopy

	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Positive likelihood ratio	Negative likelihood ratio
Intrauterine synechiae	Indeterminate	100%	Infinite	98	Infinite	1
Uterine septum	Indeterminate	100%	Infinite	98	Infinite	1

DISCUSSION

The incidence of chronic endometritis in the present study was 16.3%, which was notably lower than that reported in a previous study involving subfertile women (40.7%).[6] This discrepancy is most likely attributable to differences in diagnostic criteria used between the studies. In the current study, the diagnosis of chronic endometritis was primarily based on the presence of micropolyps. In contrast, other studies have included additional hysteroscopic features such as endometrial hyperemia and edema. The presence of micropolyps is a strong predictor of chronic endometritis, with a reported positive predictive value of 98.4%, and should therefore be carefully considered in the diagnostic process. Interestingly, previous authors reported that when the diagnosis was based on the combined findings of edema, hyperemia, and micropolyps, sensitivity was relatively low (54%) while specificity was high (99%), with a positive predictive value (PPV) of 98.4% and a negative predictive value (NPV) of 94.5%. Conversely, when diagnosis relied solely on edema and hyperemia, sensitivity increased to 91.8%, specificity to 92.9%, PPV to 63.9%, NPV to 98.8%, and overall diagnostic accuracy to 92.7%.[6]

In the present study, all cases of chronic endometritis were detected by office hysteroscopy, whereas none were identified by TVS. This finding reinforces previous evidence indicating that TVS is not a reliable modality for diagnosing chronic endometritis.[6,7] Nevertheless, histopathological examination demonstrating chronic inflammatory infiltration and plasma cells remains the definitive gold standard for diagnosis.

Office hysteroscopy offers the advantage of direct visualization of the uterine cavity. Similar to chronic endometritis, intrauterine synechiae and uterine septum were not detected by TVS in this study. For both conditions, office hysteroscopy may be considered the reference standard for diagnosis. The detection of intrauterine synechiae by office hysteroscopy has been reported to have very high specificity (100%) and an infinite positive predictive value. However, prior studies have shown that TVS, when compared with office hysteroscopy, may also demonstrate high sensitivity (100%) and PPV (100%). The diagnosis of uterine septum using office hysteroscopy demonstrates high specificity (100%) but very low sensitivity (0%). Previous studies reported that TVS had lower sensitivity (68.2%) than specificity (91.2%)6, whereas other studies documented higher sensitivity rates of up to 96%. These discrepancies are likely attributable to differences in operator expertise, interpretation criteria, and ultrasound equipment quality.

For submucosal fibroids, both TVS and office hysteroscopy demonstrated high specificity (100%) and comparable sensitivity (75%). The infinite PPV observed indicates a strong diagnostic performance for identifying submucosal fibroids. Diagnostic tools with both high sensitivity and specificity are considered reliable, and prior studies similarly reported high sensitivity and specificity for office hysteroscopy.[8,9] Another study demonstrated that TVS achieved a sensitivity of 98% and specificity of 100% in detecting submucosal fibroids.9 These findings suggest that both TVS and office hysteroscopy are effective modalities for diagnosing submucosal fibroids.

Endometrial polyps were the most frequently identified intrauterine pathology among sub-fertile women prior to IVF in this study, detected in 15.4% of cases by TVS and 47.1% by office hysteroscopy. This prevalence was higher than that reported in previous studies, which identified endometrial polyps in only 7.7% of sub-fertile women with intrauterine pathology.[10] Office hysteroscopy detected more polyps than TVS; however, when compared with histopathology, TVS demonstrated higher specificity (88%) than hysteroscopy (35%). Both modalities showed relatively low sensitivity. These findings are consistent with prior studies reporting that both TVS and hysteroscopy have lower sensitivity than specificity in detecting endometrial polyps, particularly in women with menorrhagia.[10] Consequently, a positive TVS finding for endometrial polyps is more likely to be confirmed histopathologically than a positive hysteroscopic finding.

Both TVS and office hysteroscopy demonstrated similarly high sensitivity and specificity for detecting endometrial hyperplasia, indicating their usefulness as diagnostic tools. However, both modalities exhibited low positive likelihood ratios (<10), underscoring the necessity of histopathological confirmation. Advances in TVS technology have improved the accuracy of endometrial morphological assessment. One study demonstrated the utility of measuring endometrial thickness by TVS in detecting endometrial abnormalities, including

hyperplasia, although specificity remained lower (45.5%) than sensitivity (95.8%).[11] In contrast, hysteroscopic examination based on direct visualization achieved high sensitivity (100%) and specificity (97.1%).11 Another study reported that TVS had high sensitivity (81.40%), specificity (76.92%), PPV (79.55%), and NPV (78.90%) for detecting myometrial invasion in endometrial cancer, although hysteroscopic data were not provided.[12] Collectively, these findings indicate that both TVS and office hysteroscopy require histopathological confirmation for definitive diagnosis of endometrial hyperplasia.

Recent meta-analyses further emphasize the clinical importance of identifying intrauterine pathology prior to IVF. A systematic review and meta-analysis demonstrated that hysteroscopy before IVF improved clinical pregnancy and live-birth rates, particularly in women with previous IVF failures.[13] Another large review found that even women with normal TVS or hysterosalpingography benefited from hysteroscopic evaluation, achieving higher pregnancy rates after embryo transfer.[14,15] Chronic endometritis has also been linked to implantation failure and reduced IVF success, with treatment shown to improve outcomes.[16,17] A 2022 meta-analysis reported that diagnostic hysteroscopy prior to the first IVF cycle significantly increased clinical pregnancy rates (OR ≈ 1.49), although live-birth rates were not significantly improved.[18] In women with recurrent implantation failure, a 2023 meta-analysis demonstrated that hysteroscopy was associated with higher clinical pregnancy (OR ≈ 1.64), live birth (OR ≈ 1.50), and implantation rates compared with no hysteroscopy.[19] Furthermore, a previous study found improved clinical pregnancy rates following hysteroscopy even in women without visible intrauterine pathology on baseline imaging.[20] These findings support the complementary role of hysteroscopy in the pre-IVF evaluation.

Several limitations of this study must be acknowledged. The retrospective design and incomplete medical records may have resulted in false-negative or false-positive classifications, potentially affecting sensitivity and specificity estimates. Additionally, TVS and hysteroscopy were performed by different clinicians, introducing possible inter-observer variability. Diagnostic accuracy is highly dependent on examiner expertise and equipment quality. Moreover, some hysteroscopic findings rely on subjective visual assessment and cannot be confirmed histologically, limiting direct comparison with pathology results. The relatively small number of less common abnormalities also resulted in wide confidence intervals. These limitations, together with heterogeneity observed across previous studies,[13,14] highlight the need for larger, prospective studies employing standardized diagnostic criteria to better elucidate the impact of pre-IVF intrauterine evaluation and treatment on reproductive outcomes.

CONCLUSION

In summary, this study highlights the complementary roles of transvaginal sonography and office hysteroscopy in detecting intrauterine pathology in sub-fertile women prior to IVF. While both modalities reliably detect submucosal fibroids and endometrial hyperplasia, only hysteroscopy can identify chronic endometritis, uterine septum, and intrauterine synechiae. TVS demonstrates higher specificity for endometrial polyps, whereas hysteroscopy offers superior visualization of structural abnormalities. Importantly, combining TVS with office hysteroscopy provides a more complete assessment of the uterine cavity than either modality alone, allowing the detection of subtle lesions that may negatively affect implantation. This integrated approach may enhance diagnostic accuracy and contribute to improved IVF outcomes. Histopathology remains essential for confirming suspected endometrial pathology.

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AVAILABILITY of DATA and MATERIALS

The data and supportive information are available within the article.

CONFLICT of INTEREST

There is no conflict of interests in this paper.

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