Research Article

Accuracy of Tubal Patency Assessment during Office Hysteroscopy in Comparison to Hysterosalpingography

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Abstract

Objective: To evaluate the accuracy of office hysteroscopy in assessing tubal patency compared with hysterosalpingography.

Methods: This cross-sectional study was conducted from January 2021 to May 2023 and involved 26 subjects who underwent office hysteroscopy as part of a subfertility work-up. Tubal patency was assessed using the bubble test (Parryscope test) and by measuring changes in the amount of fluid in the pouch of Douglas after the procedure. All subjects subsequently underwent hysterosalpingography as the standard method. Due to technical limitations, diagnostic laparoscopy the gold standardwas not performed. Agreement between office hysteroscopy and hysterosalpingography was evaluated using concordance rates and kappa values, along with sensitivity, specificity, positive predictive value, and negative predictive value. Pain scores during the procedure and post-procedural symptoms were also analyzed.

Results: The concordance between the two modalities in assessing tubal patency was 67% (moderate agreement), with a kappa value of 0.28 (fair agreement). Office hysteroscopy resulted in lower pain scores and a reduced incidence of post-procedural lower back pain and abdominal bloating.

Conclusion: Office hysteroscopy demonstrates fair accuracy in assessing tubal patency compared with hysterosalpingography, with the advantages of minimal pain and no serious side effects.

Keywords: HSG, office hysteroscopy, tubal patency.

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INTRODUCTION

Subfertility is one of the most overlooked reproductive health problems.[1] The prevalence of subfertility among women in Indonesia is estimated to reach 10.2% of married women aged 15–49 years, based on a World Health Organization study conducted between 1994 and 2000.[2,3] Tubal abnormalities are the leading cause of subfertility among female factors, accounting for approximately 40% of all cases.[4-6] Therefore, tubal assessment is a mandatory component of the subfertility work-up.[7]

Several diagnostic methods have been used for decades to evaluate tubal patency. The gold standard is laparoscopy with chromotubation; however, this procedure requires anesthesia and access to an operating room, both of which contribute to its high cost for patients.[8,9] Hysterosalpingography (HSG) is one of the less invasive alternatives developed to replace laparoscopy. Nonetheless, it has several limitations, including the inability to assess pelvic or ovarian adhesions, exposure to radiation, and the risk of allergic reactions to contrast media particularly in individuals with a history of iodine hypersensitivity, which may recur in 8–25% of cases.[8-12]

Office hysteroscopy is a standard component of subfertility evaluation, primarily for assessing the uterine cavity. Several studies have shown that this procedure can also be used to evaluate tubal patency.[13,14] Office hysteroscopy followed by transvaginal ultrasonography can identify the

accumulation of saline in the pouch of Douglas as an indicator of tubal patency.14,15 Tubal patency can additionally be assessed using the bubble test (Parryscope test), which evaluates the flow of air bubbles entering the tube as evidence of patency.[15]

Diagnostic office hysteroscopy can be performed in an outpatient clinic without anesthesia and completed in a single visit (one-stop service). However, further data are still needed to establish its accuracy in tubal assessment. Therefore, this study aims to evaluate the accuracy of office hysteroscopy in assessing tubal patency compared with hysterosalpingography.

METHODS

The population of this prospective study consisted of subfertile patients attending Dr. Cipto Mangunkusumo Hospital, a tertiary hospital in Central Jakarta, between February 2021 and May 2023. This research was approved by the local ethics committee of the university with protocol number 20-02-0169. Women with cervical cancer, pregnancy, Müllerian agenesis, active pelvic inflammatory disease, or a history of tubal surgery were excluded. The total sample obtained in this study was 49 participants. All women who agreed to participate provided informed consent and signed a consent form. Subfertility was defined as one year of unprotected intercourse. Between days 6 and 11 of the menstrual cycle, participants underwent an office hysteroscopy procedure. Transvaginal ultrasonography was performed before and after office hysteroscopy to determine any increase in fluid in the pouch of Douglas. A 5 Fr Bettocchi rigid hysteroscope with a 30° optic was used in the procedure. The distension medium consisted of 1–2 liters of normal saline administered at a pressure of 70 mmHg.[11,12]

Tubal patency was defined as the presence of a channel connecting the uterine and peritoneal cavities through the fallopian tubes, as confirmed by office hysteroscopy and ultrasound. Tubal patency was assessed by evaluating fluid accumulation in the pouch of Douglas before and after office hysteroscopy with the patient positioned at a 30° reverse Trendelenburg angle. If no fluid was present before the procedure, any increase in fluid after the procedure was interpreted as evidence of tubal patency. The second criterion involved assessing the flow of air bubbles into each tube. For this technique, approximately 0.25 mL of air was introduced into the IV tubing by inverting the drip chamber and tapping the infusion tubing 2–3 times to create air bubbles; the test was performed approximately 10 seconds after the administration of normal saline.[9] A positive fluid increase in the pouch of Douglas and a positive bubble test were considered indicative of tubal patency.

Office hysteroscopy and transvaginal ultrasonography were performed and evaluated by a specialist in obstetrics and gynecology. Documentation from the procedures, including hysteroscopy video recordings and digital ultrasound images, was interpreted by three observers: the primary researcher and two additional experts in hysteroscopy. The number of patent tubes per individual was categorized as follows: at least one tube patent if additional fluid was observed in the pouch of Douglas, and both tubes non-patent if no fluid was detected. Hysterosalpingography was performed one month after office hysteroscopy. Tubal patency was defined as the presence of a channel connecting the uterine and peritoneal cavities as demonstrated on HSG imaging. The results of the two examinations were compared, with hysterosalpingography used as the gold standard. Side effects were assessed after each procedure. Although diagnostic laparoscopy is the true gold standard, it was not performed due to its invasive nature, ethical considerations, and cost-effectiveness concerns in patients without suspected pathology.

Statistical analyses were performed using SPSS version 25. The essential characteristics of the study subjects were presented in tabular form. Interobserver assessment of office hysteroscopy results was conducted by three obstetrics and gynecology specialists experienced in hysteroscopy, and conclusions were drawn based on the majority agreement among the three evaluators. Statistical analysis of diagnostic concordance was conducted using agreement level testing and Cohen's Kappa coefficient to evaluate the consistency between office hysteroscopy and HSG in assessing tubal patency.

RESULTS

A total of forty-nine subfertile patients were initially recruited for this study conducted at Dr. Cipto Mangunkusumo National Hospital from

February 2021 to May 2023. Six patients became pregnant in the following cycle, eight declined further participation, and nine had incomplete data, leaving twenty-six eligible subjects for analysis. The mean age of the respondents was 32 ± 3.0 years, with an average subfertility duration of 4.0 ± 2 years. All cases involved primary infertility.

During office hysteroscopy, procedure duration ranged from 4 to 25 minutes, with an average of 13 minutes. When the findings of office hysteroscopy were compared with those of HSG, twenty-eight tubes were categorized as patent by both methods, while seven tubes were consistently identified as non-patent. Tubal patency was determined based on two criteria: a positive bubble test and the presence of additional fluid in the pouch of Douglas.

Table 1. Results from Office Hysteroscopy Compared to Gold Standard HSG (using bubble test criteria and adding fluid to the Douglas's pouch)

		HSG		Total
		Non patent	Patent	
Office hysteroscopy (bubble test and addition of fluid in the Douglas's pouch)	Non patent	7	16	23
	Patent	1	28	29
Total		8	44	52

From this data, the level of agreement is calculated according to the formula:

$$\frac{\text{True positive + True negative}}{\text{Total}} = \frac{28 + 7}{52} = 67\%$$

The evaluation of tubal patency demonstrated an agreement rate of 67%, with a kappa (κ) value of 0.28. This reflects a moderate level of observed concordance; however, the level of agreement beyond chance was relatively low, indicating only fair consistency between the two diagnostic modalities.

Based on the data in Table 1, the sensitivity of office hysteroscopy in assessing tubal patency was 87.5% (95% CI: 52.9–97.7), specificity was 63.6% (95% CI: 48.8–76.2), the positive predictive value was 30.43% (95% CI: 15.6–50.87), and the negative predictive value was 96.5% (95% CI: 82.8–99.3).

To further evaluate clinical applicability, tubal patency was also analyzed per patient using both criteria bubble test and fluid accumulation in the Douglas pouch. As shown in Table 2, twenty-four patients were categorized as having at least one patent tube based on both office hysteroscopy and HSG, whereas one patient was identified as having bilateral tubal occlusion.

Table 2. Evaluation of Tubal Fallopi using Office Hysteroscopy in 2x2 Table (Addition of Fluid in Individual Douglas Cavum in Table 2 x 2)

		HSG		Total
		Non patent	Patent	
Office hysteroscopy (bubble test and addition of fluid in the douglas cavity)	Non patent both	1	1	2
	At least of 1 tube is patent	0	24	24
Total		1	25	26

From these data, the level of concordance is calculated according to the formula:

$$\frac{\text{True positive + True negative}}{\text{Total}} = \frac{24 + 1}{25} = 96\ \%$$

The evaluation showed a concordance rate of 96%, with a kappa (κ) value of 0.64, indicating substantial agreement beyond chance and demonstrating strong consistency in assessing tubal patency at the patient level.

According to Table 2, the sensitivity and negative predictive value of office hysteroscopy were both 100% (95% CI: 20.6–100 and 95% CI: 86.2–100, respectively). Specificity was 96% (95% CI: 80.4–99.9), and the positive predictive value was 50% (95% CI: 9.4–90.5).

In the subgroup of 26 patients, pain levels during HSG and office hysteroscopy varied. Most patients undergoing HSG reported mild

pain, with several describing moderate to severe discomfort. In contrast, office hysteroscopy was generally better tolerated, with most patients reporting mild to moderate pain. Specifically, 14 patients reported mild pain during HSG, 6 reported moderate pain, and 3 experienced severe pain. Overall, these findings suggest that office hysteroscopy is associated with lower pain intensity compared with HSG, although both procedures may still cause discomfort.

Table 3. Proportion of Side Effects Experienced by Patients during the Office Hysteroscopy Procedure Compared with HSG

Side Effect	Office Hysteroscopy	HSG	*P-value*
Colic	15/26 (57.7)	16/26 (61.5)	0.1
Spotting	15/26 (57.7)	18/26 (69.2)	0.5
After procedure	13/15 (86.7)		
Without procedure	2/15 (13.3)		
Low Back pain	1/26 (3.8)	14/26 (53.8)	0.04
Abdominal bloating	2/26 (7.7)	9/26 (34.6)	0.03

Other side effects such as colic and spotting did not differ significantly between the two procedures. Most spotting episodes after office hysteroscopy (86.7%) occurred in patients who underwent concurrent additional procedures such as polypectomy, internal os dilation, or endometrial sampling. Meanwhile, the proportion of patients reporting lower back pain and abdominal bloating was substantially lower after office hysteroscopy compared with HSG. No serious adverse events or fatalities were observed in this study.

DISCUSSION

Office hysteroscopy is widely used as a diagnostic tool to evaluate the uterine cavity in subfertile women. In this study, several intrauterine abnormalities including internal uterine ostium stenosis, fibrotic tissue, and endometrial polyps were clearly identified using office hysteroscopy. When such findings were detected, therapeutic interventions such as stenosis dilation, sampling of fibrotic tissue, and polypectomy were simultaneously performed.

Recent studies have explored the expanded role of office hysteroscopy in assessing tubal patency.[11] In this research, we compared office hysteroscopy with HSG, which is the standard method for evaluating tubal patency at Dr. Cipto Mangunkusumo National Hospital. The agreement between the two modalities was 67%, with a kappa value of 0.28, indicating fair concordance. Tubal patency was determined using two parameters: accumulation of fluid in the pouch of Douglas and a positive bubble test.[11] Both indicators were considered capable of providing clinically relevant information comparable to HSG.

The bubble test is believed to offer more specific insight into individual tubal patency compared to assessing fluid in the Douglas pouch. Theoretically, confirming which tube is patent may help guide ovulation-related procedures, such as intrauterine insemination. The technique used to generate bubbles involved inverting the IV drip chamber to introduce 5–10 mL of air and flicking the infusion tubing 2–3 times. However, bubble size variability and fusion into larger bubbles (>10 mL) sometimes made it difficult to produce uniform bubble characteristics capable of reliably passing through a patent tube.

Furthermore, the timing of the bubble test is crucial. The test can be initiated approximately 10 seconds after the administration of normal saline.[15] Because most patients (up to 88%) had intracavitary abnormalities requiring operative procedures during office hysteroscopy, the duration used by operators to perform the bubble test varied considerably. This inconsistency may have contributed to the lower positive predictive value observed in the study.

Bubble test durations ranged from less than 2 minutes to more than 4 minutes. This variation likely influenced the low positive predictive value of 30.4%, suggesting that a non-patent result on office hysteroscopy is not always reliable when compared with HSG. Conversely, the negative predictive value was high (96.5%), indicating that when office hysteroscopy suggests a patent tube, the finding is highly consistent with HSG results. These findings support the potential role of office hysteroscopy in identifying patent tubes with good reliability.

In addition to the bubble test, we also evaluated the presence of fluid accumulation in

the Douglas pouch. Another study categorized fluid accumulation into three groups: patent, unilateral patent, or bilateral non-patent.[14] For practicality, interobserver assessment in this study focused solely on the presence or absence of fluid after the procedure without quantifying the amount. In one case, no fluid was detected post-procedure, and the bubble test was negative bilaterally, leading to a diagnosis of bilateral tubal occlusion consistent with the patient's HSG findings.

Clinically, these results are highly relevant. When at least one tube is patent, couples may still conceive naturally or through insemination. However, bilateral tubal occlusion necessitates assisted reproductive technologies such as IVF. Therefore, evaluating tubal patency at the patient level specifically by assessing fluid in the Douglas pouch can help classify patients according to the therapeutic pathway required.

Based on Table 2, the agreement between office hysteroscopy and HSG at the individual level was 96%, with a kappa value of 0.64, indicating substantial agreement. Sensitivity was 100%, meaning that patients with bilateral occlusion identified by office hysteroscopy were always confirmed to have the same condition on HSG. Similarly, the negative predictive value was 100%, showing that patients determined to have at least one patent tube by office hysteroscopy consistently matched HSG findings. However, this high estimate must be interpreted carefully due to the small and imbalanced sample, especially the low number of patients with bilateral occlusion (n = 1), resulting in wide confidence intervals. Specificity was 96%, demonstrating that office hysteroscopy reliably identified patients with tubal patency, supported by a narrow confidence interval.

Overall, this study highlights the potential for office hysteroscopy not only to evaluate the uterine cavity but also to serve as a screening tool for tubal patency. Nevertheless, the authors acknowledge that the sample size was minimal. Future studies with larger and more balanced samples particularly with more cases of non-patent tubes would improve the precision and reduce bias.

The sensitivity, specificity, and negative predictive values obtained in this study were higher than those reported in previous research.[11] The relatively low positive predictive value is unsurprising given the small number of non-patent tube cases. In this study, bilateral occlusion was found in only 3% of patients with primary infertility, which aligns with previous reports on the prevalence of bilateral tubal occlusion in subfertile women assessed by HSG.[12] Office hysteroscopy may also be particularly beneficial for patients who cannot undergo HSG due to contrast allergies, since it provides an alternative means of tubal evaluation.[11,12]

Although office hysteroscopy is approximately three times more costly than HSG, it offers significant advantages as the gold standard for intrauterine assessment and allows concurrent operative management. Because office hysteroscopy including any corrective procedures preceded HSG in this study, the likelihood of detecting intracavitary abnormalities during subsequent HSG was greatly reduced. Indeed, approximately 88% of subjects were found to have intrauterine pathology during office hysteroscopy.

Table 4. Conclusion table for Assessing Tubal Patency using Office Hysteroscopy

Tubal patency assessment results	Bubble test result	Transvaginal ultrasound results
Both tube patent	Bubble test flow was found in both tubal ostia	An increase in fluid was found after the office hysteroscopy procedure
Both tube nonpatent	Bubble test flow was not found in both tubal ostia	No additional fluid was found after the office hysteroscopy procedure
At least tuba patent	The bubble test flow is found in one of the tubes or not both	An increase in fluid was found after the office hysteroscopy procedure

Another finding in this study is that patients had a high tolerance level for office hysteroscopy exams. HSG caused much less discomfort than hysteroscopy (p 0.05). This is consistent with another researcher, which found comparable findings.11 Because the office hysteroscopy utilizes a technique that does not require the installation of a speculum, the use of a distension medium using saline, the tiny diameter of the office hysteroscopy, and the patient's attention is diverted by staring at the video picture, the difference in pain felt is feasible. This is distinct

from what occurs during an HSG, which includes using a speculum, catheter insertion, and clamping the cervix with a tenaculum.

This is the first study in Indonesia to add to the literature supporting office hysteroscopy's role in assessing tubal patency. This study also employed samples with diverse intracavitary abnormalities that have not been reported in other investigations; nonetheless, if the anomaly does not cover the tubal ostium, an operator may estimate tubal patency. One of the study's weaknesses is that it needed to employ the gold standard for measuring tubal patency using laparoscopic chromotubation. This consideration because the procedure is invasive, requiring anesthesia and an operation room which increases cost. This limitation of which might have influenced the sensitivity and specificity results and the existing concordance rates. The uneven sample of responders with non-patent and patent tubes is another concern.

CONCLUSION

Office hysteroscopy has sufficient accuracy for assessing tubal patency compared to hysterosalpingography using the bubble test and the addition of fluid to the pouch of Douglas. Patient tolerance for office hysteroscopy is better than for hysterosalpingography, with no serious side effects.

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