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Original Article

Transvaginal ultrasonography versus hysteroscopy in endometrial pathology diagnosis among women with abnormal uterine bleeding

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ABSTRACT

Objective: Abnormal uterine bleeding is any deviation from a normal menstrual pattern. Transvaginal ultrasonography is useful in determining endometrial thickness but cannot conclusively exclude sessile and pedunculated lesions. Hysteroscopy is an invasive procedure that detects discrete lesions. This study was aimed to evaluate the diagnostic accuracy of 2-dimensional transvaginal ultrasonography and hysteroscopy in evaluating endometrial lesions in women with abnormal uterine bleeding, by determining the sensitivity and specificity of the two methods in diagnosing the lesions.

Methods: Eighty-four cases of abnormal uterine bleeding were chosen based on inclusion criteria. The patients were subjected to routine investigations. The findings of transvaginal ultrasonography, hysteroscopy, and dilatation and curettage were compared and analyzed.

Results: Maximum incidence of abnormal uterine bleeding was observed in women between 41 and 50 years of age (73.8%). The most common presenting complaint was menorrhagia (76.1%). 76% of patients experienced symptoms for less than six months. The sensitivity and specificity of transvaginal ultrasonography were 60% and 96.3%, respectively. The sensitivity and specificity of hysteroscopy were 80.4% and 93.1%, respectively. The accuracy of transvaginal ultrasonography was 60.3%, and that of hysteroscopy was 83.3%.

Conclusion: Transvaginal ultrasonography and hysteroscopy can be used as first-line diagnostic modalities to rule out and find the causes of abnormal uterine bleeding, which can aid in instituting prompt and appropriate medical treatment.

Keywords

Hysteroscopy, transvagianl ultrasonography, TVS, AUB.

Abbreviations

Abnormal uterine bleeding (AUB); Two dimensional (2D); Positive predictive value (PPV); Negative predictive value (NPV).

INTRODUCTION

Abnormal uterine bleeding (AUB) refers to any uterine bleeding abnormality in one or more of the variables-frequency, regularity, duration, and perceived volume of bleeding[1,2]. The exact mechanism of abnormal uterine bleeding remains indeterminate but can be attributed to factors such as structural and non-structural endometrial pathologies causing disruption of the normal endometrial functioning[3]. The prevalence of AUB worldwide ranges from 10% to 30%, increasing numbers

around menarche and perimenopause[4]. Around 1% of women in the U.S. are affected by AUB[5]. Traditionally, abdominal ultrasonography and dilatation and curettage were the common procedures to diagnose and treat AUB[6]. However, recently transvaginal ultrasonography has become a routine procedure for patients with AUB.

Moreover, it has been recommended by the Royal College of Obstetricians and Gynaecologists and the American College of Obstetricians and Gynecologists[7,8]. Transvaginal ultrasonography is useful in determining endometrial thickness (ET) but cannot conclusively exclude sessile and pedunculated lesions and has a high false-negative rate for detecting focal pathology[9]. Recent studies have shown that endometrial pathology is present in 20% of the patients with normal transvaginal ultrasonography findings[10]. Hence, for further evaluation, hysteroscopy is recommended in patients with AUB with inadequate or inconclusive transvaginal ultrasonography reports[2]. Blind endometrial sampling can miss out on diagnosing endometrial cancer if less than 50 % of the endometrial cavity is affected by cancer which can pose deleterious implications in the clinical setting concerning the treatment and patient outcome. Hence, hysteroscopy with dilatation and curettage followed by histopathological examination is recommended[11]. Hysteroscopy with biopsy is the gold standard for evaluation of the uterine cavity. Stepwise evaluation of endometrial pathology in cases of AUB helps inapt and efficient treatment. This helps in preventing severe consequences and improves the quality of life. Herein, we present our study in which we study the diagnostic accuracy of two dimensional (2D) transvaginal ultrasonography and hysteroscopy in evaluating endometrial pathology, deriving information on which method is sensitive to detecting endometrial lesions. The aim of the study is to determine the sensitivity and specificity of 2D transvaginal ultrasonography and hysteroscopy in the evaluation of endometrial lesions in women with AUB. Thereby evaluating the diagnostic accuracy of the two methods in evaluating the causes of AUB.

MATERIALS AND METHODS

Eighty-four patients above 40 years of age were included in the study. They had complaints of AUB. Hysteroscopy and endometrial sampling were planned in two tertiary care centers. Patients with acute pelvic inflammatory disease were excluded from the study. Also, patients with obvious vaginal, vulval, or cervical causes of bleeding and those on hormonal replacement or any other hormonal therapy were excluded from the study. All the patients were subjected to detailed clinical history. General clinical examination, abdominal and pelvic examination in the form of bimanual and speculum examination was performed to detect any abnormal findings and exclude any local bleeding cause. Blood tests were done for all patients and were baseline. Transvaginal ultrasonography was performed to measure the uterine size, endometrial thickness, and focal lesions using conventional 2D transvaginal ultrasonography of LOGICQ2 GE with a probe of 6.5 MHz. The maximum anteroposterior depth of hyperechoic lines was measured along the transvaginal axis for endometrial assessment. Endometrial thickness was determined. Hysteroscopy was performed using Karl Storz Hysteroscope with a 5mm outer sheath diameter and 30-degree fiber-optic lens. Normal saline was used as distention media. The endocervical canal, cervix, fundus of the uterus, cavity, cornu, and tubal orifices were observed and analyzed. Tissue was taken for biopsy if a focal lesion was seen. Then, fractional curettage was done, and the curetting was sent for a histopathological examination. Biopsy was also sent for a histopathological examination. No major postoperative complications were noted in this study, such as procedure-related mortality or infectious morbidity. The findings of transvaginal ultrasonography, hysteroscopy, and histopathological reports were compared with each other. The findings were analyzed using Microsoft Excel, and a cross-tabulation was done. Using histopathological examination as standard, sensitivity, specificity, and predictive values (both positive and negative) were calculated for each pathology. Data was statistically represented by the term of range, mean, and percentages. Accuracy was represented using sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy. All statistical calculations were done using Microsoft Excel. 2 X 2 tables were constructed to analyze the diagnostic accuracy of hysteroscopy and 2D transvaginal ultrasonography specifically for intrauterine disorders, including polyps and hyperplasia. Research protocol was approved by the Institutional

Table 1. Age group of the patients

Age Group (n = 84)	Number of patients (%)
41-50	62 (73.8)
51-60	22 (26.2)

Table 2. Parity in the study

Parity (n = 84)	Number of patients (%)
Nullipara	3 (3.6)
Primipara	25(29.8)
Multipara (P2L2, P3L3, P4L4)	56 (66.6)

Table 3. Pattern of bleeding

The pattern of bleeding (n = 84)	Number of patients (%)
Polymenorrhea	5 (6)
Menorrhagia	64 (76.2)
Polymenorrhagia	12 (14.2)
Metrorrhagia	3 (3.6)

Polymenorrhea - frequent menstrual bleeding; menorrhagia - heavy menstrual bleeding; polymenorrhagia - heavy and frequent menstrual bleeding; metrorrhagia - irregular menstrual bleeding

Table 4. Validity of transvaginal ultrasonography and hysteroscopy

n=84	Disease Present	Disease Absent	Total
Transvaginal ultrasonography			
Positive Findings	18	2	20
Negative Findings	12	52	64
Total Findings	30	54	84
Hysteroscopy			
Positive	21	4	25
Negative	5	54	59
Total	26	58	84

Review Board or Ethics Committee before the study began. All human participants gave written informed consent before the study began.

RESULTS

Our study compared the efficacy of hysteroscopy and transvaginal ultrasonography in AUB in women above 40 years of age. Eighty-four women with AUB between 40 to 60 years of age underwent transvaginal ultrasonography, hysteroscopy-guided fractional curettage. Sixty-two patients (76.1%) were between 41-50 years of age (Table 1). Hysteroscopy and transvaginal ultrasonography findings were corroborated with histopathological findings that were derived from fractional curettage. Fifty-six women (66.6%) were multiparous, with the majority of patients being P2L2 (Table 2). Menorrhagia was the most common presenting symptom seen in 64 patients (76.1%), polymenorrhagia in 12 patients

Table 5. The accuracy rate of transvaginal ultrasonography and hysteroscopy for diagnosing uterine lesions

Abnormal findings	Method of diagnosis	Sensitivity	Specificity	PPV	NPV	Accuracy
Hyperplasia	Transvaginal ultrasonography	54.5%	97.2%	75%	93.4%	91.7%
	Hysteroscopy	44.4%	97.3%	66.7 %	93.5%	89.2%
Polyp	Transvaginal ultrasonography	44.4.%	98.6%	80%	71.4%	92.9%
	Hysteroscopy	88.8%	98.8%	88.8 %	98%	97.6%
Myoma	Transvaginal ultrasonography	50%	97.2%	71.4 %	93.5%	91.7%
	Hysteroscopy	100%	100%	100%	100%	100%

PPV - positive predictive value; NPV - negative predictive value

Table 6. Comparison of the histopathological examination, transvaginal ultrasonography, and hysteroscopy findings

Findings	Histopathological Examination	Transvaginal Ultrasonography	Hysteroscopy
ET< 12 mm	54	53-ET< 12 mm 1-endometrial hyperplasia	53-ET< 12 mm 1-endometrial hyperplasia
Endometrialhyperplasia	11	6-endometrial hyperplasia 5-ET<12 mm	1-polyp 4-endometrial hyperplasia 6-ET<12 mm
Polyp	9	4-polyp 2-myoma 1-endometrial hyperplasia 2-ET<12 mm	8-polyp 1-endometrial hyperplasia
Myoma (submucous)	10	5-myoma 1-polyp 4-ET<12 mm	10-myoma

ET - ndometrial thickness;

(14.2%), polymenorrhea in 5 patients (6%), and metrorrhagia in 3 patients (3.5%) (Table 3). In addition, 64 (76%) of the patients had symptoms for less than six months, and 6 (7%) had symptoms for over 12 months before reporting to the hospital.

Endometrial thickness of up to 12 mm was considered normal. Hyperplasia, polyp, and myoma were considered pathological findings. Forty patients (47.6%) underwent minimal endometrial curetting, and 34 patients (40.4%) had moderate endometrial curetting, and the rest had excess curetting. Sixty-four patients (76.19%) were diagnosed with normal endometrium via transvaginal ultrasonography. The most common lesion that transvaginal ultrasonography identified was endometrial hyperplasia (9.5%, 8/84). Less common findings were submucous fibroid (8.3%, 7/84) and endometrial polyp (6%, 5/84). Transvaginal

Table 7. Comparison of Sensitivity, Specificity, PPV, and NPV between transvaginal ultrasonography and hysteroscopy

	Transvaginal ultrasonography	Hysteroscopy
Sensitivity	60 %	80.7 %
Specificity	96.3 %	93.1 %
PPV	90 %	84 %
NPV	81.2 %	91.5 %

PPV - positive predictive value; NPV - negative predictive value.

Table 8. Comparison of previous studies to our study

Author	Method of diagnosis	Sensitivity	Specificity	PPV	NPV	Accuracy
Mathew *et al.* [23]	transvaginal ultrasonography	54	100	100	81.1	-
	-	-	-	-	-	-
Epstein *et al.* [24]	transvaginal ultrasonography	49	86	84	88	-
	hysteroscopy	100	84	86.6	94	-
Kelekci *et al.* [25]	transvaginal ultrasonography	56.3	72	56.3	72.0	65.8
	hysteroscopy	87.5	100	100	92.6	95.0
Barati *et al.* [26]	transvaginal ultrasonography	96.8	97	94	78.9	-
	hysteroscopy	97.8	99	94	99	-
Grimbizis *et al.* [22]	transvaginal ultrasonography	84.09	56.0	-	-	-
	hysteroscopy	97.26	92.0	-	-	-
Vitner *et al.* [21]	transvaginal ultrasonography	93	58	84.3	78.3	-
	hysteroscopy	92	67.7	87.3	77.7	-
el Tabbakh *et al.* [27]	transvaginal ultrasonography	77	94.6	84.4	91.6	89.8
	hysteroscopy	75.6	94.6	84.4	91.6	89.8
Goyal *et al.* [28]	transvaginal ultrasonography	95.23	94.82	93.01	96.49	-
	-	-	-	-	-	-
Tsonis *et al.* [29]	transvaginal ultrasonography	84.0	86.8	95.3	63.0	84.7
	hysteroscopy	98.9	95.1	98.4	93.9	97.3
Our study	transvaginal ultrasonography	60	96.3	90	81.2	83.3
	hysteroscopy	80.7	93.1	84	91.5	89.3

PPV - positive predictive value; NPV - negative predictive value.

ultrasonography diagnosed hyperplasia, endometrial polyp, and myomas with a specificity of 96.3%. Transvaginal ultrasonography made a false-positive diagnosis of hyperplasia in 2 cases, missed the diagnosis of endometrial polyp in 5 cases, and submucous fibroid in 5 cases. It had misdiagnosed 5 cases of polyps as normal proliferative endometrium in 2 cases, hyperplasia in 1 case, and myoma in 2

cases. Transvaginal ultrasonography misdiagnosed five submucous fibroids as a polyp in 1 case and normal secretory endometrium in 4 cases (Table 4).

Out of 84 patients, 59 patients (70.24%) had normal hysteroscopic findings. Whereas 10 cases of myoma (11.9%), 9 cases of polyp (10.7%), and 6 cases of endometrial hyperplasia (7.1%) were contingent upon the findings of hysteroscopy. Histopathology revealed 6 cases of simple endometrial hyperplasia out of 59 patients with normal hysteroscopic findings (10.17%). One case of polyp detected by hysteroscopy was diagnosed as complex endometrial hyperplasia based on histopathological examination. Transvaginal ultrasonography demonstrated 91.7% accuracy in determining hyperplasia, 92.9% accuracy in detecting polyp, and 91.7% accuracy in diagnosing myoma. On the other hand, hysteroscopy demonstrated an accuracy of 97.6% in determining intrauterine pathologies like endometrial polyp, 100% for submucous fibroid, and 89.2% for hyperplasia (Table 5).

Even though hysteroscopy diagnosed 6 cases as hyperplasia, histopathology showed them to be endometrial polyps in 1 case and normal secretory endometrium in 5 cases. The accuracy of hysteroscopy in this study was 89.3%. As per the histopathological examination, 54 of them were normal endometrium. Of the abnormal findings, 8 were simple hyperplasia, followed by 7 of them being polyp. Only 1 case of adenocarcinoma was identified by histopathology and was treated by total hysterectomy and chemo-radiotherapy (Table 6). Overall sensitivity for transvaginal ultrasonography was (60%) lower with higher specificity (96.3%) than hysteroscopy findings. The negative predictive value was higher for hysteroscopy (91%) (Table 7).

DISCUSSION

In our study, the majority of women with AUB fall between the age group of 41-50, and most of the women had ongoing symptoms of AUB lasting for more than six months. Menorrhagia was the most commonly reported symptom, followed by polymenorrhagia, polymenorrhea, and metrorrhagia. Similarly, van Trotsenburg *et al.* reported a maximum incidence of AUB between 41-50 years of age[12]. Panda *et al.* ranked 60% menorrhagia cases, next to metrorrhagia and polymenorrhagia[13].

Endometrial pathologies associated with AUB popularly go by the acronym PALM-COEIN, a widely known system coined by FIGO in 2011. PALM-COEIN refers to structural or focal endometrial pathologies such as a polyp, adenomyosis, leiomyoma, malignancy, and hyperplasia; and functional etiological causes such as coagulopathy, ovulatory dysfunction, iatrogenic and not yet classified[14]. The Endometrial thickness can vary between 4 mm to 12 mm in premenopausal women[15]. However, in postmenopausal women, endometrium more than 4mm to 5mm is considered abnormal, requiring further evaluation[11]. The cut-off value for the endometrial thickness to be considered normal was 12 mm in our study. Sixty-four patients (76.19%) had normal endometrium based on the transvaginal ultrasonography reports, and 59 cases (79.24%) were identified as normal endometrium by hysteroscopy. Ozdemir *et al.* studied 144 women and found that the endometrial thickness of 8 mm was more sensitive and specific with a 95.6% NPV and 36.3% PPV in detecting endometrial pathologies. 113 patients (78.4%) had normal endometrium and 31 (21.6%) had an abnormal endometrium composed of 11.8% hyperplasia, 4.2% endometrial polyp[16].

Transvaginal ultrasonography has become the first line of modality in assessing AUB due to its availability, economic feasibility, and non-invasive nature of the test. It aids in faster screening of endometrium to rule out any structural abnormalities[17]. However, transvaginal ultrasonography has previously shown lower efficacy in diagnosing focal intra-cavitary endometrial pathologies[18]. On the other hand, Hysteroscopy has been considered long as the gold standard in diagnosing endometrial pathologies due to its high efficacy[17]. However, hysteroscopy might be redundant in cases of AUB after identifying endometrium as normal with transvaginal ultrasonography[6].

In our study, the most common endometrial pathology detected by transvaginal ultrasonography was endometrial hyperplasia (9.5%), followed by submucous fibroid (8.3%) and endometrial polyp (6%). The sensitivity, specificity, positive predictive value, NPV for transvaginal ultrasonography was 60%, 96.3%, 90%, and 81.2%, respectively. The accuracy of transvaginal ultrasonography was 83.3%. Our findings are similar to an old study that demonstrated the same findings[19]. In a prospective

observational study, endometrial polyp was reported as the most common lesion detected on performing transvaginal ultrasonography in women with AUB[20].

The most common lesion detected by hysteroscopy in our study was endometrial myoma (12 %), followed by polyp (10.7%) and hyperplasia (7.1%). The sensitivity, specificity, positive predictive value, NPV for hysteroscopy were 80.7%, 93.1%, 84% and 91.5% respectively. The accuracy of hysteroscopy was 89.3%. Likewise, Ozdemir *et al.* reported endometrial myoma as the most common lesion detected by hysteroscopy, followed by polyp and hyperplasia[16].

Histopathological reports in our study showed 30 (35.7%) of them to be secretory endometrium (<12 mm), 24 (28.57%) of them to be in a proliferative state, 7 (8.3%) of them had a polyp, 2 (2.38%) of them being fibroid polyp, 8 (9.52%) of them being simple hyperplasia, and 2(2.38%) being complex hyperplasia. One woman had adenocarcinoma in this cohort and was further evaluated and treated. Wamsteker *et al.* (1983) derived polyp in the endometrium in 19% of the cases, hyperplasia of endometrium in 12.2% of the cases, and submucous myoma in 7.8% of the cases[19].

In our study, we found that hysteroscopy was more efficient and accurate in detecting endometrial focal pathologies than transvaginal ultrasonography. Transvaginal ultrasonography was slightly more sensitive in differentiating normal from an abnormal endometrium, whereas hysteroscopy was more specific. However, Vitner *et al.* (2013) reported slightly better sensitivity and negative predictive value of transvaginal ultrasonography than hysteroscopy in detecting focal endometrial pathologies[21]. Grimbizis *et al.* studied 98 women who underwent transvaginal ultrasonography and hysteroscopy for evaluation of AUB. The mean age of the patients was 43.3 years, with 36.8% women being nulliparous. This study demonstrated higher sensitivity, specificity, positive predictive value, and NPV of hysteroscopy compared with transvaginal ultrasonography which was comparable with our study[22]. Likewise, several other studies had similar findings [23–29]. These studies have been summarized in Table 8. However, we found the specificity of transvaginal ultrasonography to be greater than hysteroscopy, especially in identifying endometrial hyperplasia, possibly due to our study's small sample size.

CONCLUSION

Prior studies have demonstrated that hysteroscopy is the gold standard for diagnosing AUB. Our study confirms the same and adds to the existing pool of studies. The diagnostic accuracy of hysteroscopy is higher as compared to dilatation and curettage for the lesions within the endometrial cavity. Hysteroscopy with biopsy is more accurate for intracavitary lesions. Diagnostic adequacy is important for the selection of reliable treatment of AUB and avoidance of unnecessary surgical intervention. Transvaginal ultrasonography and outpatient hysteroscopy can be used in the initial evaluation of women with AUB to make a quick diagnosis and initiate appropriate treatment, especially in countries with high inpatient load with limited resources.

Conflict of Interest

The authors declare no conflict of interest.

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Research protocol was approved by the Institutional Review Board or Ethics Committee before the study began. All human participants gave written informed consent before the study began.

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References

1. Narice BF, Delaney B, Dickson JM. Endometrial sampling in low-risk patients with abnormal uterine bleeding: a systematic review and meta-synthesis. BMC Family Practice. 2018;19(1):135. doi:10.1186/s12875-018-0817-3
2. Davis E, Sparzak PB. Abnormal Uterine Bleeding. StatPearls Publishing; 2021. Accessed April 28, 2021. http://www.ncbi.nlm.nih.gov/pubmed/30422508
3. Critchley HOD, Babayev E, Bulun SE, et al. Menstruation: science and society. American Journal of Obstetrics and Gynecology. 2020;223(5):624-664. doi:10.1016/j.ajog.2020.06.004
4. Matteson KA, Raker CA, Clark MA, Frick KD. Abnormal uterine bleeding, health status, and usual

source of medical care: Analyses using the medical expenditures panel survey. Journal of Women's Health. 2013;22(11):959-965. doi:10.1089/jwh.2013.4288
5. Uterine Bleeding: Abnormal Uterine Bleeding | Cleveland Clinic. Accessed June 22, 2021. https://my.clevelandclinic.org/health/diseases/15428-uterine-bleeding-abnormal-uterine-bleeding
6. Kolhe S. Management of abnormal uterine bleeding – focus on ambulatory hysteroscopy. International Journal of Women's Health. 2018;10:127-136. doi:10.2147/IJWH.S98579
7. ACOG Committee Opinion No. 734: The Role of Transvaginal Ultrasonography in Evaluating the Endometrium of Women With Postmenopausal Bleeding. Obstetrics and gynecology. 2018;131(5):e124-e129. doi:10.1097/AOG.0000000000002631
8. NICE. Heavy menstrual bleeding: assessment and management (CG44). Nice. 2007;(January). Accessed June 22, 2021. https://www.nice.org.uk/guidance/cg44
9. Nijkang NP, Anderson L, Markham R, Manconi F. Endometrial polyps: Pathogenesis, sequelae and treatment. SAGE Open Medicine. 2019;7:205031211984824. doi:10.1177/2050312119848247
10. Nayak B, Parida S, Rautray PN, Mohapatra J, Samantaray S, Giri SK. Transvaginal Sonography (TVS) in Evaluation of Endometrial Carcinoma and Its Correlation with Histopathology: A Retrospective Analysis. Indian Journal of Gynecologic Oncology. 2017;15(1):12. doi:10.1007/s40944-016-0095-8
11. Khafaga A, Goldstein SR. Abnormal Uterine Bleeding. Obstetrics and Gynecology Clinics of North America. 2019;46(4):595-605. doi:10.1016/j.ogc.2019.07.001
12. van Trotsenburg M, Wieser F, Nagele F. Diagnostic hysteroscopy for the investigation of abnormal uterine bleeding in premenopausal patients. Contributions to gynecology and obstetrics. 2000;20:21-26. doi:10.1159/000060284
13. Panda A, Parulekar S, Gupta A. Diagnostic hysteroscopy in abnormal uterine bleeding and its histopathological correlation. The Journal of Obstetrics and Gynecology of India. 1999;175:74-76. doi:10.21276/obgyn.2021.7.2.24
14. Munro MG, Critchley HOD, Fraser IS. The FIGO classification of causes of abnormal uterine bleeding. International Journal of Gynecology and Obstetrics. 2011;113(1):1-2. doi:10.1016/j.ijgo.2011.01.001
15. Tsuda H, Ito YM, Todo Y, et al. Measurement of endometrial thickness in premenopausal women in office gynecology. Reproductive medicine and biology. 2018;17(1):29-35. doi:10.1002/rmb2.12062
16. Özdemir S, Çelik Ç, Gezginç K, KIreşi D, Esen H. Evaluation of endometrial thickness with transvaginal ultrasonography and histopathology in premenopausal women with abnormal vaginal bleeding. Archives of Gynecology and Obstetrics. 2010;282(4):395-399. doi:10.1007/s00404-009-1290-y
17. Dueholm M, Hjorth IMD. Structured imaging technique in the gynecologic office for the diagnosis of abnormal uterine bleeding. Best Practice and Research: Clinical Obstetrics and Gynaecology. 2017;40:23-43. doi:10.1016/j.bpobgyn.2016.09.010
18. Erdem M, Bilgin U, Bozkurt N, Erdem A. Comparison of transvaginal ultrasonography and saline infusion sonohysterography in evaluating the endometrial cavity in pre- and postmenopausal women with abnormal uterine bleeding. Menopause (New York, NY). 2007;14(5):846-852. doi:10.1097/gme.0b013e3180333a6b
19. Wamsteker K. Hysteroscopy in the management of abnormal uterine bleeding. In: Siegler AM, Lindeman HJ, eds. Hysteroscopy: Principles and Practice. 1st ed. JB Lippincott; 1983:128-131.
20. Goyal BK, Gaur CI, Sharma GCS, Saha MA, Das NK. Transvaginal sonography versus hysteroscopy in evaluation of abnormal uterine bleeding. Medical Journal Armed Forces India. 2015;71(2):120-125. doi:10.1016/j.mjafi.2014.12.001
21. Vitner D, Filmer S, Goldstein I, Khatib N, Weiner Z. A comparison between ultrasonography and hysteroscopy in the diagnosis of uterine pathology. European journal of obstetrics, gynecology, and reproductive biology. 2013;171(1):143-145. doi:10.1016/j.ejogrb.2013.08.024
22. Grimbizis GF, Tsolakidis D, Mikos T, et al. A prospective comparison of transvaginal ultrasound, saline infusion sonohysterography, and diagnostic hysteroscopy in the evaluation of endometrial pathology. Fertility and sterility. 2010;94(7):2720-2725. doi:10.1016/j.fertnstert.2010.03.047
23. Mathew M, Gupta R, Krolikowski A. Role of transvaginal ultrasonography and diagnostic hysteroscopy in the evaluation of patients with abnormal uterine bleeding. International Journal of Gynecology & Obstetrics. 2000;71(3):251-253. doi:10.1016/S0020-7292(00)00272-1
24. Epstein E, Ramirez A, Skoog L, Valentin L. Transvaginal sonography, saline contrast sonohysterography and hysteroscopy for the investigation of women with postmenopausal bleeding and endometrium > 5 mm. Ultrasound in obstetrics & gynecology : the official journal of the International Society of Ultrasound in Obstetrics and Gynecology. 2001;18(2):157-162. doi:10.1046/j.1469-0705.2001.00472.x
25. Kelekci S, Kaya E, Alan M, Alan Y, Bilge U, Mollamahmutoglu L. Comparison of transvaginal sonography, saline infusion sonography, and office hysteroscopy in reproductive-aged women with or without abnormal uterine bleeding. Fertility and sterility. 2005;84(3):682-686. doi:10.1016/j.fertnstert.2005.03.036

26. Barati M, Masihi S, Moramezi F, Salemi S. Office Hysteroscopy in Patients with Abnormal Uterine Bleeding and Normal Transvaginal Sonography. International Journal of Fertility and Sterility. 2008;1(4):175-178. doi:10.22074/IJFS.2007.46212.
27. El-tabbakh BMN, Slamka P. Transvaginal Sonohysterography (Tv-Sh), Versus Hysterosalpingography (Hsg) And Laparoscopy | OBGYN.Net. Published online 2011:1-11. Accessed April 17, 2021. https://www.contemporaryobgyn.net/view/transvaginal-sonohysterography-tv-sh-versus-hysterosalpingography-hsg-and-laparoscopy
28. Goyal BK, Gaur I, Sharma S, Saha A, Das NK. Transvaginal sonography versus hysteroscopy in evaluation of abnormal uterine bleeding. Medical journal, Armed Forces India. 2015;71(2):120-125. doi:10.1016/j.mjafi.2014.12.001
29. Tsonis O, Gkrozou F, Dimitriou E, Paschopoulos M. Comparative retrospective study on transvaginal sonography versus office hysteroscopy in the diagnosis of endometrial pathology among different subgroups. Journal of Obstetrics and Gynaecology Research. 2021;47(2):669-678. doi:10.1111/jog.14580