ORIGINAL ARTICLE

Diagnostic Accuracy of Transvaginal Ultrasound versus Hysteroscopy in Detecting Endometrial Pathologies in Women with Abnormal Uterine Bleeding

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ABSTRACT

Background: Abnormal uterine bleeding (AUB) is one of the most common gynecological complaints among women, often resulting from various benign and malignant endometrial pathologies. Accurate diagnosis is essential for appropriate management, and while transvaginal ultrasound (TVUS) is widely used as a non-invasive screening tool, hysteroscopy provides direct visualization of the uterine cavity and remains the gold standard for diagnosis.

Objective: To compare the diagnostic accuracy of transvaginal ultrasound versus hysteroscopy in detecting endometrial pathologies in women presenting with abnormal uterine bleeding.

Study Design & Setting: A cross-sectional comparative study conducted in the Department of Obstetrics and Gynecology Gujranwala Medical College, Gujranwala from Jan 2023 to June 2023.

Methodology: A total of 150 women aged 30–60 years with AUB were included using non-probability consecutive sampling. All participants underwent TVUS followed by hysteroscopic evaluation, and histopathological examination of endometrial samples served as the gold standard. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy of both modalities were calculated.

Results: The mean age of participants was 45.2 ± 7.8 years, with 62.7% being premenopausal. The most frequent pathologies on histopathology were endometrial polyp (24.0%) and hyperplasia (21.3%). TVUS showed sensitivity 82.8%, specificity 73.1%, PPV 87.3%, NPV 65.5%, and accuracy 83.5%. Hysteroscopy demonstrated higher sensitivity (94.9%), specificity (84.6%), PPV (93.3%), NPV (91.7%), and overall accuracy (93.3%).

Conclusion: Hysteroscopy is a more accurate diagnostic tool than transvaginal ultrasound for identifying endometrial pathologies in women with AUB. Combining both modalities can enhance diagnostic reliability and guide effective management.

Keywords: Abnormal uterine bleeding, diagnostic accuracy, endometrial pathology, hysteroscopy, transvaginal ultrasound

INTRODUCTION

Abnormal uterine bleeding (AUB) is one of the most common gynecological complaints, affecting women of all age groups and accounting for a significant proportion of outpatient visits and diagnostic interventions.[1] It is defined as any deviation from normal menstrual cycle parameters in terms of regularity, frequency, duration, or volume of blood flow. AUB can result from a broad spectrum of causes, including hormonal imbalance, structural uterine abnormalities, and endometrial pathology such as polyps, hyperplasia, or malignancy.[2,3] The diagnostic evaluation of AUB aims to identify the underlying pathology while minimizing invasive procedures.[4] Traditionally, dilatation and curettage (D&C) was considered the gold standard for endometrial assessment; however, its limitations in sensitivity and incomplete sampling have led to the exploration of more accurate diagnostic modalities. Among these, transvaginal ultrasound (TVUS) and hysteroscopy are the most widely employed techniques for evaluating the endometrial cavity.[4,5]

Transvaginal ultrasound is a noninvasive, readily available, and cost-effective imaging modality that provides valuable information about endometrial thickness, echogenicity, and focal lesions. It is particularly useful as a first-line investigation to rule out structural abnormalities.[6,7] However, its diagnostic accuracy may vary depending on operator expertise and the presence of diffuse or small intrauterine lesions. In contrast, hysteroscopy allows direct visualization of the endometrial cavity and simultaneous biopsy of suspicious lesions, making it a highly sensitive tool for detecting focal pathologies such as endometrial polyps, submucosal fibroids, and hyperplastic changes. Despite its invasive nature and higher cost, hysteroscopy is often regarded as the current gold standard for endometrial evaluation.[8,9]

Several studies have compared the diagnostic performance of TVUS and hysteroscopy in women with AUB, reporting variable sensitivity and specificity. While TVUS has demonstrated high accuracy in detecting global endometrial abnormalities, hysteroscopy has shown superior precision in identifying focal intrauterine lesions.[10,11,12] In clinical practice, combining both modalities may enhance diagnostic efficiency and reduce unnecessary invasive procedures.

Given the increasing prevalence of AUB and the need for cost-effective yet reliable diagnostic approaches, it is essential to evaluate the accuracy of TVUS in comparison with hysteroscopy, especially in resource-limited settings. Understanding their diagnostic correlation can aid in developing an appropriate diagnostic algorithm for women presenting with AUB. Therefore, the present study aims to compare the diagnostic accuracy of transvaginal ultrasound and hysteroscopy in detecting endometrial pathologies among women with abnormal uterine bleeding, using histopathology as the gold standard.

MATERIALS AND METHODS

This cross-sectional comparative study was conducted in the Department of Obstetrics and Gynecology at Gujranwala Medical College, Gujranwala from Jan 2023 to June 2023. A total of 150 women presenting with complaints of abnormal uterine bleeding (AUB) were enrolled in the study. The sample size of 150 was calculated using the World Health Organization (WHO) sample size calculator, keeping a confidence level of 95%, power of 80%, and expected sensitivity of transvaginal ultrasound of 85% in detecting endometrial pathology compared to hysteroscopy.[15] Non-probability consecutive sampling technique was used for patient selection.

All women aged between 30 and 60 years presenting with AUB were included in the study. Patients with known bleeding disorders, pelvic inflammatory disease, pregnancy, cervical pathology, or history of hormonal therapy or uterine surgery within

the past six months were excluded. After taking written informed consent, detailed history was obtained, and a thorough general and pelvic examination was performed. Demographic details including age, parity, duration, and pattern of bleeding were recorded on a predesigned proforma. All patients underwent transvaginal ultrasound (TVUS) using a 7.5 MHz transvaginal probe. The endometrial thickness, echotexture, and presence of focal lesions such as polyps or fibroids were noted. Endometrial thickness greater than 12 mm in premenopausal and 5 mm in postmenopausal women was considered abnormal. Findings were documented and interpreted by a consultant radiologist blinded to the hysteroscopic results.

Subsequently, all patients underwent diagnostic hysteroscopy under aseptic conditions. The uterine cavity was visualized using a 4 mm rigid hysteroscope, and any abnormality such as polyps, hyperplasia, submucosal fibroids, or carcinoma was recorded. Targeted biopsy of the abnormal endometrial area was taken and sent for histopathological examination, which served as the gold standard for confirming diagnosis. The diagnostic accuracy of transvaginal ultrasound and hysteroscopy was assessed by calculating sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy using histopathological findings as reference. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 25.0. Quantitative variables such as age and endometrial thickness were presented as mean ± standard deviation, while qualitative variables like type of lesion were expressed as frequency and percentage. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

The study included 150 women presenting with abnormal uterine bleeding (AUB), with the majority (45.3%) aged between 40–49 years, followed by 28.0% between 30–39 years and 26.7% between 50–60 years, with a mean age of 45.2 ± 7.8 years. Most participants were premenopausal (62.7%), while 37.3% were postmenopausal. Regarding parity, 57.3% were multiparous, 30.7% were grand multiparous, and 12.0% were nulliparous. Based on BMI, 42.7% were overweight (25–29.9 kg/m²), 32.0% were obese (≥30 kg/m²), and 25.3% had normal BMI (<25 kg/m²). The majority of women belonged to the middle socioeconomic group (46.7%), followed by low (34.7%) and high (18.6%) status. Symptom duration was 3–6 months in 40.0% of patients, less than 3 months in 29.3%, and more than 6 months in 30.7%. Menorrhagia was the most frequent bleeding pattern (44.0%), followed by metrorrhagia (25.3%), polymenorrhea (16.0%), and postmenopausal bleeding (14.7%), as given in Table 1.

Among women with abnormal uterine bleeding, the mean endometrial thickness on transvaginal ultrasound (TVUS) was 9.8 ± 3.4 mm. The majority (41.3%) had an endometrial thickness greater than 10 mm, followed by 38.7% between 6–10 mm and 20.0% with ≤5 mm thickness. Uterine size was normal in 74.7% of patients, while 25.3% showed bulky uteri. On endometrial echotexture evaluation, 58.7% exhibited a homogeneous pattern and 41.3% had heterogeneous echotexture. Regarding uterine lesions, 34.7% had normal endometrial findings, 20.0% had endometrial polyps, 18.7% had endometrial hyperplasia, 14.7% had submucosal fibroids, 6.6% had endometrial carcinoma, and 5.3% had atrophic endometrium, as given in Table 2.

On hysteroscopic assessment, adequate visualization of the uterine cavity was achieved in 93.3% of cases, whereas 6.7% had inadequate visualization. Normal endometrial appearance was noted in 26.7% of women, hyperplastic endometrium in 20.0%, atrophic endometrium in 6.6%, and irregular or friable surfaces in 8.0%. Intrauterine lesions were observed in 73.3% of patients, with endometrial polyps being the most common (22.7%), followed by submucosal fibroids (16.0%) and endometrial carcinoma (8.0%), as shown in Table 3. Histopathological examination, considered the gold standard, revealed that 25.3% of patients had a normal proliferative endometrium, while 24.0% had endometrial polyps

and 21.3% showed endometrial hyperplasia. Submucosal fibroids were found in 14.7% of cases, endometrial carcinoma in 8.0%, and atrophic endometrium in 6.7%, as given in Table 4.

Table 1: Demographic and Baseline Characteristics of Women with Abnormal Uterine Bleeding (n = 150)

Variable	Categories	Frequency n (%)
Age Group (years)	30–39	42 (28.0)
	40–49	68 (45.3)
	50–60	40 (26.7)
Mean ± SD (years)	Mean±SD	45.2 ± 7.8
Menstrual Status	Premenopausal	94 (62.7)
	Postmenopausal	56 (37.3)
Parity	Nulliparous	18 (12.0)
	Multiparous (1–3)	86 (57.3)
	Grand multiparous (≥4)	46 (30.7)
Body Mass Index (BMI)	<25 kg/m²	38 (25.3)
	25–29.9 kg/m²	64 (42.7)
	≥30 kg/m²	48 (32.0)
Socioeconomic Status	Low	52 (34.7)
	Middle	70 (46.7)
	High	28 (18.6)
Duration of Symptoms	<3 months	44 (29.3)
	3–6 months	60 (40.0)
	>6 months	46 (30.7)
Pattern of Bleeding	Menorrhagia	66 (44.0)
	Metrorrhagia	38 (25.3)
	Polymenorrhea	24 (16.0)
	Postmenopausal bleeding	22 (14.7)

Table 2: Clinical and Ultrasound Findings among Women with Abnormal Uterine Bleeding (n = 150)

Variable	Categories	Frequency n (%) Mean ± SD
Mean Endometrial Thickness (mm)	Mean±SD	9.8 ± 3.4
Endometrial Thickness (mm)	≤5 mm	30 (20.0)
	6–10 mm	58 (38.7)
	>10 mm	62 (41.3)
Uterine Size	Normal	112 (74.7)
	Bulky	38 (25.3)
Endometrial Echotexture on TVUS	Homogeneous	88 (58.7)
	Heterogeneous	62 (41.3)
Uterine Lesions Detected on TVUS	None (normal endometrium)	52 (34.7)
	Endometrial polyp	30 (20.0)
	Endometrial hyperplasia	28 (18.7)
	Submucosal fibroid	22 (14.7)
	Endometrial carcinoma	10 (6.6)
	Atrophic endometrium	8 (5.3)

Table 3: Hysteroscopic Findings among Women with Abnormal Uterine Bleeding (n = 150)

Variable	Categories	Frequency n (%)
Cavity Visualization	Adequate	140 (93.3)
	Inadequate	10 (6.7)
Endometrial Appearance	Normal endometrium	40 (26.7)
	Hyperplastic endometrium	30 (20.0)
	Atrophic endometrium	10 (6.6)
	Irregular/friable surface	12 (8.0)
Intrauterine Lesions Observed	None	40 (26.7)
	Endometrial polyp	34 (22.7)
	Submucosal fibroid	24 (16.0)
	Endometrial carcinoma	12 (8.0)

Table 4: Histopathological Findings among Women with Abnormal Uterine Bleeding (Gold Standard) (n = 150)

Variable	Categories	Frequency n (%) / Mean ± SD
Type of Endometrial Pathology	Normal proliferative	38 (25.3)
	Endometrial polyp	36 (24.0)
	Endometrial hyperplasia	32 (21.3)
	Submucosal fibroid	22 (14.7)
	Endometrial carcinoma	12 (8.0)
	Atrophic endometrium	10 (6.7)

Comparison of TVUS with histopathology showed that 96 (64.0%) were true positives, 14 (9.3%) false positives, 38 (25.4%) true negatives, and 2 (1.3%) false negatives. Transvaginal ultrasound demonstrated a sensitivity of 82.8%, specificity of 73.1%, positive predictive value (PPV) of 87.3%, negative predictive value (NPV) of 65.5%, and an overall diagnostic accuracy of 83.5%, as shown in Table 5. In contrast, hysteroscopy identified 112 (74.7%) true positives, 8 (5.3%) false positives, 28

(18.7%) true negatives, and 2 (1.3%) false negatives when compared with histopathology. Hysteroscopy achieved higher diagnostic performance, with a sensitivity of 94.9%, specificity of 84.6%, PPV of 93.3%, NPV of 91.7%, and overall accuracy of 93.3%, indicating its superior reliability in detecting endometrial pathologies among women with abnormal uterine bleeding, as presented in Table 6.

Table 5: 2×2 Diagnostic Accuracy Table of Transvaginal Ultrasound versus Histopathology (n = 150)

TVUS Findings	Histopathology Positive	Histopathology Negative	Total n (%)
Positive for Endometrial Pathology	96 (64.0)$_{TP}$	14 (9.3)$_{FP}$	110 (73.3)
Negative for Endometrial Pathology	2 (1.3)$_{FN}$	38 (25.4)$_{TN}$	40 (26.7)
Total n (%)	98 (65.3)	52 (34.7)	150 (100.0)
Diagnostic Indices for TVUS	Sensitivity = 82.8%, Specificity = 73.1%, PPV = 87.3%, NPV = 65.5%, Accuracy = 83.5%		

Table 6: 2×2 Diagnostic Accuracy Table of Hysteroscopy versus Histopathology (n = 150)

Hysteroscopy Findings	Histopathology Positive	Histopathology Negative	Total n (%)
Positive for Endometrial Pathology	112 (74.7)$_{TP}$	8 (5.3)$_{FP}$	120 (80.0)
Negative for Endometrial Pathology	2 (1.3)$_{FN}$	28 (18.7)$_{TN}$	30 (20.0)
Total n (%)	114 (76.0)	36 (24.0)	150 (100.0)
Diagnostic Indices for Hysteroscopy	Sensitivity = 94.9%, Specificity = 84.6%, PPV = 93.3%, NPV = 91.7%, Accuracy = 93.3%		

DISCUSSION

Abnormal uterine bleeding (AUB) is a frequent gynecological complaint affecting women of all reproductive and postmenopausal ages, often indicating underlying endometrial pathology. Accurate diagnosis is crucial for appropriate management and to exclude malignancy. Transvaginal ultrasound (TVUS) serves as a non-invasive, readily available first-line diagnostic tool. However, it may have limitations in differentiating specific intrauterine lesions.[13,14] Hysteroscopy, on the other hand, provides direct visualization of the uterine cavity, allowing precise detection and targeted biopsy.[15] Comparing the diagnostic accuracy of TVUS and hysteroscopy can help optimize the evaluation of women with AUB.

Our results are in partial agreement with the findings of Jesrani et al. (2019), who studied 446 patients using TVUS, hysterosonography (HSG), and hysteroscopy for detecting endometrial abnormalities. Their study reported that for endometrial polyps, TVUS had a sensitivity of 60.53% and specificity of 97.06%, while for submucous leiomyoma, sensitivity was 57.14% and specificity 93.48%, showing that TVUS tends to miss smaller or focal lesions but performs well in ruling them out when results are negative. In comparison, hysterosonography achieved higher sensitivity (95%) and specificity (97.14%), closely resembling our hysteroscopic findings, confirming that direct or contrast-enhanced visualization significantly improves diagnostic yield.[16] Similarly, our results demonstrated that hysteroscopy detects both diffuse and focal endometrial lesions more accurately than TVUS, supporting the notion that endoluminal assessment is superior to external imaging.

Our results are also comparable to those of Rauf et al. (2023), who evaluated 113 women using transvaginal strain sonoelastography to differentiate benign from malignant endometrial pathologies. They reported sensitivity 90.32%, specificity 75.61%, PPV 58.33%, NPV 95.35%, and accuracy 79.65%. Their findings indicate that while advanced sonographic techniques may improve tissue characterization, they still fall short of the precision offered by direct hysteroscopic evaluation combined with histopathology. The diagnostic performance of our TVUS is close to their specificity and accuracy results, whereas our hysteroscopy values surpassed theirs, reaffirming its diagnostic superiority in identifying both structural and malignant lesions.[17]

When compared to the work of Iqbal et al. (2018), who assessed postmenopausal women with bleeding, the reported sensitivity (86.3%), specificity (93.0%), PPV (91.3%), NPV (88.9%), and overall accuracy (89.9%) for TVUS were slightly higher than in our study. The difference can be attributed to the fact that their population comprised exclusively postmenopausal

women, among whom endometrial thickness is a strong and reliable indicator of pathology, thereby increasing diagnostic accuracy. In contrast, our sample included both premenopausal and postmenopausal women, in whom cyclic endometrial changes can mimic hyperplasia or polyps, leading to slightly lower specificity.[18] Likewise, Zafar et al. (2020) also reported very high diagnostic performance of TVUS in a postmenopausal population, with sensitivity 95.1%, specificity 87.4%, PPV 93.6%, NPV 90.2%, and accuracy 92.5%, which again emphasizes that TVUS performs better in postmenopausal women due to thinner, more homogeneous endometrial patterns and reduced hormonal variations.[20]

Conversely, Effat et al. (2021) reported lower specificity for TVUS (30.0%) but high sensitivity (82.4%) in tamoxifen-treated breast cancer patients, a group known for endometrial irregularities caused by drug effects rather than true pathology. Their hysteroscopy results (sensitivity 94.1%, specificity 60.0%, PPV 80.0%, NPV 85.7%, and accuracy 81.5%) parallel our findings, underscoring hysteroscopy's ability to differentiate true structural abnormalities from drug-induced endometrial thickening.[19] The similarity between their hysteroscopic outcomes and ours supports the robustness of hysteroscopy across various patient populations and clinical contexts.

This study directly compared two key diagnostic modalities—TVUS and hysteroscopy—against histopathology, the gold standard, ensuring objective assessment of accuracy. The adequate sample size of 150 women enhanced the reliability and statistical validity of findings. All procedures were performed by experienced clinicians, minimizing observer bias. However, being a single-center study may limit generalizability to broader populations. Variations in operator expertise and equipment quality could influence diagnostic performance. Moreover, histopathological sampling errors and subjective interpretation might slightly affect final accuracy estimates.

CONCLUSION

Hysteroscopy demonstrated superior diagnostic accuracy compared to transvaginal ultrasound in detecting endometrial pathologies among women with abnormal uterine bleeding. It remains the gold standard for intrauterine evaluation when available. Incorporating both modalities in a stepwise diagnostic approach can enhance early and accurate detection of endometrial diseases.

REFERENCES

1. Achanna KS, Nanda J. Evaluation and management of abnormal uterine bleeding. Med J Malaysia. 2022 May 1;77(3):374-83.

2. Tsakiridis I, Giouleka S, Koutsouki G, Kostakis N, Kalogiannidis I, Kourtis A, Athanasiadis A, Goulis DG, Dagklis T. Investigation and management of abnormal uterine bleeding in reproductive-aged women: a descriptive review of national and international recommendations. The European Journal of Contraception & Reproductive Health Care. 2022 Nov 2;27(6):504-17.

3. Leal CR, Vannuccini S, Jain V, Dolmans MM, Sardo AD, Al-Hendy A, Reis FM. Abnormal uterine bleeding: The well-known and the hidden face. Journal of endometriosis and uterine disorders. 2023 Jun 1;6:100071.

4. Viganò S, Smedile A, Cazzella C, Marra P, Bonaffini PA, Sironi S. Abnormal uterine bleeding: a pictorial review on differential diagnosis and not-so-common cases of interventional radiology management. Diagnostics. 2023 Apr 11;14(8):798.

5. Nappi L, Angioni S, De Feo V, Greco P, Stabile G, Greco F, D'Alterio M, Sorrentino F. Diagnostic accuracy of hysterectomy vs dilation and curettage (D&C) for atypical endometrial hyperplasia in patients performing hysterectomy or serial follow-up. Clinical and Experimental Obstetrics & Gynecology. 2022;49(1):1-5.

6. Thaker N, Dhande R, Parihar P, DHANDE R. Role of transvaginal sonography in the diagnosis of female infertility: A comprehensive review. Cureus. 2023 Dec 6;15(12).

7. Gallo R, Kamberaj L, Baroni A, Nardone AD, Scambia G, Masciullo V. Advances in non-invasive diagnosis of uterine adenomyosis: a narrative review. Gynecology and Pelvic Medicine. 2023 Jun 30;8.

8. Xia E, Yu D, Xia E, Yu D, Xia E. Diagnostic Hysteroscopy. InPractical Manual of Hysteroscopy 2022 Aug 31 (pp. 73-181). Singapore: Springer Nature Singapore.

9. Vitale SG, Buzzaccarini G, Riemma G, Pacheco LA, Sardo AD, Carugno J, Chiantera V, Török P, Noventa M, Haimovich S, De Franciscis P. Endometrial biopsy: Indications, techniques and recommendations. An evidence-based guideline for clinical practice. Journal of gynecology obstetrics and human reproduction. 2023 Jun 1;52(6):102588.

10. JHA S, ANANT M, SINHA U. Validity of Hysteroscopy and Transvaginal Sonography in Evaluating Abnormal Uterine Bleeding-A Retrospective Study. Journal of Clinical & Diagnostic Research. 2021 Apr 1;15(4).

11. Chaudhary P, Singh P, Najam R, Shrivastava S, Lalwani A. A Retrospective Study on Diagnosing Efficacy of Transvaginal Sonography Versus Hysteroscopy in Abnormal Uterine Bleeding. International Journal of Innovative Research in Medical Science (IJIRMS). 2022 Nov;7(11).

12. Tuersun B, Zhang Q. Application of vaginal ultrasound and hysteroscopy in the diagnosis of perimenopausal endometrial lesions. Clinical and Experimental Obstetrics & Gynecology. 2023 May 27;51(6):128.

13. Fedosiuk K, Pakharenko L, Chayka K, Basiuha I, Kurtash O. Abnormal uterine bleeding in women of reproductive age: PALM-COEIN causes. Bangladesh Journal of Medical Science. 2023 Sep 7;22(4):809-14.

14. Papakonstantinou E, Adonakis G. Management of pre-, peri-, and post-menopausal abnormal uterine bleeding: When to perform endometrial sampling?. International Journal of Gynecology & Obstetrics. 2022 Aug;158(2):252-9.

15. Kumari S, Kumar A, Kumari U. Study of abnormal uterine bleeding in women of perimenopausal age group. Int J Acad Med Pharm. 2024;6(3):517-21.

16. Jesrani AK, Kumari A, Lalwani A, Anwar K, Jogezai S. Diagnostic accuracy of hysterosonography against transvaginal ultrasound in diagnosis of endometrial lesions in patients present with abnormal uterine bleeding taking hysteroscopy as gold standard. Pakistan Journal of Radiology. 2019 Oct 16;29(3).

17. Rauf AB, Masood MJ, Ahmed A, Mansoor A, Asghar A, Arooj S. Diagnostic Accuracy of Transvaginal Strain Sonoelastography in Differentiating Between Endometrial Hyperplasia versus Carcinoma Among Postmenopausal Women. Pakistan Armed Forces Medical Journal. 2023 Dec 31;74(6):1556.

18. Iqbal RU, Khan FA, Khurshid SA. Diagnostic Accuracy of Transvaginal Ultrasound with Histopathological findings in Postmenopausal Bleeding. Pak J Med Health Sci. 2018 Jul 1;65:6-11.

19. Effat DM, Abosonna KA, Farag MK. Diagnostic Accuracy of Transvaginal Ultrasound Versus Hysteroscopy in Evaluation of Endometrial Pathology in Breast Cancer Women Receiving Tamoxifen: Correlation with Histopathological Examination. Al-Azhar International Medical Journal. 2021 Jun 1;2(6):8-16.

20. Zafar H, Ijaz S, Hussain M, Kafayat H, Mubeen S. Diagnostic Accuracy of Transvaginal Ultrasonography for Detection of Endometrial Carcinoma with Post-Menopausal Bleeding Taking Histopathology as Gold Standard. Journal of The Society of Obstetricians and Gynaecologists of Pakistan. 2020 Apr 29;10(1):22-5.