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SENSITIVITY & SPECIFICITY OF TRANSVAGINAL ULTRASONOGRAPHY IN DETECTING ENDOMETRIAL PATHOLOGY OF POSTMENOPAUSAL BLEEDING

[1]*Dr. Berkheez Shabir, [2]Dr. Rehana Afshan and [3]Dr. Zahoor Hussain Daraz

[1]MBBS, MS (Obstetrics & Gynaecology).
[2]MBBS, MD (Radiology & Imaging).
[3]MBBS, MD (Paediatrics).

***Corresponding Author: Dr. Berkheez Shabir**

MBBS, MS (Obstetrics & Gynaecology).

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ABSTRACT

Title: Sensitivity & specificity of Transvaginal Ultrasonography in detecting endometrial pathology of postmenopausal bleeding". **Introduction:** Menopausal women with endometrial pathology usually present with vaginal bleeding having several causes, such as exogenous estrogen usage, atrophic endometritis/vaginitis, endometrial cancer, endometrial/cervical polyps and endometrial hyperplasia. Postmenopausal bleeding represents 5% of all gynecologic outpatient attendances. Lately, Transvaginal Ultrasonography is one of the diagnostic modalities used to evaluate endometrial pathology in women with postmenopausal bleeding. Dilatation and curettage is still considered gold standard for the investigation of endometrial pathology. This study is aimed at determining the sensitivity and specificity of transvaginal sonography in detecting endometrial pathology by confirming it with histologic findings in women with postmenopausal bleeding. **Objective:** To determine the sensitivity, specificity, positive and negative predictive values of TVS in diagnosis of uterine pathology in postmenopausal bleeding. **Method:** A cross-sectional study was conducted in the Gynaecological Oncology Division of Department of Obstetrics and Gynaecology BSMMU on 64 menopausal women presenting with vaginal bleeding and visiting our outpatient department. Proper examination was done after taking a detailed history with the help of pre-designed data sheet. TVS was done in patients to measure the endometrial thickness following which fractional curettage was performed and all the biopsy samples were assessed. In this study the sensitivity, specificity, positive and negative predictive values of TVS in the diagnosis of uterine pathology in postmenopausal bleeding was evaluated. **Results:** Sixty-four menopausal women with postmenopausal bleeding were enrolled in the study. Of them, 09 candidates didn't comply with inclusion criteria and were excluded from the study; hence dropout rate was 14%. A total of 55 subjects were followed after TVS with fractional curettage and with histopathology report. Depending on the endometrial thickness the subjects were divided into two groups: ≤ 5mm (Group 1) and >5 mm (Group 2). There were 20 subjects in Group 1 and 35 subjects in Group 2. Out of 55 subjects 44 were in the age group of ≤ 60 years and rest were above 60 years of age. Among 20 subjects in Group1 (≤5mm) 5 subjects had endometrial pathology. Among 35 subjects in Group 2 (>5mm) total 31 subjects had abnormal endometrial pathology. The subjects with endometrial pathology were offered proper medical and surgical intervention accordingly. The sensitivity, specificity, positive and negative predictive values of TVS in the diagnosis of uterine pathology in PMB was evaluated by appropriate statistical analysis. Receiver operator curve (ROC) analysis was performed to determine a cutoff point (5.5mm) with highest sensitivity and specificity; furthermore, Fisher exact test and Independent T test among two groups were estimated and found significant. **Conclusion:** Transvaginal Ultrasonography has high sensitivity and specificity in determining endometrial pathology and there is a significant relation between endometrial thickness and endometrial pathology. Endometrial thickness of >5.5mm can be used as risk indicator in predicting endometrial pathology and endometrial thickness of >13mm can be used as a risk indicator for endometrial carcinoma.

KEYWORDS:
TVS: Transvaginal Ultrasonography
ROC: Receiver Operator Curve
PMB: Post-Menopausal Bleeding
BSMMU: Bangabandhu Sheikh Mujib Medical University.

INTRODUCTION

Postmenopausal bleeding (PMB) is defined as bleeding per vagina following established menopause. Menopausal women with endometrial pathology usually present with vaginal bleeding. Postmenopausal bleeding represents 5% of all gynecologic outpatient attendances.

Vaginal bleeding is the presenting symptom in 90% of patients with endometrial carcinoma of menopausal women[1], the majority of the patients with post-menopausal bleeding experience vaginal bleeding secondary to atrophic changes of vagina or endometrium. However, depending upon risk factors and age, around 14% patients have endometrial carcinoma.[2,3,4,5]

Endometrial pathology particularly endometrial cancer is the most common cancer found in women after the attainment of menopause in many countries including united states where 40,100 cases of endometrial cancer were noted in 2008 alone and 7470 patients died of the same disease.[6] The prevalence of endometrial cancer and hyperplasia was 1.0% and 5.8% in women of reproductive age and 3.0% and 12.1% in postmenopausal women, respectively. Thus a sound clinical approach is needed for diagnosis and exclusion of endometrial pathology. Endometrial pathology in women can present with post-menopausal bleeding & has several causes, such as exogenous estrogens usage, atrophic endometritis/vaginitis, endometrial cancer, tubercular endometritis, endometrial or cervical polyps, cervical malignancy, and endometrial hyperplasia.

These complaints may significantly affect quality of life of women and lead to increased surgical interventions and ultimately have significant impact on health care system. Dilatation and curettage (D&C) is still considered gold standard for the investigation of Postmenopausal bleeding (PMB).[7,8] This procedure has 2 main drawbacks- first it is an invasive one and has to be done under anesthesia, so it cannot be applied repeatedly in high risk women and those with recurrent bleeding. Second, it may miss lesions such as small polyps or small endometrial carcinoma. Several other methods are present for finding the cause of endometrial pathology and one of them is pelvic ultrasonography and especially TVS (Transvaginal ultrasonography).

Transvaginal ultrasonograhy uses higher frequency ultrasound at a greater proximity to the uterus and the endometrial-myometrial interface can be seen clearly than with the full bladder with trans-abdominal technique. Several studies have assessed the accuracy of Transvaginal ultrasonography (TVS) in evaluating the endometrium for malignancy. Measurement of endometrial thickness using Transvaginal ultrasonography (TVS) is helpful in diagnosis of endometrial pathology, including endometrial cancer and in assessment of myometrial invasion. It has been suggested in various studies and standard text books that an endometrial thickness (ET) of less than 5 mm measured by Transvaginal ultrasonography (TVS) in peri-menopausal and post-menopausal women with abnormal bleeding is unlikely to indicate any serious endometrial pathology like endometrial cancer, thus endometrial biopsy considered unnecessary.[9] Endometrial biopsy is usually considered unnecessary in post-menopausal uterine bleeding when endometrial thickness is less than 5mm as the risk of endometrial hyperplasia or cancer is low in such cases. In this study the accuracy of ET (Endometrial thickness) for diagnosis of EP (endometrial pathology) in postmenopausal bleeding will be evaluated. The clinical approach to post-menopausal bleeding requires prompt and efficient evaluation to exclude any endometrial pathology or diagnose carcinoma. Women with suspected endometrial pathology will be investigated initially with Transvaginal ultrasonography (TVS) and later endometrial biopsy.

Transvaginal ultrasonography has been excellent in visualization of endometrium indirectly and has been a standard alternative to invasive procedures with many reliable and satisfactory results. Maximum antero-posterior thickness of endometrium in long axis of trans-vaginal view of uterus is measured as the endometrial thickness (ET). The studies and reporting done earlier has compared the results of Transvaginal ultrasonography (TVS) with endometrial biopsy and has found consistently that the endometrial thickness of <4-5mm is not related with endometrial cancer in postmenopausal bleeding women.[10] There have been various reports & studies which showed high negative predictive values even touching 100% of TVS in excluding endometrial pathology making it a reliable first approach for a patient with suspected of endometrial pathology.[11,12] Transvaginal ultrasonography (TVS) has been seen very useful in a triage of patients in whom endometrial biopsy sample was insufficient for diagnosis.[13]

Lately, Transvaginal Ultrasonography (TVS) as a diagnostic modality used to evaluate endometrial pathologies in women with postmenopausal bleeding permits use of high frequency ultrasound waves at greater proximity to the uterus. Transvaginal sonography is superior to trans-abdominal ultrasonography in evaluation of most cases of endometrial pathology. Dilatation and curettage (D&C) is still considered gold standard for the investigation of endometrial pathology. Hence this study is aimed at determining the sensitivity and specificity of transvaginal sonography in detecting endometrial pathology by confirming it with histopathological findings in women with postmenopausal bleeding

MATERIALS AND METHODS

This was a cross-sectional study conducted in the Gynecological Oncology division of Department of Obstetrics & Gynaecology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh for 11/2 years after clearance from Institutional Review

board. All menopausal women presenting with vaginal bleeding at the Outpatient Department of Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh were taken into study and a non-random purposive sampling was done according to the availability of the patients who fulfilled the inclusion criteria. Women on drugs/hormones and with (endometrial carcinoma, vulvar, vaginal or cervical cancer, cervical polyp, myomatous polyp) were excluded. The purpose and procedure of the study was discussed with the patients after informed written consent was taken. For each and every subject a pre-designed structured data collection sheet was used for the collection the information. And the data was collected by taking detailed history, relevant clinical examination and doing relevant laboratory investigation. Transvaginal Ultrasonography (TVS) was done in all patients to measure the endometrial thickness in the department of Nuclear Medicine and Allied Sciences by the concerned radiologist using vaginal transducer. The vaginal probe was inserted into the vagina with the subject in the lithotomy position. Endometrial thickness was measured at the thickest point between the two basal layers on the anterior and posterior uterine walls and included both endometrial layers together in long axis or sagittal plane. After TVS fractional curettage was performed by the Gynecologist under general anesthesia/deep sedation in lithotomy position and separate endocervical and endometrial samples were collected and were send separately for histopathology, all the biopsy samples were assessed by the concerned Pathologist of Department of Pathology BSMMU.

Statistical analysis was done using Statistical Package for Social Science for Windows (SPSS20). Demographic profile and descriptive variables of all patients were extracted with mean and standard deviations and were jotted down in tabular and diagrammatic form. According to the endometrial thickness as per TVS reports, patients were divided into 2 groups, Group-1 (≤5mm) and Group-2 (>5mm). In this study, sensitivity, specificity, positive and negative predictive values of endometrial thickness by TVS were evaluated in detecting endometrial pathology, by appropriate statistical analysis using Independent T test, Fischer exact test and Likelihood ratio.

Receiver Operating Characteristic (ROC) curve was used to determine the best cut-off point of endometrial thickness for detection of endometrial pathology with highest possible sensitivity and specificity along with the cut off value of endometrial carcinoma.

RESULTS

Sixty-four menopausal women with postmenopausal bleeding were enrolled in the study. Of them, 09 candidates were withdrawn as they didn't comply with the inclusion criteria and few had insufficient sample for biopsy and thus were excluded from the study and hence dropout rate was 14% (Fig-I). 55 candidates fulfilled the criteria for study and thus were included in study.

All the subjects were followed after TVS with fractional curettage and histopathology report. The subjects with endometrial pathology were offered proper medical and surgical intervention accordingly. All the subjects were parous and none was nulliparous, 10 subjects had parity in the range of 1 to 3, forty subjects had parity ranging between 4 and 6, and rest of 5 subjects had parity above 7. Total of 19 subjects had hypertension and out of 55 subjects 44 were in the age group of ≤ 60 years and rest were above 60 years of age. (Table-1).

Descriptive statistics of the study population shows minimum endometrial thickness (ET) of 4mm, and maximum ET of 33mm with mean 9.9mm (SD±7.14). In this study population minimum age of subject was 41years, maximum was 76 years, mean age was 55.49±8.82 years and minimum menopausal age was 40 years, maximum was 55 years, and mean menopausal age was 46.1 ± 2.87(SD) years. Minimum parity was 1 and maximum parity was 8 with mean parity as 4.32 with standard deviation ±1.23. (Table -2).

Distribution of patients according to endometrial thickness by Transvaginal sonography (Table-3) showed 20 subjects having endometrial thickness (ET) ≤ 5mm, 20 subjects had endometrial thickness (ET) between 6mm to 10 mm, 6 subjects had endometrial thickness (ET) between 11mm to 15mm, 4 subjects had ET between 16mm to 20 mm, 2 subjects had ET between 21mm to 25mm, 1 subject had ET between 26mm to 30mm, 2 subjects had ET above 30mm.

Depending on the endometrial thickness the study population was divided into two groups: ≤ 5mm (Group-1) and >5 mm (Group-2). There were a total of 20 subjects in Group-1 and 35 subjects in Group-2. (Table-4).

Table-5 shows the distribution of endometrial pathologies in both the groups of study population according to endometrial thickness group 1 had total 15 cases with atrophy, 3 cases with hyperplasia, 2 cases with polyp and no carcinoma; Group 2 had total 4 cases with atrophy, 14 cases with hyperplasia, 6 cases with polyp, 11 cases with carcinoma.

Table-6 and Figure II shows endometrial pathology distribution in total study population after histopathology reports, endometrial atrophy constituted total of 19 cases out of 55 that makes a percentage of 34.55%, followed by endometrial hyperplasia which were 17 cases in total making 30.90%, followed by 11 cases of endometrial carcinoma making 20% and rest of 8 cases were endometrial polyp that makes a percentage of 14.55%. Figure III shows the same in bar diagram.

Among 20 subjects in Group1 (≤5mm) 5 subjects had endometrial pathology and 15 had normal biopsy findings and the difference was statistically significant with P value <0.0005). Among 35 subjects in Group 2 (>5mm) total 31 subjects had abnormal endometrial pathology and 4 patients had normal endometrial biopsy which was also found to be statistically significant (Table-7), (Fig-III). The subjects with endometrial pathology were offered proper medical and surgical intervention accordingly.

In the current study Endometrial Thickness of ≤5mm was chosen and sensitivity of 86.11%, specificity of 78.94%, positive predictive value 88.57% and negative predictive value as 75.00% along with accuracy of 83.63%, likelihood ratio + of 04 and likelihood ratio – of 0.52 were determined for the prediction of the endometrial pathology by TVS, (Table-8).

After determination of sensitivity and specificity at 5mm of endometrial thickness, both groups were compared with Fishers exact test and the association between the two groups was found statistically significant. (Table-9).

Figure-IV shows relationship of endometrial thickness with endometrial pathology in 2 groups.

According to (ROC) receiver operating characteristics curve analysis (Figure-V), the cut off value of endometrial thickness of 5.5 mm was determined with the help of Youden's index in detection of endometrial pathology in menopausal women with post-menopausal bleeding and this cut off had a sensitivity of 86% and specificity of 80%. (Table-10).

In addition to above (Figure-VI) shows another (ROC) receiver operating characteristics curve analysis showing cut off value of endometrial thickness of 13mm in detecting endometrial carcinoma which was determined with the help of Youden's index and this cut off had a sensitivity of 81.8% and specificity of 90.9%. (Table-11).

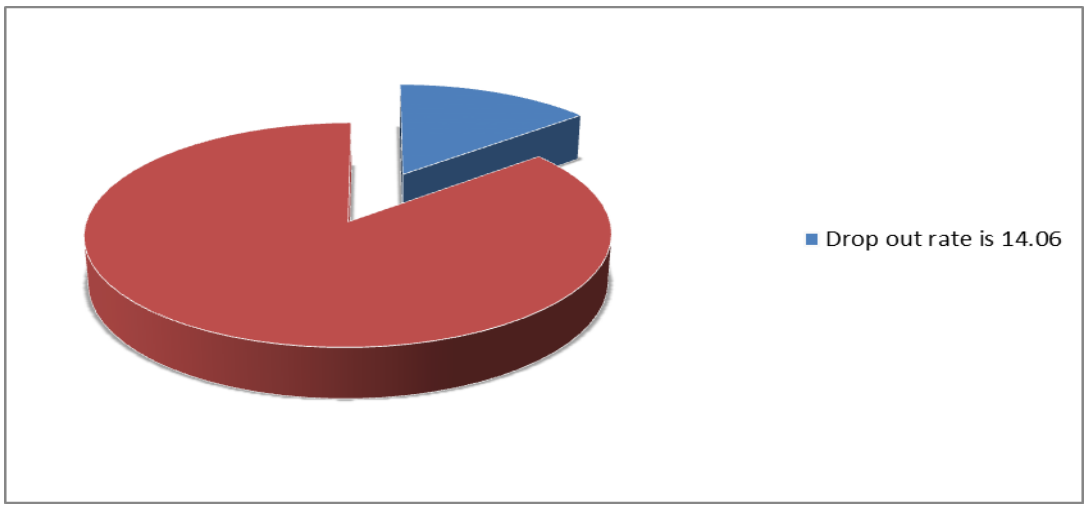

Figure 1: Pie diagram showing drop out percentage from study population.

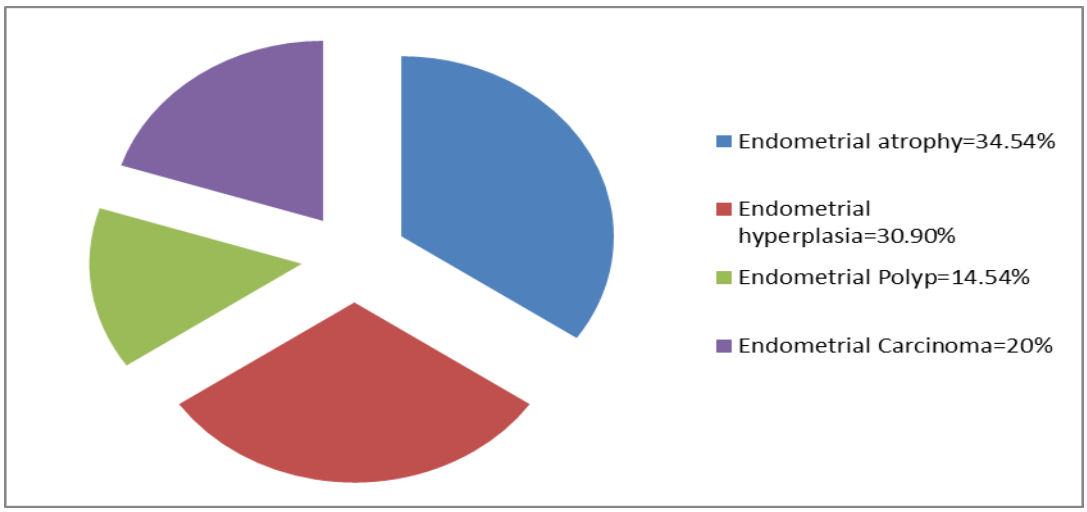

Figure II: Pie diagram showing percentage distribution of study population according to endometrial pathologies.

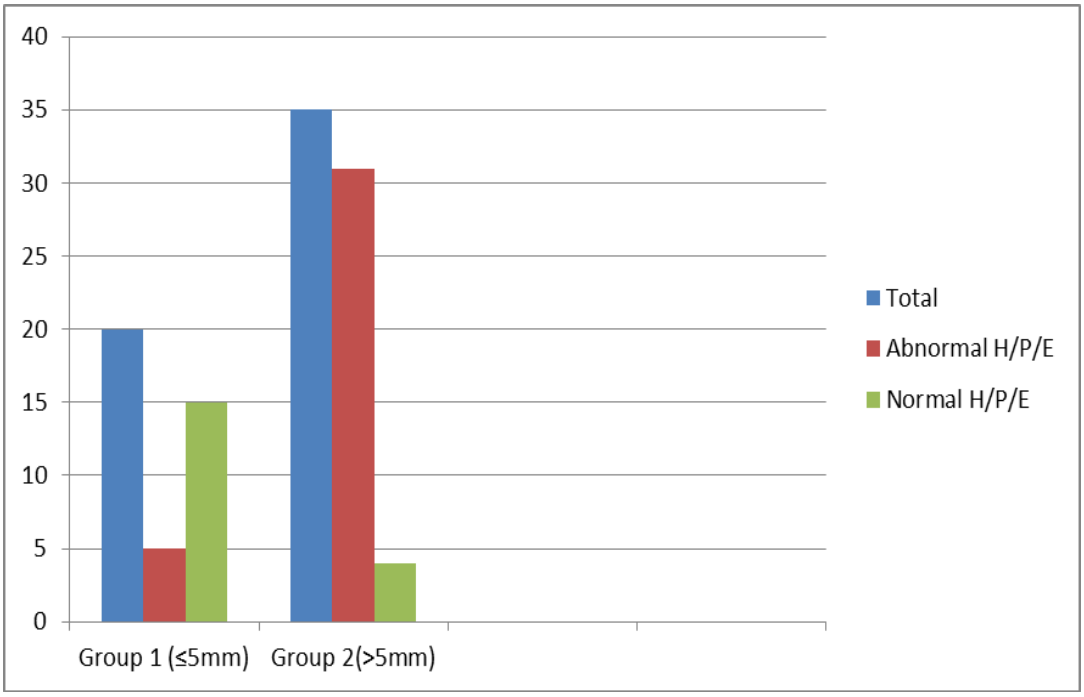

Figure III: Bar diagram showing distribution of cases according to histopathology in Group1 (≤5mm) and Group 2(>5mm).
H/P/E = Histopathological Examination

Table 1: Shows baseline characteristics of the study population with age and parity with mean menopausal age.

Baseline characteristics	Frequency	Percentage (%)
Age (years)		
45-60	44	80.0
>60	11	20.0
Parity		
a) Nulliparous	0	0.0
b) Para 1 – 3	10	18.2
c) Para 4 – 6	40	72.7
d) Para 7 – 9	5	9.1
Hypertension	19	34.5

Table 2: Shows the descriptive features of baseline characteristics of study population with range, mean of endometrial thickness, age, menopausal age and parity.

Characteristics	N	Minimum	Maximum	Mean	Std. Deviation
Endometrial Thickness (mm)	55	4.00	33.00	9.9582	7.14813
Age (Years)	55	41.00	76.00	55.490	8.82940
Menopausal Age (Years)	55	40.00	55.00	46.072	2.87296
Parity (Number)	55	1.00	8.00	4.3273	1.23310

Table 3: Shows distribution of women according to endometrial thickness on TVS (Transvaginal Ultrasound).

Endometrial Thickness on TVS (mm)	Frequency	Percentage (%)
≤5	20	36.4
6-10	20	36.4
11-15	06	10.9
16-20	04	7.3
21-25	02	3.6
26-30	01	1.8
>30	02	3.6

Table 4: Shows division of study population into two groups according to endometrial thickness i. e Group 1 and Group 2 and number of subjects in each group.

Endometrial thickness	No. of Patients	%
≤ 5mm (Group 1)	20	36.36
>5mm (Group 2)	35	63.63
Total	**55**	**100%**

Table 5: Shows distribution of endometrial pathology in study population based on endometrial thickness.

Endometrial Pathology	Endometrial Thickness ≤ 5mm Group I		Endometrial Thickness >5mm Group-II		P value
	No	%	No	%	
Endometrial Atrophy	15	75.0%	04	11.43%	<0.001*
Endometrial Hyperplasia	03	15.0%	14	40.0%	
Endometrial Polyp	02	10.0%	06	17.14%	
Endometrial Carcinoma	00	0.0%	11	31.43%	
Total	20	100.0%	35	100.0%	

Statistical analysis was performed using SPSS software 20 with Independent T test.
P = Significant < 0.05*

Table 6: Endometrial pathology distribution in total study population with number and percentage irrespective of groups.

Endometrial pathology	Group1 ≤5mm ET	Group2 >5mm ET	Total number	Percentage %
Endometrial atrophy	15	04	19	34.55
Endometrial Hyperplasia	03	14	17	30.90
Endometrial polyp	02	06	8	14.55
Endometrial Carcinoma	00	11	11	20.00
Total	20	35	55	100%

Table 7: Shows the accuracy of TVS in predicting normal and abnormal endometrium at cut off level <5mm endometrial thickness.

Endometrial Thickness On TVS	Abnormal Endometrial biopsy (Disease positive)	Normal Endometrial biopsy (Disease negative)	Total	Accuracy	P value
(>5mm)	31(88.6%)	04(11.4%)	35	83.63%	0.001
(≤5mm)	05(25%)	15(75%)	20		
Total	36(65.5%)	19(34.5%)	55		

Statistical analysis was performed using SPSS software 20 with Independent T test.

Table 8: Shows the parameters of performance of TVS at endometrial thickness of 5mm in predicting endometrial pathology of study population.

Variable	Value
Sensitivity	86.11%
Specificity	78.95%
Positive Predictive Value	88.57%
Negative Predictive Value	75.00%
Accuracy	83.63%
Positive Likelihood Ratio	04
Negative Likelihood Ratio	0.52

Table 9: Showing the distribution of abnormal pathology among two groups.

Endometrial Thickness	Endometrial Pathology Present No. (%)	Endometrial Pathology Absent No. (%)	Total	LR+	*P* value
>5mm	31 (88.6%)	04 (11.4%)	35 (100%)	04	<0.001
≤5mm	05 (25%)	15 (75%)	20 (100%)		

Data were expressed as frequency and percentage and analyzed by Fischer-Exact test.

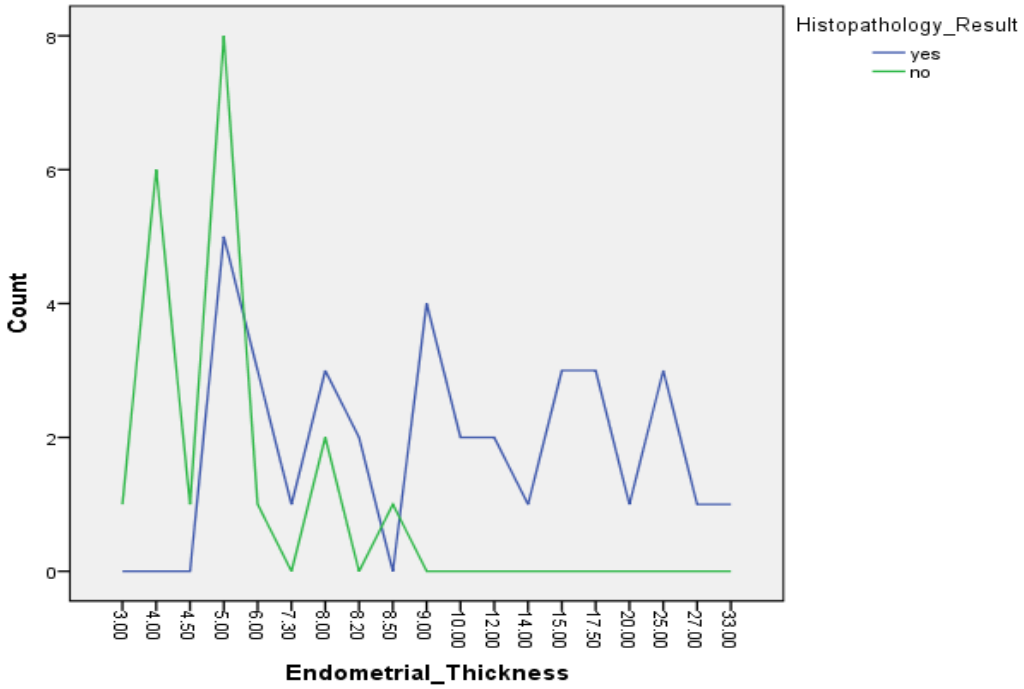

Figure IV: Showing the relationship of endometrial thickness with endometrial pathology. Endometrial thickness = mm

ROC Curve

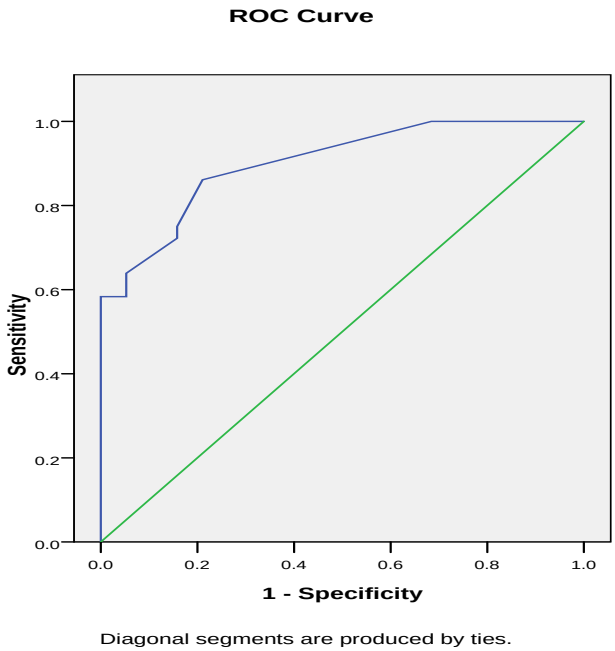

Figure V: ROC curve analysis predicting sensitivity and specificity of TVS in detecting endometrial pathology in postmenopausal bleeding.

Area Under the Curve Test Result Variable(s): Endometrial Thickness				
AUC	Std. Error	P value	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.912	0.037	0.000	0.840	0.985

Table 10: Showing the endometrial thickness with highest sensitivity and specificity for detecting Endometrial Pathology with the help of ROC & Youden's Index.

Coordinates of the Curve		
Endometrial Thickness	**Sensitivity**	**1 – Specificity**
2.0000	1.000	1.000
3.5000	1.000	0.950
4.2500	1.000	0.650
4.7500	1.000	0.600
5.5000	**0.857**	**0.200**
6.6500	0.771	0.150
7.6500	0.743	0.150
8.1000	0.657	0.050
8.3500	0.600	0.050
8.7500	0.600	0.000
9.5000	0.486	0.000
11.0000	0.429	0.000
13.0000	0.371	0.000
14.5000	0.343	0.000
16.2500	0.257	0.000
18.7500	0.171	0.000
22.5000	0.143	0.000
26.0000	0.057	0.000
30.0000	0.029	0.000
34.0000	0.000	0.000

ROC Curve

Case Processing Summary

Cancer	Valid N (list wise)
Positive(a)	11
Negative	44

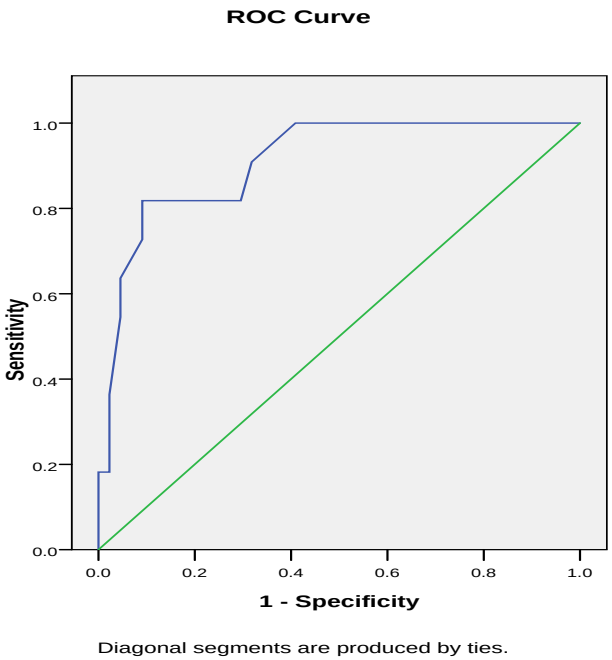

Figure VI: ROC curve analysis predicting sensitivity and specificity of TVS in detecting Endometrial Carcinoma in postmenopausal bleeding.

Area under the Curve

Test Result Variable(s): Endometrial Thickness

Area	Std. Error(a)	Asymptotic Sig.(b)	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.910	0.044	0.000	0.823	0.997

Table 11: Showing the endometrial thickness with highest sensitivity and specificity for endometrial carcinoma with the help of ROC & Youden's Index.

Coordinates of the Curve

Endometrial Thickness	Sensitivity	1 – Specificity
2.0000	1.000	1.000
3.5000	1.000	0.977
4.2500	1.000	0.841
4.7500	1.000	0.818
5.5000	1.000	0.523
6.6500	1.000	0.432
7.6500	1.000	0.409
8.1000	0.909	0.318
8.3500	0.818	0.295
8.7500	0.818	0.273
9.5000	0.818	0.182
11.0000	0.818	0.136
13.0000	**0.818**	**0.091**
14.5000	0.727	0.091
16.0000	0.636	0.045
17.2500	0.545	0.045
20.7500	0.364	0.023
24.5000	0.273	0.023
26.0000	0.182	0.023
30.0000	0.182	0.000
34.0000	0.000	0.000

DISCUSSION

Some women after menopause present with vaginal bleeding & in fact postmenopausal bleeding (PMB) represents 5% of all gynecologic outpatient attendances. It should be considered as the principal feature that demands investigation and our main aim of investigation was to exclude endometrial pathology.

Omer and Osman in 2002 found that endometrial thickness is the most important parameter differentiating endometrial pathologies.[14] They proposed TVS as the test of first choice in such women. Our findings also support the accuracy of TVS to be used the first choice for detection of endometrial pathology however Bindman R *et al*, 1998 found a lower accuracy comparatively to ours.[15]

Endometrial thickness can be measured by TVS and can be utilized to avoid unnecessary biopsy. The optimal cut off thickness in present study in diagnosing endometrial diseases was 5.5mm or less. Gupta et al, 2002 demonstrated that a cut off value of 5mm or less excludes endometrial pathology with good certainty. Hence my study is in agreement with Gupta's study. Goldstein found a remote possibility of having carcinoma in 907 subjects when the endometrial thickness is less than 4mm, similarly Karlson *et al* reported no pathology being found when endometrial thickness is less than 4mm.

Gull *et al*, 2003 suggested that TVS scan is an excellent tool for determining necessity of biopsy and no endometrial cancer is missed when cut off of less or equal to 4 is used. Timmerman's *et al*, 2007 suggested TVS as a first line investigation for women suffering with post- menopausal bleeding per vaginum.[16]

In the present study 55 women who took part presented with postmenopausal bleeding had different values regarding thickness of their endometrium and risk factors and it was associated with varied presentation and most common endometrial pathology which we found was endometrial hyperplasia 30.9% followed by endometrial carcinoma in 20% followed by endometrial polyp in 14.55% of women. Smith Bindman R *et al* and Gupta JK *et al* also found endometrial carcinoma as one of the leading causes of endometrial pathology however our percentage was more in comparison probably due to study conducted in tertiary care hospital where referred cases are encountered more often.

Various studies reveal that atrophic changes to endometrium occur after menopause which causes bleeding[17] and in our study we found endometrial atrophic changes in 34.55% of patients. However, depending upon risk factors and age patients present with different clinical features and around 14% patients have been found to have endometrial carcinoma.[4,5,10]

Endometrial pathology particularly endometrial cancer is the most common cancer found in women after the attainment of menopause.[6] This finding is quite similar to our study where we found endometrial cancer in 20% cases. The prevalence of endometrial cancer and hyperplasia was found to be high after menopause and these clinical features were similar in our study.

In the year 2009, ACOG committee[18] opinion showed various comparative study results of endometrial thicknesses determined by TVS and its association with endometrial pathology in women with post-menopausal bleeding where Epstein, 2001 and Gul, 2003 are notable which showed a negative predictive value of 100%[19] and these results were similar to present study in which we determined a negative predictive value of 95% at the value of 5.5mm of endometrial thickness in excluding endometrial disease.

Moradan S *et al*, 2011 evaluated 60 women with post-menopausal bleeding and determined the endometrial thickness and found 6mm to be cut-off value to exclude any endometrial pathology[20], he found sensitivity, specificity of 83.3% and 86.7% respectively. These finding were similar to our study where we found sensitivity and specificity of endometrial thickness (5.5mm) 86% and 80% respectively. He got 2 cases of endometrial hyperplasia and 3 cases of endometrial polyp in Group<6mm which was again similar to our study where we found 3 cases of endometrial hyperplasia and 2 cases of endometrial polyp in Group-1 <5mm.

Kaul I *et al*, 2012 compared Transvaginal Ultrasonography (TVS) with histopathology results of 50 women and found TVS a cheap and reliable way of determining pathology with sensitivity of 100% and specificity of 80%[21], these findings were almost comparable with our study where we found TVS having sensitivity and specificity of 86% and 80% respectively in detection of endometrial pathology.

Mallick A *et al*, 2013 studied the results of histopathological specimens of 200 women and found endometrial carcinoma as one of the important cause of post-menopausal bleeding; the results of this study were similar to our study where we found carcinoma in 20% of the study subjects who presented with post-menopausal bleeding.[22]

Karmarkar PJ *et al*, 2014 collected 240 specimens for histopathological study in women who presented with post-menopausal bleeding and found 206 (82.4%) having pathological changes including atrophy, hyperplasia, polyp and carcinoma, these study findings were quite similar with our findings where we found endometrial pathology present in 36/55. (65.5%).[23]

Therefore, in comparison to our study, slightly different cut off values were suggested but all determined and proved that TVS is the first line investigation and can prevent invasive procedure in most. This study demonstrates and concluded a cut off level of 5.5 mm of endometrial thickness for diagnosis of endometrial pathology and results were in agreement to most of the other studies. Hence in conclusion ET of ≤5.5mm rules out EP with great certainty having sensitivity 86% and specificity 80%. In support of our study Weber *et al* have reported sensitivity of more than 90% with cut off value of 5mm. In addition to this, a cut off value of endometrial thickness for detection of endometrial carcinoma was also calculated which was found to be around 13mm with sensitivity of 81.8% and specificity of 90.9%.[24]

CONCLUSION

From this study we conclude that Transvaginal Ultrasonography has high sensitivity and specificity in determining endometrial pathology in post-menopausal bleeding and there is a significant relation between endometrial thickness and endometrial pathology. Endometrial thickness of >5.5mm can be used a risk indicator in predicting endometrial pathology in women with post-menopausal bleeding, and endometrial thickness of >13mm can be used a risk indicator in predicting endometrial carcinoma. Detection of endometrial pathology by Transvaginal Ultrasonography is a reliable, cheap technique with no radiation hazards.

Recommendation

Endometrial thickness of menopausal women with bleeding determined by TVS (Transvaginal Ultrasonography) helps to track down the endometrial pathology with good accuracy. A value more than 5.5mm has been found to be associated with significant endometrial pathology needing intervention, endometrial thickness <5.5mm may also be associated with endometrial pathology but the incidence is less. Moreover, endometrial thickness of >13mm was found to be associated with endometrial carcinoma. Hence routine determination of endometrial thickness by Transvaginal ultrasonography after menopause can be implemented to keep track of the women at risk of endometrial pathology.

Limitations of the study

1. Sample size is small.
2. Study was conducted in Bangabandhu Sheikh Mujib Medical University (BSMMU) only, a tertiary care hospital and does not represent the whole community of Bangladesh

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