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Original Article

Obstetrics and Gynaecology Section

Transvaginal Ultrasonography and Hysteroscopy in Evaluation of Abnormal Uterine Bleeding- A Cross-sectional Study

G SINDHUJHA SEKAR[1], A ESTHER RUBY[2], P LALITHA[3]

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ABSTRACT

Introduction: In perimenopausal age group particularly, 70% of all gynaecological consultations are for Abnormal Uterine Bleeding (AUB). About 30% of women seek medical assistance for AUB during their reproductive age group and about one third of hysterectomies are carried out for AUB alone.

Aim: To determine the sensitivity, specificity, positive predictive value and negative predictive value of Transvaginal Ultrasonography (TVS) versus hysteroscopy in detecting uterine abnormalities

Materials and Methods: A cross-sectional study in patients with AUB, admitted to the Department of Obstetrics and Gynaecology at RGGWCH, Puducherry between February 2016 and February 2017 who met the inclusion criteria were included. Sample size was 85 cases. After taking detailed history and physical examination the patient was investigated to rule out organic causes of AUB and then TVS and hysteroscopy were done. Any intrauterine pathology was looked for and endometrial sampling was taken from the abnormal sites for Histopathological Examination (HPE). Both TVS and hysteroscopy results were compared with histopathology which is the gold standard.

Results: The sensitivity of TVS in diagnosis of uterine fibroid in comparison to hysteroscopy was 94.74% and the specificity was 71.21%. The sensitivity of hysteroscopy in diagnosis of endometrial hyperplasia in comparison to HPE was 75% and the specificity was 87.01%. The sensitivity of TVS in diagnosis of endometrial hyperplasia in comparison to HPE was 37.5% and the specificity was 90.91%. The sensitivity of hysteroscopy in diagnosis of polyp in comparison to HPE was 100% and the specificity was 97.3%. The sensitivity and specificity of TVS in diagnosis of polyp in comparison to HPE were 9.09% and 93.24%, respectively.

Conclusion: TVS had a high sensitivity to detect fibroids but its value in detecting hyperplasia and polyps was in question in this study. But hysteroscopy had a maximum sensitivity to detect polyps and high sensitivity to detect endometrial hyperplasia compared to histopathology which is a gold standard investigation.

Keywords: Fibroid, Histopathology, Hyperplasia, Polyp

INTRODUCTION

The Abnormal Uterine Bleeding (AUB) is one of the leading causes for seeking gynaecological advice. AUB may be defined as any variation from the normal menstrual cycle and includes change in regularity or frequency of menses, in the duration of flow, or in the amount of blood loss. Accordingly, AUB is divided into Heavy Menstrual Bleeding (HMB), frequent/infrequent, inter-menstrual, postcoital, pre/ postmenstrual bleeding, prolonged/ shortened periods, acute and chronic AUB [1]. The PALM-COEIN (Polyp; Adenomyosis; Leiomyoma; Malignancy and Hyperplasia; Coagulopathy; Ovulatory Dysfunction; Endometrial; Latrogenic and Not yet classified) classification system for AUB has been approved by International Federation of Gynaecology and Obstetrics (FIGO) [2]. In recent times, several methods including TVS, saline infusion sonography and hysteroscopy, have been developed to assess the uterine cavity, with their own advantages and disadvantages. TVS is a rapid noninvasive and cost-effective method which assesses the structural uterine pathologies. TVS detects fibroids, adenomyosis, endometrial thickness and morphology as well as regularity of endo-myometrial border [3]. Hysteroscopy, on the other hand, allows direct visualisation of the uterine cavity and guides sampling of any suspected lesion and has an established diagnostic value for many uterine conditions. Hysteroscopy is highly sensitive and specific for endometrial polyps and submucous myomas. However, hysteroscopy is not as cost-effective and convenient as ultrasonography, as the latter is associated with relatively less patient discomfort and does not necessitate anaesthesia [4]. Hysteroscopy is also operator-dependent and requires specialised equipment and trained staff. In the present context of increasing cost awareness and an ever-increasing litigious environment, a balance has to be achieved between the practice of "blanket medicine" aiming at performance of all investigations and a condition-based approach [5]. Hysteroscopy was a first line investigation in AUB in a study conducted by Swathi GR et al., in 2020 [6]. Hysteroscopy is superior to TVS in detecting endometrial polyp and hyperplasia. The diagnostic efficacy of hysteroscopy for submucous fibroid is 100%. TVS is more efficacious than hysteroscopy for detecting adenomyosis. TVS is superior to hysteroscopy in investigating postmenopausal bleeding. This was a study conducted by Baghel P et al., in 2018 [7]. This study was undertaken, to compare the diagnostic values of TVS and those of hysteroscopy and to determine the sensitivity, specificity, positive predictive value and negative predictive value of TVS versus hysteroscopy in detecting uterine abnormalities.

Study Objectives

- To study and compare the diagnostic value of TVS and hysteroscopy in evaluation of AUB.
- To determine whether the number of diagnostic hysteroscopies (invasive) can be reduced by TVS (noninvasive) examinations.
- To associate TVS and hysteroscopic findings with histopathological findings for evaluating intrauterine pathology in cases of AUB.

MATERIALS AND METHODS

A cross-sectional study was carried out in Department of Obstetrics and Gynaecology in Rajiv Gandhi Government Women and Children Hospital, Puducherry between February 2016 to February 2017 after obtaining approval from IEC (GHIEC/2016). A total of 85 cases with AUB were included.

Sample size calculation: The sample size was estimated by using the OpenEpi, Version 3. To calculate the sample size, AUB accounts for 33% of female patients referred to gynaecologists were taken into consideration as per the study conducted by Goyal BK et al., [8].

Inclusion criteria: Women aged 20 to 55 years with AUB; parous and nulliparous women were included.

Exclusion criteria: Postmenopausal women; women with uterus size more than 16 weeks; known cases of coagulation disorders; women with pregnancy related bleeding; virgin women; known cases of carcinoma cervix or uterine malignancy and women with known pelvic inflammatory disease were excluded.

Study Procedure

Patients satisfying the inclusion criteria were enrolled after getting informed consent. HMB can be defined as excessive menstrual blood loss interfering with a woman's physical, social, emotional and material quality of life [9]. After taking detailed history and physical examination patient was investigated to rule out organic causes of AUB with Complete Blood Count (CBC), Renal Function Tests (RFT), Liver Function Tests (LFT), Blood grouping and typing, Bleeding Time (BT), Clotting Time (CT), Prothrombin Time (PT), Thyroid function tests and Urine Pregnancy Test (UPT) to rule out pregnancy. After getting informed written consent for the procedure, TVS and Hysteroscopy was performed. TVS was done on admission. Bladder was emptied. Privacy is provided to the patient and if sonologist is male then a female assistant was present. The patient was put in supine with thighs abducted, knees flexed and buttocks elevated on a pillow. A transvaginal probe is covered with a condom. A small amount of jelly is applied to the tip of the probe, condom interface and outside sheath. The probe is gently inserted into the vagina and the bladder, ovaries, uterus, cervix and fallopian tubes are evaluated. Endometrial thickness more than 15 mm was taken as endometrial hyperplasia in our study [10]. For hysteroscopy, the patient was kept nil oral for 8 hours prior to hysteroscopy. Hysteroscopy was performed under general anaesthesia/spinal anaesthesia/saddle block and hysteroscopy directed biopsy was taken. Our ultrasound machine was Mindray with 6.5 MHZ transvaginal probe. Ultrasound variables studied include endometrial thickness, endometrial echogenicity, endometrial-myometrial interface and myometrium. Hysteroscope was performed using a Karl storzhysteroscope with 30 degree fibroptic lens with 5 mm sheath and normal saline as distension medium. Endometrial cavity was visualised systematically. Any intrauterine pathology was looked for and endometrial sampling was taken from the abnormal sites for HPE [11]. Fluid input and output was monitored. Patient's general condition and vitals were checked. Any bleeding per vaginum was watched for.

STATISTICAL ANALYSIS

Means and proportions were calculated for continuous and categorical variables respectively. Sensitivity, specificity and predictive values were calculated subsequently. Kappa coefficient was calculated to measure agreement between the tests. Miscrosoft Excel 2013 was used for data entry and Statistical Package for the Social Sciences (SPSS) version 21.0 was used for statistical analysis.

RESULTS

Majority of the study participants were in the age group of 41-50 years (52.9%). Maximum of the study participants were multipara with parity more than or equal to three (47.1%), while 41.2% of the study participants had a parity of two. Majority of the study participants were in normal weight 44 (51.8%) classification according to BMI [10], where 31 (36.5%) were found to be overweight and 10 (11.7%) of them were obese. HMB was found to be the most common presenting symptom 83 (97.6%) among the study participants [Table/Fig-1].

Variables	Frequency	Percent
Age (in years)		
20-30	3	3.5
31-40	31	36.5
41-50	45	52.9
51-60	6	7.1
Parity		
Nullipara	3	3.5
1	7	8.2
2	35	41.2
≥3	40	47.1
BMI (kg/m^2)		
Normal	44	51.8
Overweight	31	36.5
Obese	10	11.7
Presenting symptom		
Heavy menstrual bleeding	83	97.6
Inter-menstrual bleeding	1	1.2
Postcoital bleeding	1	1.2
Polyp on P/S		
Present	10	11.8
Absent	75	88.2
Size of uterus		
Non significant	9	10.6
Bulky	44	51.8
6-16 weeks	32	37.6
Duration of symptom		
1 month and less	18	21.2
>1 and <6 months	29	34.1
6 months to <1 year	27	31.8
1 to 2 years	4	4.7
>2 years	7	8.2
Endometrial thickness		
<5 mm	8	9.4
6 to 10 mm	48	56.5
11 to 15 mm	16	18.8
>15 mm	13	15.3

[Table/Fig-1]: Distribution of study participants according to characteristics (n=85). BMI: Body mass index; P/S: per speculum examination

Nearly 11.8% of the study participants were found to have polyp on P/S examination. Majority of the study participants 44 (51.8%) were found to have a bulky uterus on examination, whereas 37.6% of them had an enlarged uterus with its size ranging from 6-16 weeks. Majority of the study participants had their symptoms for a duration ranging from one month to six months, while 27 (31.7%) of the participants had their symptoms for a period of six months to one year [Table/Fig-1].

Nearly 34.1% (18.8%+15.3%) of the study participants had an endometrial thickness levels more than normal (normal endometrial thickness is 12 mm), while 8 (9.4%) of them had a thickness of endometrium less than 5 mm [Table/Fig-1].

TVS showed presence of endometrial polyp among five of the study participants (5.9%) and cervical polyp in one participant (1.2%). TVS showed presence of adenomyosis in six of the study participants

(7.1%). TVS showed presence of anterior wall fibroid in 15.3%. TVS showed presence of endometrial hyperplasia in 15.3% of the study participants. Cystic ovaries or polycystic ovaries were seen in nine of all the study participants (10.6%) of which two were large ovarian cysts of size 10×8 cm and 6×5 cm. On performing a hysteroscopy, six participants were found to have endocervical polyp (7.0%) and one patient was found to have cervical fibroid [Table/Fig-2].

Variables	Frequency	Percentage
Presence of polyp		
Cervical polyp	1	1.2
Endometrial polyp	5	5.9
Absent	79	92.9
Presence of adenomyosis		
Present	6	7.1
Absent	79	92.9
Fibroid		
Nil	48	56.5
AWF	13	15.3
AWF+PWF	5	5.9
PWF	12	14.1
SMF	2	2.3
SSF	1	1.2
FF	3	3.5
CF	1	1.2
Presence of endometrial hyperplasia		
Present	13	15.3
Absent	72	84.7
Presence of cervical polyp		
Present	1	1.2
Absent	84	98.8
Cystic/Polycystic ovaries		
Present	9	10.6
Absent	76	89.4

[Table/Fig-2]: Distribution of study participants based on presence of different pathologies on TVS (n=85).
AWF: Anterior wall fibroid; PWF: Posterior wall fibroid; SMF: Submucosal fibroid; SSF: Subserosal fibroid; FF: Fundal fibroid; CF: Cervical fibroid

The sensitivity of TVS in diagnosis of uterine fibroid in comparison to hysteroscopy was 94.74% and the specificity was 71.21%. Moderate agreement was observed between the two tests (Kappa coefficient=0.493) [Table/Fig-3].

TVS (Fibroid)	Hysteroscopy		
	Present	Absent	Total
Present	18	19	37
Absent	1	47	48
Total	19	66	85
Sensitivity	94.74% (73.97-99.87)		
Specificity	71.21% (58.75-81.7)		
Positive predictive value	48.65% (38.98-58.42)		
Negative predictive value	97.92 % (87.39-99.69)		
Cohen's kappa value of agreement	0.493		
Over-estimation	22.35%		
Under-estimation	1.17%		
Accurate	76.47%		

[Table/Fig-3]: Diagnosis of fibroid on TVS and hysteroscopy.

The sensitivity of hysteroscopy in diagnosis of endometrial hyperplasia in comparison to HPE was 75% and the specificity was 87.01%. Moderate agreement was observed between the two tests (Kappa coefficient=0.428). The sensitivity of TVS in diagnosis of endometrial hyperplasia in comparison to HPE was 37.5% and the specificity was 90.91%. Moderate agreement was observed between the two tests (Kappa coefficient=0.255) [Table/Fig-4,4a].

Hysteroscopy (Endometrial hyperplasia)	Histopathology		
	Present	Absent	Total
Present	6	10	16
Absent	2	67	69
Total	8	77	85
Sensitivity	75.0% (34.9-96.8)		
Specificity	87.01% (77.41-93.59)		
Positive predictive value	37.5% (22.9-54.79)		
Negative predictive value	97.1% (90.96-99.11)		
Cohen's kappa value of agreement	0.428		
Over-estimation	11.76%		
Under-estimation	2.35%		
Accurate	85.88%		

[Table/Fig-4]: Diagnosis of endometrial hyperplasia on hysteroscopy and HPE.

TVS (Endometrial hyperplasia)	Histopathology		
	Present	Absent	Total
Present	3	7	10
Absent	5	70	75
Total	8	77	85
Sensitivity	37.5% (8.52-75.51)		
Specificity	90.91% (82.16-96.27)		
Positive predictive value	30.0% (12.06-57.26)		
Negative predictive value	93.33% (89.07-96.01)		
Cohen's kappa value of agreement	0.255		
Over-estimation	8.24%		
Under-estimation	5.88%		
Accurate	85.88%		

[Table/Fig-4a]: Diagnosis of endometrial hyperplasia on TVS and HPE.

The sensitivity of TVS and hysteroscopy together in diagnosis of endometrial hyperplasia in comparison to HPE was 37.5% and the specificity was 97.4%. Moderate agreement was observed between the two tests (Kappa coefficient=0.42) [Table/Fig-5]. The sensitivity of TVS in diagnosis of endometrial hyperplasia in comparison to hysteroscopy was 31.25% and the specificity was 92.75%. The positive and negative predictive values were 50% and 85.33%, respectively. Moderate agreement was observed between the two tests (Kappa coefficient=0.28).

Transvaginal US+Hysteroscopy (endometrial hyperplasia)	Histopathology		
	Present	Absent	Total
Present	3	2	5
Absent	5	75	80
Total	8	77	85
Sensitivity	37.5% (8.52-75.51)		
Specificity	97.4% (90.93-99.68)		
Positive predictive value	60.0% (22.64-88.49)		
Negative predictive value	93.75% (89.75-96.25)		
Cohen's kappa value of agreement	0.42		
Over-estimation	2.35%		
Under-estimation	5.88%		
Accurate	91.76%		

[Table/Fig-5]: Diagnosis of endometrial hyperplasia on TVS+Hysteroscopy and HPE.

Among patients with positive findings hyperplastic endometrium was found to be the commonest 16 (18.8%), followed by fluffy endometrium 14 (16.5%) on hysteroscopic examination [Table/Fig-6].

Findings on hysteroscopy	Frequency	Percentage
Normal	19	22.35
Atrophic endometrium	2	2.35
Fluffy endometrium	14	16.47
Hyperplastic endometrium	16	18.8
Endometrial polyp	5	5.88
Ecto cervical polyp	2	2.35
Endo cervical polyp	6	7.05
cervical fibroid	1	1.2
Other fibroids	18	21.17
Septate uterus	1	1.2
Products of conception	1	1.2
Total	85	100

[Table/Fig-6]: Distribution of study participants based on findings on hysteroscopy (n=85).

The sensitivity of hysteroscopy in diagnosis of polyp in comparison to HPE was 100.0% and the specificity was 97.3%. Good agreement was observed between the two tests (Kappa coefficient=0.713) [Table/Fig-7]. Histopathologic examination revealed the presence of hyperplastic endometrium in 9.4% and endometrial polyp in 12.9% of the study participants [Table/Fig-8].

	Histopathology		
Hysteroscopy (Polyp)	Present	Absent	Total
Present	11	2	13
Absent	0	72	72
Total	11	74	85
Sensitivity	100.0% (71.51-100.0)		
Specificity	97.3% (90.58-99.67)		
Positive predictive value	84.62% (58.36-95.57)		
Negative predictive value	100.0%		
Cohen's kappa value of agreement	0.713		
Over-estimation	2.35%		
Under-estimation	0.0%		
Accurate	97.6%		

[Table/Fig-7]: Diagnosis of polyp on hysteroscopy and HPE.

Findings on histopathology	Frequency	Percentage
Normal	64	75.3
Atrophic endometrium	1	1.2
Hyperplastic endometrium	8	9.4
Endometrial polyp	11	12.9
Endometrial carcinoma	1	1.2
Total	85	100

[Table/Fig-8]: Distribution of study participants based on findings on histopathology (n=85).

The sensitivity and specificity of TVS in diagnosis of polyp in comparison to HPE was 9.09% and 93.24%, respectively [Table/Fig-9]. The specificity of TVS+Hysteroscopy in diagnosis of polyp in comparison to HPE was 100%. The negative predictive value was 88.10% [Table/Fig-10]. The sensitivity of TVS in diagnosis of endometrial polyp in comparison to hysteroscopy is observed to be 7.69% and specificity is 93.06%. Specificity of TVS in diagnosis of endometrial polyp in comparison with Hysteroscopy is observed to be 93.06% and the negative predictive value was calculated to be 84.81%.

	Histopathology		
TVS (Polyp)	Present	Absent	Total
Present	1	5	6
Absent	10	69	79
Total	11	74	85
Sensitivity	9.09% (0.23-41.28)		
Specificity	93.24% (84.93-97.77)		
Positive predictive value	16.67% (2.51-60.88)		
Negative predictive value	87.34% (85.0-89.6)		
Cohen's kappa value of agreement	0.029		

[Table/Fig-9]: Diagnosis of polyp on TVS and HPE.

	Histopathology		
TVS+Hysteroscopy (Polyp)	Present	Absent	Total
Present	1	0	1
Absent	10	74	84
Total	11	74	85
Sensitivity	9.03% (0.23-41.28)		
Specificity	100% (95.14-100)		
Positive predictive value	100.0%		
Negative predictive value	88.10% (85.99-89.92)		
Cohen's kappa value of agreement	0.148		
Over-estimation	0.0%		
Under-estimation	11.76%		
Accurate	88.23%		

[Table/Fig-10]: Diagnosis of polyp on TVS + Hysteroscopy and HPE.

Out of 16 cases of endometrial hyperplasia detected by hysteroscopy, six cases were detected by HPE [Table/Fig-11]. One cervical fibroid and one endometrioid carcinoma were detected in two cases [Table/Fig-12].

Hyperplasia	Hyperplasia detected by hysteroscopy	Hyperplasia in HPE
Present	16 cases of hyperplasia detected by hysteroscopy	6 cases confirmed by HPE. Simple hyperplasia without atypia-3 Simple hyperplasia with atypia-3
Absent	2 cases hyperplasia not detected	SHP without atypia CHP with atypia

[Table/Fig-11]: Endometrial hyperplasia correlation between hysteroscopy and histopathology.
SHP: Simple hyperplasia; CHP: Complex hyperplasia

Special case	TVS	ET	Hysteroscopy	HPE
Cervical dysplasia	Cervical fibroid	2 mm	Atrophic endo,cervical fibroid	Cervical dysplasia, atrophic endo
Endometrioidca	Endo hyperplasia	17 mm	Endometrial hyperplasia	Endometrioidca
Cervical polyp	Cervical polyp	6 mm	Fluffy endo,cervical polyp	Polyp, DPE
Submucous fibroid	1-SMF 2-SMF	11 mm 13 mm	Fluffy endometrium Fluffy endometrium	DPE DPE
Products of conception	Endometrial hyperplasia	14 mm	Appearance similar to POC	POC
Sepate uterus	AW fibroid	3 mm	Normal endometrium, sepatate uterus	PE

[Table/Fig-12]: Special cases in this study.
SMF: Submucosal fibroid; DPE: Disordered proliferative endometrium; POC: Products of conception; PE: Proliferative endometrium

DISCUSSION

In this study, majority of the patients were in the age group of 41-50 years (52.9%) followed by 31-40 years who represented 36.5% of the study population. The youngest patient was 29-year-old and the eldest was 55-year-old

Krishnamoorthy N et al., conducted a study on 100 women with AUB and the mean age of the patients was 42.9 years [3]. Majority of the patients were in normal weight (51.8%) classified according to BMI. A 36.5% were found to be overweight and 11.8% of them were obese. This is in contrast to a study done by El-Khayat W et al., where 77% patients were obese [12]. The maximum number of patients suffered for a period of >1 month to less than 6 months (34.1%) while 21.2% of the patients had their symptoms for a period of less than a month. A 12.9% of patients had their symptoms for more than a year and have resorted to various forms of supportive therapy.

Tahir MM et al., studied 400 women all above the age of 35 years with the maximum incidence between 40 and 50 years which is in agreement with this study [Table/Fig-13] [5,8,13-17]. In this study, 75 (88.3%) patients were multiparous and 3 (3.5%) patients were nulliparous. This is in agreement with a study conducted by Krishnamoorthy N et al., where 97 patients were multiparous and 3 were nulliparous [3]. [Table/Fig-14] [3,12,14,18-20].

Study	Age maximum incidence
Present study	41-50
Pal L et al., [5]	41-50
Goyal BK et al., [8]	41-50
Barati M et al., [13].	>40
Kumari M et al., [14]	31-50
Van Trotsenburg M et al., [15]	41-50
Tahir MM et al., [16]	40-50
Kathuria R and Bhatnagar B, [17]	30-45

[Table/Fig-13]: Age group of maximum incidence of AUB in previous studies [5,8,13-17].

Study	Multipara %	Nullipara %
Present study	88.3	3
Krishnamoorthy N et al., [3]	97	3
El-khayat W et al., [12]	88	
Kumari M et al., [14]	61.4	22.9
Wanderley MS et al., [18]	70	
Bhosle A et al., [19]	71	
Nandan N et al., [20]	90.9	9.1

[Table/Fig-14]: Distribution of patients according to parity in various studies [3,12,14,18-20]

Comparing the duration of symptoms, in this study, it appears that maximum patients seek medical opinion within 6 months after the start of their symptoms. In a study conducted by Kathuria R and Bhatnagar B, the majority of patients seek medical help after suffering for 3-6 months' time (50%) which agrees with our study [17]. The uterine size on clinical examination was normal in only 10.6% patients. This is in contrast to a study done by Pal L et al., where the uterus was classified as normal size in 63% patients [5]. HMB was the most common presenting symptom reported in 83(97.6%) patients. Inter-menstrual bleeding was the complaint in only one (1.2%) patient [Table/Fig-15] [3,8,12,14,17,21-23].

Post coital bleeding was the complaint in only one patient (1.2%). In a study by Khaturia R et al., the commonest presenting complaint was menorrhagia (46%) followed by polymenorrhoea (30%) and metrorrhagia (18%) [17]. These studies correlate with our findings. A study by Krishnamoorthy N et al., had 71 patients with menorrhagia and 8 patients with metrorrhagia [3].

The most common lesion detected by TVS is uterine fibroids (43.52%) followed by endometrial hyperplasia. In a study conducted by Haq K et al., the commonest lesion detected by TVS is fibroids (42%) which are in line with our study [24]. The commonest lesion detected by hysteroscopy in our study is also fibroid uterus (22.37%) followed by endometrial hyperplasia (18.8%). This was

Study	Heavy menstrual bleeding (HMB) %	Intermenstrual bleeding %
Present study	97.6	1.2
Krishnamoorthy N et al., [3]	71	8
Goyal BK et al., [8]	58	32
El-khayat W et al., [12]	40	34
Khaturia R et al., [17]	46	18
Kumari M et al., [14]	40	24
Babacan A et al., [21]	69.4	
Rajesh et al., [22]	73	
Panda et al., [23]	60	

[Table/Fig-15]: Most common presenting symptom in various studies [3,8,12,14,17,21-23]

comparable with a study conducted by El-khayat W et al., where hysteroscopy detected endometrial hyperplasia in 20% cases [12]. Histopathology diagnosed 11 cases of polyps (12.9%) followed by endometrial hyperplasia (9.4%). In a study conducted by El-khayat W et al., histopathology diagnosed endometrial polyp in 13 cases (26%) [12]. TVS detected 37 cases of fibroid uterus of which 15.3% were anterior wall fibroid, 14.1% were posterior wall fibroid and both anterior and posterior wall fibroid were seen in 5.9% of them. Out of the 37 fibroids detected by TVS, 19 fibroids were picked up by hysteroscopy also. The sensitivity of TVS in diagnosis of uterine fibroid in comparison to hysteroscopy was 94.74% and specificity was 71.21% [Table/Fig-16] [3,18,25,26]. Fedele L et al., studied the efficacy of TVS and hysteroscopy in detecting submucous myomas [27]. TVS was found to be 100% sensitive and 94% specific in diagnosing submucous myomas in the study conducted by Fedele L et al. TVS also detected 6 (7.1%) cases of adenomyosis and the diagnosis of adenomyosis was made by the typical USG findings like anteroposterior asymmetry of the myometrium, poor endomyometrial differentiation and presence of myometrial cysts. But hysteroscopy did not detect any case of adenomyosis. Histological confirmation was not possible for fibroids and adenomyosis due to nonavailability of representative sample and most patients were treated with conservative management.

	Fibroids			
Study	Sensitivity %	Specificity %	PPV %	NPV %
Present study	94.74	71.21	48.65	97.92
Krishnamoorthy N et al., [3]	77.3	76		
Vercellini P et al., [25]	80	69	83	65
Balic D et al., [26]	100	100	100	100
Wanderley MS et al., [18]	57.9	98.2		

[Table/Fig-16]: Sensitivity and specificity of TVS to detect fibroids in various studies [3,18,25,26].

TVS detected five endometrial polyps (5.9%) and one cervical polyp, out of which only cervical polyp (1.2%) was detected by hysteroscopy and later confirmed by histopathology also. All the five endometrial polyps diagnosed by TVS turned out to be 2 cases of endometrial hyperplasia, two cases of fluffy endometrium and one normal endometrium in hysteroscopy but all the 5 cases turned out to be either proliferative or secretory endometrium in HPE. The sensitivity of TVS in diagnosis of endometrial polyp in comparison to hysteroscopy is observed to be 7.69% and specificity is 93.06%. The sensitivity of TVS keeping HPE as gold standard is 9.09% and 93.24%. The sensitivity and specificity of TVS in detecting polyps were 56.25% and 91.67% respectively in a study conducted by Krishnamoorthy N et al., [Table/Fig-17] [3,18,26,28,29]. TVS detected 13 cases of endometrial hyperplasia. Endometrial thickness of >15 mm was considered as endometrial hyperplasia in TVS. Out of these 13 cases, hysteroscopy showed seven cases of endometrial hyperplasia and three cases were confirmed as endometrial hyperplasia in histopathology. The sensitivity

of TVS in detection of endometrial hyperplasia with histopathology as gold standard is 37.5% and specificity is 87.01%. This is in correlation with a study conducted by Krishnamoorthy N et al., which gave sensitivity and specificity of TVS in diagnosis of endometrial hyperplasia as 45.71% and 75.56% [Table/Fig-18] [3,18,26].

Study	Polyps			
	Sensitivity %	Specificity %	PPV %	NPV %
Present study	9.09	93.24	16.67	87.34
Krishnamoorthy N et al., [3]	56.25	91.67		
Balic D et al., [26]	100	56.4	50	100
Feitosa IMSD et al., [28]	27.3	94.7		
Wanderley MS et al., [18]	71.4	60.3	62.5	69.5
Makled AK et al., [29]	91.6	92.1	78.5	97.2

[Table/Fig-17]: Sensitivity and specificity of TVS to detect polyps in various studies [3,18,26,28,29].

Study	Endometrial hyperplasia			
	Sensitivity %	Specificity %	PPV %	NPV %
Present study	37.5	87.01	53.85	87.5
Krishnamoorthy N et al., [3]	45.71	76.56		
Balic D et al., [26]	22.7	100	100	66.7
Wanderley MS et al., [18]	58.3	68.1	15.6	94.2

[Table/Fig-18]: Sensitivity and specificity of TVS to detect endometrial hyperplasia in various studies [3,18,26].

Hysteroscopy diagnosed 16 cases of endometrial hyperplasia of which 6 cases were confirmed by HPE. In our study, the sensitivity of hysteroscopy in diagnosis of endometrial hyperplasia in comparison to HPE is 75% and specificity is 87.01%. In a study by Sheetal GP et al., the sensitivity and specificity of hysteroscopy to detect endometrial hyperplasia was found to be 75% and 92.5% which is comparable to our study [Table/Fig-19] [3,25,26,30-32].

Study	Endometrial hyperplasia			
	Sensitivity %	Specificity %	PPV %	NPV%
Present study	75	87.01	37.5	97.1
Krishnamoorthy N et al., [3]	60	78.12		
Sheetal GP et al., [30]	75	92.5		
Vercellini P et al., [25]	45	99	38	94
Bettocchi S et al., [31]	74	93	70	94
Balić D et al., [26]	86.4	100	100	91.9
Fakhar S et al., [32]	63	92		

[Table/Fig-19]: Sensitivity and specificity of hysteroscopy to detect endometrial hyperplasia [3,25,26,30-32].

Hysteroscopy diagnosed five endometrial polyps and eight cervical polyps where 11 cases were confirmed by histopathology. The sensitivity of hysteroscopy in diagnosis of polyp keeping HPE as gold standard is 100% and specificity is 97.3%. The highest sensitivity and specificity by hysteroscopy was found for endometrial polyps in this study which was similar to other studies. Sheetal GP et al., reported a sensitivity and a specificity of 100% and 95.78% for endometrial polyps [Table/Fig-20] [3,14,26,30,31,33,34].

Hysteroscopy detected 19 cases of fibroids of which one was cervical fibroid which in biopsy turned out to be cervical dysplasia. Hysteroscopy also showed two cases of atrophic endometrium, one case of septate uterus and one case with hysteroscopic appearance similar to products of conception.

The above findings indicate that each modality has its own limitations. The accuracy of TVS in the diagnosis of IM fibroids is good but it cannot differentiate between endometrial polyps, hyperplasia and early cancers. Hysteroscopy is superior to TVS in the diagnosis of intracavitary lesions like polyps and submucous

Study	Polyps			
	Sensitivity %	Specificity %	PPV %	NPV %
Present study	100	97.3	84.62	100
Krishnamoorthy N et al., [3]	93.75	78.57		
Sheetal GP et al., [30]	100	95.78		
Kumari M et al., [14]	100			
Mukhopadhayay S et al., [33]	71.4	100		
Bettocchi S et al., [31]	89	93	90	92
Balić D et al., [26]	100	100	100	100
Tajossadat A et al., [34]	93	100		

[Table/Fig-20]: Sensitivity and specificity of hysteroscopy to detect polyps in various studies [3,14,26,30,31,33,34].

myoma. Krishnamoorthy N et al., give similar conclusions in their study [3]. Barati M et al., recommend hysteroscopy for patients with AUB as a second step even if TVS is normal [13].

Baskett TF et al., studied the efficiency of a one stop menstrual clinic to demonstrate the cost and clinical effectiveness of using hysteroscopy as a preliminary investigation performed at the initial visit in selected patients [35]. The results of our study agree with their rationale. Compared to TVS, hysteroscopy gives a direct visualisation of the endometrial cavity and hence detects any focal lesion. TVS has a good sensitivity in detecting fibroids. Negative predictive value of TVS for detection of fibroids was 97.92%. But TVS was poorly sensitive (37.5%) in detecting endometrial hyperplasia but its negative predictive value is 93.06%. TVS showed poor sensitivity in detecting polyps (9.09%), whereas hysteroscopy showed highest sensitivity in detecting polyps (100%). Sensitivity of hysteroscopy in diagnosis of endometrial hyperplasia was 75% but it had a good negative predictive value of 97.1%.

In one study, Epstein E et al., sensitivity and specificity of hysteroscopy were 100% and 84%, respectively; which agree with our results [36]. In another study carried out in UK by Tahir MM et al., 400 patients with AUB were investigated [16]. For the first step, transvaginal sonography and endometrial biopsy, and as the second step, hysteroscopy were recommended and it agrees with the current study. In another study in Italy by Garuti G et al., 419 patients with AUB were considered [20]. It again demonstrated that transvaginal sonography was a suitable diagnostic method for the first step, but hysteroscopy was more accurate than transvaginal sonography. Similarly, Mathlouthi N et al., and Yela DA et al., found diagnostic values favoured hysteroscopy to diagnose uterine pathologies [37,38]. In another study in Turkey by Kelekci S et al., for diagnosis of intra uterine lesions in patients with or without AUB; trans-vaginal sonography and hysteroscopy were carried out. Sensitivity and specificity of trans-vaginal sonography were 56.3% and 100%, respectively [39]. Also, hysteroscopy had 81.3% sensitivity and 100% specificity. Therefore, hysteroscopy is one of the best methods to detect the polyps for this area. According to high conformity between the hysteroscopy and pathology, diagnostic ability of hysteroscopy was higher than transvaginal sonography. Therefore, it is recommended that patient with AUB whose transvaginal sonography is normal, hysteroscopy is considered to be as the second step. Trans-vaginal ultrasonography is a widely available, comparatively cheap and practical method to diagnose uterine pathologies. It is noninvasive and causes minimal discomfort to the patient. Therefore, it is mostly used as the initial modality in patients with AUB. It is a very helpful tool for screening. Although one histopathological report of endometrial cancer have been observed, no ultrasound report was suggestive of malignancy, similarly to the study of Grimbizis GF et al., in which TVS was also not able to discriminate hyperplasia or endometrial cancer from other intracavitary lesions [40]. The sensitivity of TVS to detect uterine fibroids in comparison to hysteroscopy was 94.74%.

But the sensitivity of TVS to detect endometrial hyperplasia taking histopathology as gold standard is 37.5% only. But the sensitivity of hysteroscopy in diagnosis of endometrial hyperplasia was 75% and diagnosis of polyp was 100%. Combined approach of TVS and hysteroscopy did not give a much improvement in sensitivity of TVS. Hence, a much invasive approach hysteroscopy can be made as a one step approach in diagnosis of endometrial pathology in AUB but TVS alone is not sufficient to diagnose endometrial hyperplasia. But TVS is a single step modality to detect uterine fibroids in AUB.

Limitation(s)

Hysteroscopic procedure was carried out by many gynaecologists with different level of experience and not by a consistent hysteroscopist, Subjective variation was unavoidable. Histological confirmation was not included for fibroids and adenomyosis due to conservative management in many patients.

CONCLUSION(S)

Transvaginal Ultrasonography had a high sensitivity to detect fibroids but its value in detecting hyperplasia and polyps was in question in our study. But hysteroscopy had a maximum sensitivity to detect polyps and high sensitivity to detect endometrial hyperplasia compared to histopathology taken as a gold standard investigation. Therefore, it is recommended that patient with AUB whose transvaginal sonography is normal, hysteroscopy is considered to be as the second step. To conclude, a combination of all the three modalities (Transvaginal sonography/hysteroscopy and endometrial biopsy) was found to increase the diagnostic accuracy in patients with AUB and will effectively guide us in planning the appropriate management for these patients. Adequate diagnosis is crucial for the selection of relevant treatment of AUB and avoidance of major surgical procedures. Even though TVU is a good tool for the initial evaluation of uterine pathologies, a hysteroscopy examination is essential in the majority of the doubtful cases. Hysteroscopy offers better diagnostic value for uterine pathologies, and uterine polyps in particular.

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PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Department of Obstetrics and Gynaecology, Sri Venkateswara Medical College and Hospital, Puducherry, India.
2. Chief Medical Officer (NFSG), Department of Obstetrics and Gynaecology, Rajiv Gandhi Government Women and Children Hospital, Puducherry, India.
3. Chief Medical Officer (NFSG), Department of Obstetrics and Gynaecology, Rajiv Gandhi Government Women and Children Hospital, Puducherry, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
G. Sindhujha Sekar,
29, Main Avenue, West Brindavan, Puducherry, India.
E-mail: sindhujha.g@gmail.com

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