Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/mjafi

Original Article

Transvaginal sonography versus hysteroscopy in evaluation of abnormal uterine bleeding

Col B.K. Goyal, vsm^{a,*}, Capt Indu Gaur^b, Gp Capt Sunil Sharma^c,
Maj Arunabha Saha^d, Col N.K. Das^e

^a Senior Adviser (Obst-Gynae & Gynae Onco), Command Hospital (West Command), Chandimandir, India

^b Medical Officer (Obst-Gynae), Base Hospital, Delhi Cantt 10, India

^c Classified Specialist (Obst-Gynae), Naval Hospital, Powai, Mumbai, India

^d Graded Specialist (Obst-Gynae), 159 Gen Hospital, C/O 56 APO, India

^e Classified Specialist (Obst-Gynae), Command Hospital (Eastern Command), Kolkata 700027, India

ARTICLE INFO

Article history:

Received 25 July 2014

Accepted 1 December 2014

Available online 16 February 2015

Keywords:

Abnormal uterine bleeding

Transvaginal sonography

Hysteroscopy

Endometrial polyp

Submucous fibroid

ABSTRACT

Background: Abnormal uterine bleeding (AUB) accounts for 33% of female patients referred to gynaecologists. Common causes of AUB include endometrial polyps, endometrial hyperplasia, submucous fibroids and anovulation. Accurate diagnosis of the cause of AUB can reduce the frequency of hysterectomy. This study was aimed at assessing the usefulness of TVS in comparison with hysteroscopy in AUB evaluation.

Methods: 100 female patients with AUB were enrolled in the study. Each patient was subjected to TVS where uterine cavity was studied in detail and hysteroscopy under anaesthesia using saline as distension medium. Sensitivity, specificity and predictive value of TVS as compared to hysteroscopy were calculated. Subgroup analysis within each group was also performed.

Results: Menorrhagia was the commonest presenting symptom in the study population ($n = 58$) followed by metrorrhagia, menometrorrhagia and continuous bleeding >21 days. 74 female patients had normal size uterus. In 57 patients, the uterine cavity was normal on TVS. Thickened endometrium, endometrial polyp and submucous fibroids were seen in 19, 16 and 6 patients respectively. Hysteroscopy showed normal cavity in 59 female patients and polypoid endometrium, polyps or submucous fibroids in 41. TVS was found to have high sensitivity and specificity (95.23 and 94.82 respectively) and high positive and negative predictive value. Strength of agreement between TVS and hysteroscopy was high (kappa value 0.898).

Conclusion: TVS is recommended as first line investigation in AUB. If TVS shows normal cavity, further evaluation can be omitted and patient started directly on medical treatment for her symptoms.

© 2014, Armed Forces Medical Services (AFMS). All rights reserved.

* Corresponding author. Tel.: +91 9831423985.

E-mail address: bkgnona@gmail.com (B.K. Goyal).

<http://dx.doi.org/10.1016/j.mjafi.2014.12.001>

0377-1237/© 2014, Armed Forces Medical Services (AFMS). All rights reserved.

Introduction

Abnormal uterine bleeding (AUB) describes all abnormal patterns of menstrual bleeding that may result from a wide variety of causes including anovulation, pregnancy, uterine pathology and coagulopathies.¹ The term AUB usually indicates one of the following clinical presentations – *menorrhagia* (abnormally long or heavy menses lasting >7 days or involving blood loss >80 mL), *metrorrhagia* (menses occurring at irregular intervals) or *menometrorrhagia* (a combination of the two). It is the single most common complaint that reproductive age females bring to their clinicians and it accounts for 33% of female patients referred to gynaecologists.² Differential diagnosis of AUB includes problems relating to pregnancy, infection, vaginal and cervical abnormalities, benign and malignant uterine neoplasia, coagulopathies, endocrine disorders, trauma, foreign bodies, systemic disease and bleeding related to medications.¹ In order to arrive at the cause of AUB, the clinician should evaluate the patient with judicious use of investigative tools available to him.

A careful history and physical examination are the most useful tools for starting the evaluation of AUB. Infrequent, irregular, unpredictable menstrual bleeding that varies in amount, duration and character and is not preceded by any recognizable or consistent pattern of premenstrual molimina and unaccompanied by any visible or palpable genital tract abnormality, can be diagnosed as anovulatory bleeding. Conversely, regular monthly periods that are heavy or prolonged are more likely related to an anatomical lesion or a bleeding disorder than to anovulation.

Anything that can significantly improve the accuracy of diagnosing the cause of bleeding, can reduce the frequency of hysterectomy as a cure. Dilatation and curettage (D & C) used to be the mainstay of investigation for abnormal uterine bleeding but it is not accurate for diagnosing focal intrauterine lesions such as endometrial polyps or submucous fibroids which may be small or located in areas difficult to curette.^{3–6} Currently, the main diagnostic methods which are being used in the evaluation of AUB are transvaginal ultrasonography and diagnostic hysteroscopy.⁷ According to some authors, diagnostic hysteroscopy represents an indispensable pre-surgical investigation,⁸ although the value of transvaginal ultrasonography compared with hysteroscopy is yet not fully defined.

In evaluation of AUB, what should be the ideal work-up plan? We undertook the present study to compare the accuracy of TVS as compared with hysteroscopy in cases of abnormal uterine bleeding and to formulate the ideal investigation protocol in these female patients with AUB.

Materials and methods

This prospective observational study was conducted at the Department of Obstetrics and Gynaecology of a tertiary care teaching hospital of the Armed Forces from January 2012 to June 2014. The study population included female patients attending the OPD for abnormal uterine bleeding and the sample size consisted of 100 patients not known to have an on-

going pregnancy. Patients with AUB who were hemodynamically unstable, unmarried young female patients where TVS is not desirable, uterine size larger than 12 weeks gestation, patients with known coagulation disorders and those with a cervical lesion or cancer were not included in this study.

Each patient meeting the selection criteria underwent a preliminary assessment by history and clinical examination. The bleeding pattern was categorized as either menorrhagia, metrorrhagia, menometrorrhagia or continuous bleeding for more than 21 days. The uterine size was assessed clinically and determined as normal or enlarged (in weeks of pregnancy size). TVS examination was performed at the first visit in the office setting itself. The uterine anatomy and the adnexae were visualized using a 7.5 MHz vaginal probe transducer (General Electric, Milwaukee, C3 real time sector scanner). Appearance of the endometrial stripe was recorded as either normal or abnormal; a specific note was made of any focal lesion seen in terms of an endometrial polyp, submucous fibroid, intramural fibroid, or thickened endometrium (>12 mm). The contour of the endometrial stripe was assessed in the midline sagittal plane and the point of maximum thickness of the stripe (ET) was measured.

Hysteroscopy under anaesthesia was then scheduled at a subsequent visit. Hysteroscopy was scheduled in the early proliferative phase of the menstrual cycle in patients complaining of regular AUB. Hysteroscopy was performed using a 30° hysteroscope and diagnostic sheath of 5 mm diameter (Karl-Storz Endoscopy) with a fiberoptic cold light source; normal saline was used as the distending medium and the procedure was performed under direct video monitoring.

A total of 100 patients completed the study and underwent both TVS and hysteroscopy. The results of hysteroscopy were taken as the “gold standard” for the diagnosis of intracavitary pathology. Sensitivity, specificity and predictive value of the TVS in detecting the intracavitary lesions were calculated with hysteroscopy taken as the gold standard. Subgroup analysis of various TVS findings was also undertaken and accuracy of TVS in assigning the cause was determined for each pattern. Statistical analysis was performed online using the facility provided on the website www.medcalc.org and www.graphpad.com.

Results

100 consecutive patients presenting with menstrual complaints who met the selection criteria were studied by TVS and hysteroscopy for this study and evaluated. The data was arranged in Microsoft Excel sheet and was analysed statistically.

The age of our patients ranged from 19 to 55 years but maximum number of patients who developed menstrual abnormalities belonged to 41–50 year age group ($n = 51$). 10 patients were above 51 years of age and 10 patients below 30 years.

Parity distribution of the subjects ranged between 0 and 5. Fifty-one patients in our study were para-2, which is in keeping with the modern trends of family size. There were two nulliparas and six with parity four or above.

Table 1 depicts the distribution of various menstrual abnormalities seen in our study group. Menorrhagia was the

Table 1 – Distribution of bleeding pattern.

Bleeding pattern	Numbers (n = 100)
Menorrhagia	58
Metrorrhagia	32
Menometrorrhagia	7
Continuous bleeding >21 days	3

most common complaint amongst our patients (n = 58) followed by metrorrhagia (n = 32). Menometrorrhagia and continuous bleeding for >21 days were less common symptoms seen in 7 and 3 women respectively.

We had clinically assessed the size of the uterus in weeks of gestation and found that 74% of our patients with abnormal menstrual pattern had normal size uterus. 15 patients had 6-weeks size uterus whereas 8- and 10-weeks size uterus was seen in 9 and 2 patients respectively. We had excluded uteri larger than 12 weeks from our study because fibroids are the most likely cause of such enlargements where the presence of fibroids as the cause of menstrual symptoms may confound the results of evaluation of the cavity. The uterine sizes in our subjects are shown in Table 2.

TVS findings of our patients are summarized in Table 3. On TVS, we found that uterine cavity was normal in 57 of our patients presenting with various menstrual abnormalities. The endometrial pattern was either trilaminar or secretory but the ET was less than 12 mm. In 19 patients, the ET was thickened and more than 12 mm. Endometrial polyp was diagnosed in 16 patients and a submucous fibroid in six (Fig. 1). Two patients with persistent irregular bleeding in the reproductive age group seemed to have retained products of conception on TVS assessment.

Hysteroscopic findings seen in our patients have been tabulated in Table 4. In 59 cases, hysteroscopy did not reveal any endometrial abnormality in the uterine cavity. Polypoidal endometrium was seen in 17 cases and a discrete endometrial polyp was identified in 16 cases. Submucous fibroid was identified in five of six cases where a submucous fibroid was suspected on TVS (Fig. 2). The patient where retained products of conception were suspected on TVS was found to have retained products in one case and polypoidal endometrium in the other.

Table 5 brings out the correlation between TVS and hysteroscopic findings. Of the 100 cases evaluated in this study, hysteroscopic findings matched the TVS findings 91 times and were at variance with the TVS findings in only 9 cases. In 57 cases, when the TVS findings suggested a normal uterine cavity, a normal cavity was confirmed at hysteroscopy in 55 cases whereas in two patients, hysteroscopy revealed abnormalities in the uterine cavity. On the other hand, of the 43 cases where TVS showed some abnormality, hysteroscopy

Table 2 – Uterine size.

Uterine size	Numbers (n = 100)
Normal size	74
6 weeks size	15
8 weeks size	9
10 weeks or more	2

Table 3 – TVS findings.

TVS finding	Numbers (n = 100)
Normal endometrium with a trilaminar or secretory type ET <12 mm	57
Thickened ET (>12 mm)	19
Endometrial Polyp	16
Submucous fibroid	6
Irregular shadow? Products of conception	2

also revealed some abnormality in 40 cases. However, in four of these cases there was disparity between TVS diagnosis and hysteroscopic diagnosis. On two occasions a thickened endometrium on TVS actually was proven on hysteroscopy to be a polyp and just the reverse on another two occasions.

Sub-group analysis of the various TVS findings is given in Table 6. When we look at the subset of patients found to have normal endometrial cavity on TVS, we find that 55 out of 57 patients were actually found to have normal uterine cavity on hysteroscopy giving a high accuracy of 96.55% to TVS. In the thickened endometrium TVS subgroup, of the 19 patients, 16 were actually seen to have polypoidal endometrium on hysteroscopy (accuracy 84.21%) but on 2 occasions, it was in fact an endometrial polyp and once it turned out to be a normal uterine cavity. In the endometrial polyp subset of patients on TVS, 13 out of 16 patients were found to have polyps, two were found to have just polypoidal endometrium and one had normal uterine cavity. The submucous fibroids were confirmed on hysteroscopy in five of the six cases whereas the retained products of conception cases have already been mentioned above.

The results of our study were analysed statistically. It was found that TVS finding of a normal endometrium had an accuracy of 96.49%. When TVS diagnosis was thickened endometrium, hysteroscopy confirmed it to be polypoidal endometrium in 84.21% cases whereas if TVS diagnosis was endometrial polyp, the diagnosis was confirmed by hysteroscopy in 81.255% cases. Accuracy of TVS in the diagnosis of submucous fibroids was found to 83.33% in our study.

Sensitivity, specificity, disease prevalence, positive predictive value and negative predictive value were calculated online by using the facility available at website www.medcalc.org. TVS was found to have a very high sensitivity of 95.23% (CI 84.16–99.30%), specificity of 94.82% (CI 85.57–98.71%), disease prevalence rate of 42.0% (CI 32.14–52.29%), positive predictive value of 93.01% (CI 82.39–97.6%) and negative predictive value of 96.49% (CI 88.07–99.48%).

Strength of agreement between TVS and hysteroscopy was determined by calculating the kappa value online on www.graphpad.com. The kappa value for our data was found to be 0.898 (SE 0.045, CI 0.810–0.985), indicating very good strength of agreement between TVS and hysteroscopy for assessment of the uterine cavity in patients with AUB.

Discussion

Premenopausal female patients with abnormal uterine bleeding constitute a large proportion of gynaecologic

Fig. 1 – TVS images. 1. Normal uterine cavity with triple layer endometrium, 2. Thickened endometrium, 3. Endometrial polyp, 4. Submucous fibroid.

consultations⁹ often resulting in a variety of tests being ordered. Most common pathologies causing AUB in premenopausal patients are submucous fibroids, adenomyosis, endometrial polyps and endometrial hyperplasia. Accurate diagnosis of the etiologic cause may result in treatment directed at the specific pathology and may avoid major surgery.

The most common diagnostic tests for evaluation of AUB are hysteroscopy, sonohysterography and transvaginal ultrasonography (TVS), either alone or in combination. It has been documented that the performance of the various diagnostic tests available is often poorly understood by those who order and who administer the diagnostic procedure.¹⁰ Therefore it is essential for the clinician to understand the appropriate place of various diagnostic tools in the evaluation of AUB. During the last two decades, TVS has been proposed as an alternative or a complement to hysteroscopy in the work-up of patients with AUB.^{11–13} Reliability of TVS in excluding the presence of intracavitary disorders in pre- and postmenopausal females has been demonstrated repeatedly and some authors have even questioned the appropriateness of hysteroscopy after a negative TVS.^{14,15}

We had undertaken the present study to evaluate the efficacy of TVS in patients with AUB as compared to hysteroscopy (gold standard). Among 100 patients with AUB included

in this study, 57 had normal endometrial findings on TVS. Wood et al,¹³ in their study of menorrhagia, had found that 33 of 97 patients had normal uterine cavity.

In our study we found that TVS has a very high predictive value, both negative as well as positive. Its high negative predictive value (96.49% in our study) lends credence to the notion that hysteroscopic investigation may be omitted in patients where TVS suggests a normal uterine cavity. The physician may directly institute treatment for the patient based on the TVS findings and patient's symptomatology and consider hysteroscopy only if the problem does not respond to the medical treatment. Vercellini et al¹⁵ who found negative predictive value of TVS of the order of 94% in their study of menorrhagic patient also support the above contention. Indman et al¹⁴ studied 238 patients with AUB and found the negative predictive value of TVS to be 89%. Barati et al,¹⁶ however, found that only 21.8% patients with AUB with normal TVS findings were found to have some abnormality on hysteroscopy and recommended that even after a normal TVS, a second-step office hysteroscopy should be considered.

In our study, we found the positive predictive value of TVS to be as high as 93.01% which compares well with the findings of Vercellini et al (89%) and Indman et al (87%). Abnormal TVS could comprise of endometrial polyp, submucous fibroid or thickened endometrium. We used 12 mm thickness of endometrium as the upper limit of normal in premenopausal patients, beyond which it was called thickened endometrium. Thickened endometrium on TVS is expected to correlate with endometrial hyperplasia on histopathology or polypoidal endometrium on hysteroscopy. Vercellini et al¹⁵ used 14 mm as the cut-off for normal whereas Emmanuel et al¹⁷ used 12 mm as the cut-off. Just as TVS can differentiate between endometrial polyp and endometrial hyperplasia with fair accuracy, its ability to detect submucous fibroids is also as high

Table 4 – Hysteroscopy findings.

Hysteroscopic finding	Numbers (n = 100)
Normal cavity	59
Polypoidal endometrium	17
Endometrial polyp	16
Submucous fibroid	6
Products of conception	2

Fig. 2 – Hysteroscopic images. 1. Normal uterine cavity, 2. Polypoidal thickened endometrium, 3. Endometrial polyp, 4. Submucous fibroid.

as 83.33%. Fedele et al¹² also studied efficacy of TVS and hysteroscopy in detecting submucous myomas in 71 patients scheduled to undergo hysterectomy for symptomatic fibroids. They found TVS to be 100% sensitive and 94% specific in diagnosing submucous myomas with a negative predictive value of 100% and positive predictive value of 81%. Hysteroscopy, on the other hand, had sensitivity of 100%, specificity 96%, negative predictive value 100% and positive predictive value 87%. Indman et al¹⁴ also found that TVS was 99% successful in detecting submucous myomas. Results of the meta-analysis of Farquhar et al⁷ to determine the accuracy of TVS, saline hystero-graphy and hysteroscopy showed that TVS is less accurate than saline hystero-graphy and hysteroscopy in diagnosing submucous fibroids, which is contrary to our findings.

Towbin et al¹¹ in their study of efficacy of TVS versus hysteroscopy in evaluation of uterine cavity in patients with excessive uterine bleeding found hysteroscopy to be significantly more sensitive as compared to TVS. They studied 149 cases of menorrhagia, metrorrhagia and postmenopausal bleeding and found sensitivity of 54% with TVS and 79% with hysteroscopy. Specificity of the two investigative modalities, however, was comparable in their study.

Table 5 – TVS-hysteroscopy correlation.

Correlation	Numbers (n = 100)
Normal TVS & normal hysteroscopy	55
Normal TVS & abnormal hysteroscopy	2
Abnormal TVS & normal hysteroscopy	3
Abnormal TVS & abnormal hysteroscopy	40 ^a

^a On four occasions abnormal TVS findings were not corresponding with the hysteroscopic abnormality.

To conclude, our study adds to the body of evidence available in literature regarding the usefulness of TVS in evaluation of the uterine cavity for AUB. It is recommended that TVS be used as the first-step investigation for cases of AUB in the reproductive age group. In case the TVS shows normal uterine cavity, further evaluation can be omitted and patient can be started on medical treatment for her symptoms. If the patient fails to respond to medical treatment, only then should further evaluation with hysteroscopy or sono-hystero-graphy should be considered. In case the initial TVS shows some abnormality, it can help in directing the appropriate next intervention. For example, if TVS suggests an endometrial polyp, then one could directly plan operative hysteroscopy whereas a thickened endometrium could be taken up for office endometrial sampling.

Table 6 – TVS-hysteroscopy correlation: Sub-group analysis.

TVS finding	Number	Hysteroscopy finding	Number
Normal endometrium	57	Normal cavity	55
		Polypoidal endometrium	1
		Endometrial polyp	1
Thickened endometrium	19	Polypoidal endometrium	16
		Endometrial polyp	2
		Normal cavity	1
Endometrial polyp	16	Endometrial polyp	13
		Polypoidal endometrium	2
Submucous fibroid	6	Normal cavity	1
		Submucous fibroid	5
Retained products of conception	2	Normal cavity	1
		Polypoidal endometrium	1
		Retained products of conception	1

Conflicts of interest

All authors have none to declare.

REFERENCES

1. Fritz MA, Speroff L, eds. *Clinical Gynecologic Endocrinology and Infertility*. 8th ed. Philadelphia: LWW; 2011:591–606.
2. Mencaglia L, Perino A, Hamou J. Hysteroscopy in perimenopausal and postmenopausal women with abnormal uterine bleeding. *J Reprod Med*. 1987;32:577–582.
3. Word B, Wideman GL. The fallacy of simple uterine curettage. *Obstet Gynecol*. 1958;12:642–648.
4. Grimes DA. Diagnostic dilation and curettage: a reappraisal. *Am J Obstet Gynecol*. 1982;42:1–6.
5. Stock RJ, Kanbur A. Prehysterectomy curettage. *Obstet Gynecol*. 1975;45:537–541.
6. Stovall TG, Soloman SK, Ling FW. Endometrial sampling prior to hysterectomy. *Obstet Gynecol*. 1989;73:405–408.
7. Farquhar C, Ekeroma A, Furness S, Arroll B. A systematic review of transvaginal sonography, sonohysterography and hysteroscopy for the investigation of abnormal uterine bleeding in premenopausal women. *Acta Obstet Gynecol Scand*. 2003;82:493–504.
8. Wamsteker K, Emanuel MH, de Kruif. Fibroids. In: Lewis BV, Magos AL, eds. *Endometrial Ablation*. Edinburgh: Churchill Livingstone; 1993:161–181.
9. Coulter A, Bradlow J, Agass M, et al. Outcomes of referrals to gynaecology out-patient clinics for menstrual problems: an audit of general practice records. *Br J Obstet Gynaecol*. 1991;98:789–796.
10. Eisenberg JM, Sankey V, Williams MD, et al. Computer based audit to detect and correct overutilization of laboratory tests. *Med Care*. 1977;15:915–921.
11. Towbin N, Gviazda I, March C. Office hysteroscopy versus transvaginal ultrasonography in evaluation of patients with excessive uterine bleeding. *Am J Obstet Gynecol*. 1996;174:1678–1682.
12. Fedele L, Bianchi S, Dorta M, et al. Transvaginal sonography versus hysteroscopy in the diagnosis of uterine submucous myomas. *Obstet Gynecol*. 1991;77:745–748.
13. Wood C, Hurley VA, Leoni M. The value of vaginal ultrasound in the management of menorrhagia. *Aust N Z J Obstet Gynecol*. 1993;33:198–200.
14. Indman PD. Abnormal uterine bleeding: accuracy of vaginal probe ultrasound in predicting abnormal hysteroscopic findings. *J Reprod Med*. 1995;40:545–548.
15. Vercellini P, Cortesi I, Oldani, et al. The role of transvaginal ultrasonography and outpatient diagnostic hysteroscopy in the evaluation of patients with menorrhagia. *Hum Reprod*. 1997;12:1768–1771.
16. Barati M, Masihi S, Moramezi F, Salemi S. Office hysteroscopy in patients with abnormal uterine bleeding and normal transvaginal sonography. *Int J Fertil Steril*. 2008;1:175–179.
17. Emmanuel M, Verdel M, Wamsteker K, et al. A prospective comparison of transvaginal ultrasonography and diagnostic hysteroscopy in the evaluation of patients with abnormal uterine bleeding: clinical implications. *Am J Obstet Gynecol*. 1995;172:547–552.