

Transvaginal Ultrasonography and Saline Infusion Sonohysterography for the Detection of Intra-uterine Lesions in Pre- and Post-menopausal Women with Abnormal Uterine Bleeding

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This prospective study investigated 79 pre- and 25 post-menopausal women with abnormal uterine bleeding who underwent conventional transvaginal ultrasonography (TVS) and saline infusion sonohysterography (SIS) and compared the results with histopathological findings obtained by dilatation and curettage, hysteroscopy or hysterectomy. Histological examination revealed normal endometrial histology in 28 patients, intracavitary polyps in 46 patients, submucosal fibroids in 18 patients, intramural fibroids in six patients and endometrial hyperplasia in six patients.

The sensitivity and specificity of TVS in detecting endometrial polyps were 65.2% and 87.9%, respectively, compared with 91.3% and 93.1% for SIS. The sensitivity and specificity of TVS in detecting uterine fibroids were 95.8% and 95.0%, respectively, versus 91.6% and 98.7% for SIS. These results show that SIS is a satisfactory method of identifying lesions and that it is easy and cost-effective, and improves on the diagnostic utility of TVS. SIS is also a less invasive alternative to hysteroscopy, so should result in less morbidity in the evaluation of abnormal uterine bleeding in women.

KEY WORDS: ABNORMAL UTERINE BLEEDING; TRANSVAGINAL SONOGRAPHY; SALINE INFUSION SONOHYSTEROGRAPHY; INTRA-UTERINE LESIONS

Introduction

The most frequent indication in women for gynaecological surgical intervention and one that may arise in any age group is abnormal uterine bleeding.¹ In women with

abnormal uterine bleeding, such as those with uterine fibroids (myomas) and endometrial polyps, endometrial hyperplasia or adenomyosis occurs in only 30 – 50% of cases; a malignant pathology

such as adenocarcinoma occurs in 1% of those < 50 years of age and in 10 – 15% of those > 50 years of age.^{2,3} In about 50% of cases, abnormal uterine bleeding arises as a result of dysfunction, making surgical intervention unnecessary.⁴ Most benign and malignant lesions of the uterus have the macroscopic appearance of a polyp.⁵ Consequently, non-invasive investigations are advisable before surgery.

Hysteroscopy is accepted as the gold standard for determining the cause of endometrial pathologies presenting with abnormal uterine bleeding.⁶ Although invasive procedures are valuable in finding the cause of abnormal uterine bleeding, they can have complications⁷ and do not give any information regarding adnexa and myometrium. The non-invasive diagnostic technique of choice in the diagnosis of abnormal uterine bleeding in women should be easily applicable and enable determination of which invasive technique (i.e. endometrial sampling, dilatation and curettage [D&C] and hysteroscopy) may, subsequently, be appropriate.

Transvaginal ultrasonography (TVS) can be used to diagnose with high sensitivity polyps, submucosal fibroids,^{8,9} endometrial hyperplasia and carcinoma;^{10,11} however, the accuracy of TVS in the diagnosis of focal endometrial lesions is limited.¹² Saline infusion sonohysterography (SIS) is increasingly used for investigation of the uterine cavity. It is an easy, fast and well-tolerated diagnostic method, hence may be indicated in situations in which conventional TVS cannot assure the normality of the uterine cavity or in which TVS detects an abnormality but cannot be used to define its nature.¹³ With the use of SIS, single-layer evaluation of the endometrial lining is possible, which gives a more detailed picture of the uterine cavity

compared with traditional sonography. It can provide specific information about the location and extent of subendometrial lesions affecting the uterine cavity and can facilitate the appropriate choice of surgery. Use of SIS has been reported to be highly sensitive and specific, particularly in diagnosing the cause of abnormal uterine bleeding in pre-menopausal women.^{12,14}

The purpose of the present study was to evaluate the feasibility of the surface visualization of intra-uterine pathology and to compare the diagnostic accuracy of TVS and SIS with invasive procedures, such as D&C, hysteroscopy and hysterectomy, in women with abnormal uterine bleeding. The effectiveness of SIS in determining the relationship of submucosal fibroids with the endometrial cavity in women previously diagnosed with fibroids was also examined.

Patients and methods

PATIENTS

This study was undertaken at the Göztepe Research and Training Hospital, Istanbul, Turkey, between 1 October 2003 and 31 April 2005 and involved women with abnormal uterine bleeding. All patients were included in the study prospectively; those who did not complete both the TVS and the SIS procedures were excluded from the study. Other exclusion criteria were obvious infection, cervical abnormalities and pathology of the adnexa. All women participating in the study completed a questionnaire detailing their menstrual, gynaecological and obstetric histories. They were classified as either pre-menopausal (defined as amenorrhoea for > 12 months) or post-menopausal. The study was approved by the Ethics Committee of Göztepe Research and Training Hospital and all patients gave written informed consent before entry.

TVS AND SIS PROCEDURES AND EVALUATIONS

All patients first received a detailed bimanual examination of the uterus and adnexa, and a Pap smear was obtained in every case. This was followed by a TVS examination (LOGIQ 200; General Electric Medical Systems, Milwaukee, WI, USA) with a transvaginal ultrasound probe (6.5 MHz) by one of two experienced gynaecologists. The myometrium and endometrium were examined in longitudinal and transverse planes. Any discontinuity was noted and all other findings, such as deformations of the endometrial lining, absence of the central echo-dense line or variable echo density, were considered to be normal. The accepted threshold maximum thickness of the endometrium examined during the early or mid-proliferative phase in pre-menopausal patients was 8 mm at the thickest part and, for post-menopausal patients, it was 5 mm. All endometrial measurements below these values were considered normal.^{4,6,15} An endometrial polyp was defined as a smooth-margined, echogenic mass with homogeneous texture and of variable size and shape. A submucosal myoma was defined as a solid, circular structure of mixed echogenicity, arising from the myometrium and protruding into the uterine cavity; it should be covered by intact epithelium.¹⁶ Any intracavity abnormalities were recorded. The maximum depth of the endometrium was measured in the longitudinal plane.

For SIS examination, patients were placed in the dorsal lithotomy position. A standard bivalve speculum was inserted and the uterine cervix was cleansed with an antiseptic solution (povidone-iodine). A sterile disposable catheter, 15 cm long and with diameter 2 mm, was introduced through the cervical os until it reached the fundus. The speculum was withdrawn and

the transvaginal ultrasound (6.5 MHz) probe was introduced. Up to 20 ml of sterile saline solution was infused into the uterine cavity; 5 – 10 ml usually proved to be sufficient to distend the cavity, and the distended cavity was observed directly by sonography (LOGIQ 200; General Electric Medical Systems). The location and size of any uterine abnormalities were noted on a case record form. The anterior and posterior endometrial thicknesses were measured at the thickest part, in the longitudinal plane and then in the transverse plane from the cervix to the fundus. These two measurements were added together to calculate the total endometrial thickness.

Results for TVS and SIS were expressed using the following criteria: normal cavity; endometrial hypertrophy (single-layer endometrial thickness > 6 mm for pre-menopausal women and > 3 mm for post-menopausal women);¹⁷ endometrial atrophy (single-layer endometrial thickness < 2 mm); endometrial polyp (hyperechogenic lesion with a pedunculated attachment to the endometrium); submucosal myoma (lesion of mixed echogenicity disrupting the endometrial continuity);¹⁶ intramural myoma (intramural lesion with distinct margins); and suspicious lesion (irregular endometrial echo of variable echogenic texture).¹⁶ The location of any feature was recorded according to standard criteria of uterine anatomy as being either on the anterior or posterior side and relative to the fundus and isthmus.¹⁸

AFTER COMPLETION OF TVS AND SIS

At the end of the TVS and SIS procedures, the lower portion of the uterus and the cervical canal were examined and photographed. Uterine malignancy was suggested if a vegetative, hypervascularized, usually hard lesion was detected. A polyp was suspected if a

smooth, poorly vascularized, soft, pedunculated lesion protruded into the cavity. A diagnosis of submucosal fibroid was made if a smooth, regularly shaped or lobulated lesion distorted the surface of the uterine cavity.¹⁹

Women with an abnormal TVS or SIS result, especially those with an intra-uterine lesion (endometrial hypertrophy, polyp, submucosal fibroid or suspicion of cancer) were scheduled for an appropriate surgical procedure (D&C, hysteroscopy or hysterectomy). The pre-diagnosis achieved with TVS and SIS was compared with the pathological results of specimens obtained by D&C, hysteroscopy and hysterectomy. Hysteroscopy and hysterectomy were used as the gold standards for a definitive diagnosis. In women in whom hysteroscopy was not feasible (i.e. sonographic findings did not raise the suspicion of a local lesion), a full D&C of the entire uterine cavity was performed. The resected tissues from the uterine cavity and endocervix were placed in separate containers with 10% formaldehyde and sent for histological analysis. The histological results were compared with the TVS and SIS results separately, using pathology results as a reference.

STATISTICAL ANALYSIS

The accuracies of TVS and SIS were compared using the McNemar test; $P < 0.05$ was considered statistically significant. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy of TVS and SIS for all endometrial pathologies, endometrial polyps and fibroids were calculated by comparing the results of each method with those obtained by histological examination.

Results

A total of 140 women with abnormal uterine bleeding were prospectively evaluated by

TVS and SIS between 1 October 2003 and 31 April 2005 and completed the questionnaires. Of these, 115 met the inclusion criteria for the study and, hence, were eligible to take part. Of these, a further 11 were excluded because they were subsequently found not to have completed both the TVS and the SIS tests. As a result, 104 women remained who had fully undergone TVS, SIS and an invasive surgical intervention during the study period. Of these 79 were pre-menopausal (amenorrhoea for > 12 months) and 25 were post-menopausal. The mean age of the pre-menopausal women was 42 (range 32 – 52) years and that of the post-menopausal women was 48 (range 44 – 68) years. Thirty-five (44.3%) of the pre-menopausal women had menorrhagia, 27 (34.2%) had menometrorrhagia and 17 (21.5%) had polymenorrhoea. D&C was performed in 73 of the 104 women (70.2%), hysteroscopy in 18 cases (17.3%) and hysterectomy in 13 cases (12.5%).

The pathological results of the specimens obtained at surgical intervention indicated that 28 of the 104 women (26.9%) had a normal endometrium (atrophic, proliferative or secretory), 46 (44.2%) had endometrial polyps, 18 (17.3%) had submucosal myomas, six (5.8%) had uterine fibroids unrelated to the cavity and six (5.8%) had endometrial hyperplasia. Comparison of the pathological results with those of the TVS and SIS procedures are summarized in Tables 1 and 2, respectively.

The sensitivity, specificity, PPN, NPV and diagnostic accuracy of TVS and SIS for endometrial polyps and uterine fibroids (myomas) are shown in Table 3. When the diagnostic accuracies of TVS and SIS for endometrial polyps were compared with the pathology results, there was a significant difference ($P < 0.05$) between TVS and the

Detection of intra-uterine lesions in pre- and post-menopausal women

TABLE 1:
Comparison of transvaginal sonography (TVS) findings with pathological results in women with abnormal uterine bleeding

TVS result	Pathological result					Total
	Normal	Endometrial hyperplasia	Submucosal fibroids	Intramural fibroids	Endometrial polyps	
Normal	18	1	1	0	8	28
Endometrial hyperplasia	3	3	0	0	6	12
Submucosal fibroids	1	0	13	0	2	16
Intramural fibroids	1	0	4	6	0	11
Endometrial polyps	5	2	0	0	30	37
Total	28	6	18	6	46	104

Data are number of women.

TABLE 2:
Comparison of saline infusion sonohysterography (SIS) findings with pathological results in women with abnormal uterine bleeding

TVS result	Pathological result					Total
	Normal	Endometrial hyperplasia	Submucosal fibroids	Intramural fibroids	Endometrial polyps	
Normal	23	2	0	0	1	26
Endometrial hyperplasia	2	4	0	0	3	9
Submucosal fibroids	1	0	16	0	0	17
Intramural fibroids	0	0	0	6	0	6
Endometrial polyps	2	0	2	0	42	46
Total	28	6	18	6	46	104

Data are number of women.

pathology results, whereas no significant difference was observed between SIS and the pathology results. With regard to the diagnostic accuracies of TVS and SIS in detecting uterine fibroids, the difference between the sonographic results and the corresponding pathology results was not significant either for TVS or for SIS. There was also no significant difference between the TVS and SIS methods in diagnostic consistency for uterine fibroids.

By combining the results of TVS, SIS and D&C in the pre-menopausal group endometrial polyps were diagnosed in 48.1%

(38/79) of patients, submucosal fibroids in 15.2% (12/79), intramural fibroids in 5.1% (4/79) and hyperplasia in 5.1% (4/79), and in 26.6% (21/79) the result was normal. In the post-menopausal group endometrial polyps were diagnosed in 32.0% (8/25) of patients, submucosal fibroids in 24.0% (6/25), intramural fibroids 8.0% (2/25) and hyperplasia in 8.0% (2/25), and in 28.0% (7/25) the result was normal.

Four patients were found to have fibroids in the uterine cavity that seemed to be submucosal fibroids on TVS results, however SIS examination indicated that they were

TABLE 3:
Diagnostic parameters of transvaginal sonography (TVS) and saline infusion sonohysterography (SIS) in the detection of endometrial polyps and uterine fibroids (myomas) with abnormal uterine bleeding

	Endometrial polyps	Uterine fibroids (myomas)
TVS		
Sensitivity	65.2%	95.8%
Specificity	87.9%	95.0%
PPV	81.0%	85.1%
NPV	76.1%	98.7%
Diagnostic accuracy	77.8%	95.1%
Statistical significance vs pathology	$P < 0.05$	NS
SIS		
Sensitivity	91.3%	91.6%
Specificity	93.1%	98.7%
PPV	91.3%	95.6%
NPV	93.1%	97.5%
Diagnostic accuracy	92.3%	97.1%
Statistical significance vs pathology	NS	NS

NS, not statistically significant ($P > 0.05$); PPV, positive predictive value; NPV, negative predictive value.

intramural fibroids in the posterior wall of the uterus. Six patients were found to have endometrial hyperplasia; four of these were diagnosed by SIS.

Discussion

The present study evaluated the diagnostic accuracy of TVS and SIS for the detection of intracavitary abnormalities. TVS is a non-invasive modality that provides excellent imaging of the uterus and endometrium. It is relatively painless, well accepted by patients and can be performed either in the office or at a hospital at a relatively low cost.²⁰ However, as seen in the present study, it has several limitations, especially with regard to the evaluation of intracavitary abnormalities. TVS often produces equivocal findings and not all polyps or submucosal fibroids and abnormal endometrial growths can be excluded;²¹ furthermore, patients may need to be subjected to further investigations. TVS cannot always

distinguish submucosal fibroids from intramural fibroids which impinge upon the uterine cavity. For example, four intramural fibroids that appeared to be submucosal by TVS were correctly found to be intramural by SIS in the present study.

The diagnostic efficacy of TVS has been found to be lower than SIS when compared with the pathology results, especially for endometrial polyps compared with submucosal fibroids.^{21,22} In the present study, the sensitivity, specificity, PPV and NPV of TVS were 65.2%, 87.9%, 81.0% and 76.1%, respectively, in detecting endometrial polyps and 95.8%, 95.0%, 85.1% and 98.7%, respectively in detecting fibroids. Vercellini *et al.*,²³ in a large series, reported that TVS had 80% sensitivity and 69% specificity for diagnosing submucosal fibroids. So, although it has also been found that the diagnostic accuracy of TVS is high for uterine fibroids, unlike SIS and hysteroscopy, TVS cannot reveal the relationship of fibroids to the cavity.

Goldstein *et al.*²⁴ also found that small structural abnormalities can be easily missed and that it is not always possible to differentiate between endometrial and myometrial abnormalities by TVS and that it was inadequate in distinguishing between dysfunctional uterine bleeding and endometrial hyperplasia. Using TVS in the present study, some cases of endometrial polyps were interpreted as normal endometrium. Our findings confirmed that, because of its low sensitivity TVS, is inadequate in evaluating the cause of abnormal uterine bleeding. We found that the accuracy of SIS in the diagnosis of intracavitary abnormalities was higher than that of TVS.

SIS, when combined with TVS in the present study, showed markedly better sensitivity in the detection and localization of lesions in the uterine cavity. Knowing the correct location of lesions during the treatment, for example if D&C is being planned, makes it possible to avoid proceeding blindly. Pre-operative use of SIS may assist in choosing the best conservative surgical treatment for the patient.²⁵ In a systematic review and meta-analysis of 24 studies, de Kroon *et al.*¹⁴ found SIS to be both feasible and accurate in the evaluation of the uterine cavity in pre- and post-menopausal women. They concluded that SIS, in combination with an aspiration biopsy in selected cases, is suitable as the standard diagnostic procedure in pre- and post-menopausal women complaining of abnormal uterine bleeding. When women with myomas were excluded, polyps were common among women with abnormal uterine bleeding and in older pre-menopausal women: only 3% of women aged < 35 years had polyps compared with 23% of women aged \geq 35 years.²⁶

TVS is a sensitive tool in the diagnosis of

endometrial abnormalities in post-menopausal women,²⁰ however, distinction between endometrial hyperplasia and other benign lesions is relatively difficult. Nevertheless, TVS has been found to have high sensitivity and specificity in detecting endometrial hyperplasia, particularly in post-menopausal women with uterine bleeding.²⁷ However, SIS is more effective than TVS because TVS generally fails to discriminate between endometrial hyperplasia, polyps and submucosal myomas.²⁸ In addition, the exact location of the polyps or growths cannot be identified on TVS.

Information obtained by SIS helps in determining whether a diagnostic or operative hysteroscopy is needed.²⁹ The feasibility of using SIS, although comparable with diagnostic hysteroscopy in pre-menopausal women, is low in post-menopausal women.¹⁴ Thus, the pathological examination of material obtained by endometrial biopsy maintains its significance as the primary method in the diagnosis of endometrial hyperplasia and endometrial carcinoma, particularly in post-menopausal women.³⁰ Histological samples for analysis were obtained from all patients in the present study, hence it was possible to compare the results of TVS and SIS with those of histology. The most frequently observed abnormality was a benign polyp, followed by submucosal fibroids and endometrial hyperplasia and these data are consistent with the literature, although the frequency of benign pathology was higher in the present study.^{3,9,10}

In conclusion, for the identification and assessment of uterine lesions, SIS is a simple, safe, reliable, effective and well-tolerated method without complications that complements TVS in the pre-operative examination of uterine pathology. SIS has been found to be superior to TVS in most studies that have compared their

effectiveness in detecting intracavitary lesions and may enable the number of diagnostic hysteroscopies to be reduced by as much as 50%.⁴ It could also halve the number of interventions in pre- and post-menopausal women with normal histological findings.³¹ Patients in whom no intracavitary abnormality is detected by SIS require no further evaluation and are best

treated with medical therapy. We believe that SIS will reduce the number of unnecessary surgical procedures and will, thus, lower costs and reduce morbidity in the evaluation of abnormal uterine bleeding in women.

Conflicts of interest

The authors had no conflicts of interest to declare in relation to this article.

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References

- 1 Lewis BV: Hysteroscopy for the investigation of abnormal uterine bleeding. *Br J Obstet Gynaecol* 1990; **97**: 283 – 284.
- 2 Concin H, Bösch H, Schwarzler P: Hysteroscopy—applications and risks. Hysteroscopy versus fractionated curettage: therapeutic insufficiency of abrasion. *Gynakol Geburtshilfliche Rundsch* 1995; **35**: 114 – 116.
- 3 Mencaglia L, Perino A: Diagnostic hysteroscopy today. *Acta Eur Fertil* 1986; **17**: 431 – 439.
- 4 Bronz L, Suter I, Rusca T: The value of transvaginal sonography with and without saline instillation in the diagnosis of uterine pathology in pre- and postmenopausal women with abnormal bleeding or suspect sonographic findings. *Ultrasound Obstet Gynecol* 1997; **9**: 53 – 58.
- 5 Genton CY: Myometrium and endometrium. Histopathologic aspects of benign lesions. *Arch Gynecol Obstet* 1994; **225**(suppl 2): 350 – 355.
- 6 Clark TJ, Voit D, Gupta JK, *et al*: Accuracy of hysteroscopy in the diagnosis of endometrial cancer and hyperplasia: a systematic quantitative review. *JAMA* 2002; **288**: 1610 – 1621.
- 7 Clark TJ: Outpatient hysteroscopy and ultrasonography in the management of endometrial disease. *Curr Opin Obstet Gynecol* 2004; **16**: 305 – 311.
- 8 Narayan R, Goswamy RK: Transvaginal sonography of the uterine cavity with hysteroscopic correlation in the investigation of infertility. *Ultrasound Obstet Gynecol* 1993; **3**: 129 – 133.
- 9 Fedele L, Bianchi S, Dorta M, *et al*: Transvaginal ultrasonography versus hysteroscopy in the diagnosis of uterine submucous myomas. *Obstet Gynecol* 1991; **77**: 745 – 748.
- 10 Osmers R, Völksen M, Schauer A: Vaginosonography for early detection of endometrial carcinoma? *Lancet* 1990; **335**: 1569 – 1571.
- 11 Granberg S, Wikland M, Karlsson B, *et al*: Endometrial thickness as measured by endovaginal ultrasonography for identifying endometrial abnormality. *Am J Obstet Gynecol* 1991; **164**: 47 – 52.
- 12 Farguhar C, Ekeroma A, Furness S, *et al*: A systematic review of transvaginal ultrasonography, sonohysterography and hysteroscopy for the investigation of abnormal uterine bleeding in premenopausal women. *Acta Obstet Gynecol Scand* 2003; **82**: 493 – 504.
- 13 Dubinsky TJ, Parvey HR, Gormaz G, *et al*: Transvaginal hysterosonography: comparison with biopsy in the evaluation of postmenopausal bleeding. *J Ultrasound Med* 1995; **14**: 887 – 893.
- 14 de Kroon CD, de Bock GH, Dieben SW, *et al*: Saline contrast hysterosonography in abnormal uterine bleeding: a systematic review and meta-analysis. *BJOG* 2003; **110**: 938 – 947.
- 15 Smith-Bindman R, Kerlikowske K, Feldstein VA, *et al*: Endovaginal ultrasound to exclude endometrial cancer and other endometrial abnormalities. *JAMA* 1998; **280**: 1510 – 1517.
- 16 Parsons AK, Lense JJ: Sonohysterography for endometrial abnormalities: preliminary results. *J Clin Ultrasound* 1993; **21**: 87 – 95.
- 17 Osmers R, Puchta J, Suren A: Pathological findings in the postmenopausal endometrium. In: *Ultrasound and the Uterus* (Osmers R, Kurjak A, eds). Carnforth, MK: Parthenon Publishing Group, 1995; pp 31 – 44.
- 18 Bernard JP, Lecuru F, Darles C, *et al*: Saline contrast sonohysterography as first-line investigation for women with uterine bleeding. *Ultrasound Obstet Gynecol* 1997; **10**: 121 – 125.
- 19 Epstein E, Ramirez A, Skoog L, *et al*: Transvaginal sonography, saline contrast sonohysterography and hysteroscopy for the investigation of women with postmenopausal bleeding and endometrium > 5 mm. *Ultrasound Obstet Gynecol* 2001; **18**: 157 – 162.
- 20 Emanuel MH, Verdel MJ, 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.
- 21 Schwarzler P, Concin H, Bösch H, *et al*: An evaluation of sonohysterography and diagnostic hysteroscopy for the assessment of intrauterine pathology. *Ultrasound Obstet Gynecol* 1998; **11**: 337 – 342.
- 22 Erdem M, Bilgin U, Bozkurt N, *et al*: Comparison of transvaginal ultrasonography and saline infusion sonohysterography in evaluating the endometrial cavity in pre- and postmenopausal women with abnormal uterine bleeding. *Menopause* 2007; **14**: 846 – 852.
- 23 Vercellini P, Cortesi I, Oldani S, *et al*: The role of transvaginal ultrasonography and outpatient diagnostic hysteroscopy in the evaluation of patients with menorrhagia. *Hum Reprod* 1997; **12**: 1768 – 1771.
- 24 Goldstein SR, Zelster I, Horan CK, *et al*: Ultrasonography-based triage for perimenopausal patients with abnormal uterine bleeding. *Am J Obstet Gynecol* 1997; **177**: 102 – 108.
- 25 Mihm LM, Quick VA, Brumfield JA, *et al*: The accuracy of endometrial biopsy and saline sonohysterography in the determination of the cause of abnormal uterine bleeding. *Am J Obstet Gynecol* 2002; **186**: 858 – 860.
- 26 Clevenger-Hoeft M, Syrop CH, Stovall DW, *et al*: Sonohysterography in premenopausal women with and without abnormal bleeding. *Obstet Gynecol* 1999; **94**: 516 – 520.
- 27 Giusa-Chiferi MG, Gonçalves WJ, Baracat EC, *et al*: Transvaginal ultrasound, uterine biopsy and hysteroscopy for postmenopausal bleeding. *Int J Gynaecol Obstet* 1996; **55**: 39 – 44.
- 28 Gaucherand P, Piacenza JM, Salle B, *et al*: Sonohysterography of the uterine cavity: preliminary investigations. *J Clin Ultrasound* 1995; **23**: 339 – 348.
- 29 Cepni I, Ocal P, Erkan S, *et al*: Comparison of transvaginal sonography, saline infusion sonography and hysteroscopy in the evaluation of uterine cavity pathologies. *Aust NZ J Obstet Gynaecol* 2005; **45**: 30 – 35.
- 30 Dijkhuizen FP, De Vries LD, Mol BW, *et al*: Comparison of transvaginal ultrasonography and saline infusion sonography for the detection of intracavitary abnormalities in premenopausal women. *Ultrasound Obstet Gynecol* 2000; **15**: 372 – 376.
- 31 Dueholm M, Forman A, Jensen ML, *et al*: Transvaginal sonography combined with saline contrast sonohysterography in evaluating the uterine cavity in premenopausal patients with abnormal uterine bleeding. *Ultrasound Obstet Gynecol* 2001; **18**: 54 – 61.

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