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ORIGINAL ARTICLE

Hysterohydrosonoscopy—an integrated modality for uterine imaging

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Abstract Office hysteroscopy and hydrosonography have long been viewed as competitive methods. This study was aimed to find out whether a combined approach of hysteroscopy followed by hydrosonography could provide more accurate information about the uterine lumen. Consecutive patients referred for diagnostic hysteroscopy were recruited to the study. Each patient had a transvaginal ultrasound scan, hysteroscopy, and immediately thereafter hydrosonography. Additional information retrieved by hydrosonography was recorded. When hysteroscopy revealed a normal uterine cavity, no further information was gained from hydrosonography. However, in 80% of the cases where hysteroscopy showed an abnormal uterine cavity (e.g., septum, adhesions, fibroid, endometrial polyp), hydrosonography added significant information regarding the size of the lesion, degree of fibroid encroachment, or luminal contour. We conclude that a combination of diagnostic hysteroscopy and hydrosonography could serve as a simple "one-stop" approach for full evaluation of the uterine cavity.

Keywords Hysteroscopy · Hysterosonography · Imaging · Uterine cavity

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Introduction

Office hysteroscopy (HS) and hydrosonography (HSG) have long been viewed as competitive methods for visualization of the uterine cavity. Both are performed in order to visualize the uterine cavity and are carried out in an office setting by a single operator; they share the same indications, have similar diagnostic accuracy and safety record, and are equally tolerated by the patients. In spite of same diagnostic accuracy, each method has its own strengths and weaknesses. HS enables direct visualization of the uterine cavity whereas HSG is an indirect technique. On the other hand, HSG allows measurements of intracavitary lesions while HS does not. Currently, after initial assessment of the uterine cavity by transvaginal ultrasound scan (TVUS), HS is employed as a first-line procedure by endoscopists, whereas HSG is preferred by US experts. After either method, in case of an abnormal finding, an operative HS is performed as a treatment.

Since early publications, these procedures were compared with each other for diagnostic accuracy for various indications in different patient populations; however, they had rarely been considered complementary [1–11].

The aim of this study was to find out whether HSG immediately after HS could provide further and more complete information about the uterine cavity.

Materials and methods

This was a prospective cohort study performed between January 2007 and January 2010 in the Women's Health Center of the Maccabi Health Services, affiliated with Hadassah Hebrew University Medical Center. The study included patients referred for diagnostic HS. Each patient gave informed consent prior to the procedure according to

institutional guidelines. The patients underwent a three-step procedure: (1) a TVUS, (2) HS, and immediately afterward (3) HSG with the residual saline. TVUS of the uterus was performed in both sagittal and oblique transverse planes with a 6.5-MHz probe (LOGIQ 200, SUMSUNG GE Medical System, South Korea). Subsequently, the vagina and cervix were disinfected with betadine solution, and HS was performed by a rigid 5-mm hysteroscope (Karl Storz, Tuttlingen, Germany) with a 30° angle view at the distal end. During the procedure, the uterus was visualized with an infusion of 0.9% saline solution. The uterine cavity was considered abnormal if an endometrial polyp, submucous myoma, uterine septum, or adhesions were seen. Immediately after removing the hysteroscope, HSG of the uterus was performed with the residual distension fluid left inside the uterine cavity and without the additional insertion of a balloon catheter into the cervical canal. The added information provided by the HSG was recorded.

Results

A total of 64 patients were recruited for the study. Patients' characteristics and the indications for the procedure are detailed in Table 1. Five patients were excluded because of the inability to complete the HSG due to escape of saline from the uterine cavity immediately after HS. Three excluded patients were 2 to 3 months after cervical dilatation either naturally by a normal delivery or surgically prior to a curettage for missed abortion.

HS revealed a normal cavity in 59% of patients (n=35). In these cases, there was full agreement between HS and HSG and the HSG did not add further information about the cavity. In 24 patients (41%), an abnormal uterine cavity was detected by HS: endometrial polyps (n=14), submucous fibroids (n=2), intrauterine adhesions (n=4), and Mullerian duct anomalies (n=4). In 20 out of 24 (83%) of these cases, HSG provided additional information by enabling measurements of the intracavitary lesions whether a polyp (Fig. 1), a fibroid, or a septum, the degree of fibroid encroachment, and better delineation of luminal contour in case of coarse uterine adhesions (Fig. 2). The HSG did not add further information in cases of delicate intrauterine adhesions and arcuate uterine cavity.

Table 1 Patients' characteristics and indications for HS

Characteristics	
Age mean ± SD (range) years	35±10.9 (21–68)
Parity mean ± SD (range)	2.6±1.8 (0–7)
Menopausal status	8%
Indications for HS	
Menorrhagia/metrorrhagia (n=18)	28.1%
Postpartum bleeding (n=12)	18.7%
Hypomenorrhea (n=2)	3.1%
Suspected uterine deformation (n=7)	10.9%
Uterine cavity check up prior to IVF (n=10)	15.6%
Asymptomatic finding on TVUS (n=12)	18.7%
Postmenopausal bleeding (n=3)	4.7%

TVUS transvaginal ultrasound

Discussion

Competitive techniques

Many studies were published in the last two decades comparing the diagnostic accuracy of each method with comparable results: sensitivity of 90%, specificity of 80–85%, positive predictive value of 90%, and negative predictive value of 80% for both [1–6, 8, 9]. A systematic review of 19 publications between 1980 and 2001 assessing the diagnostic accuracy of TVUS, HSG, and HS for abnormal uterine bleeding in premenopausal women concluded that the performance of HSG and HS was comparable and superior to TVUS in detecting intrauterine abnormalities [10]. Only recently a new study design was published by two groups using HSG and HS sequentially. Makris et al. compared 3D HSG and HS done at a later stage in 242 cases of abnormal uterine bleeding [12]. Gumus et al. use a similar study design in 77 asymptomatic postmenopausal patients [7]. However, in contrast with our study, these authors employed the two methods on two separate occasions and still compared HSG and HS.

Complementary techniques

Our preliminary study is unique in its concept of performing HSG as complementary to HS in the diagnosis of an abnormal uterine cavity and in employing HSG immediately after HS using the residual distension medium left after the HS. By performing the sequence of luminal examination, TVUS–hysteroscopy–hysterosonography, more data could be retrieved from a single uterine imaging session. This modification has once been described by Cheng and Lin in a retrospective study investigating only submucous fibroids, but since then was unjustly neglected [13]. The new technology of 3DUS is now being credited of excellent view of the uterine cavity, but is still less available than 2DUS, more costly, and requires special expertise. The low technical failure rate of 7.8% (five out of 64) due to saline backflow through the cervix after removing the hysteroscope is surprising as the majority of our study group is women in their fertile years. We suggest

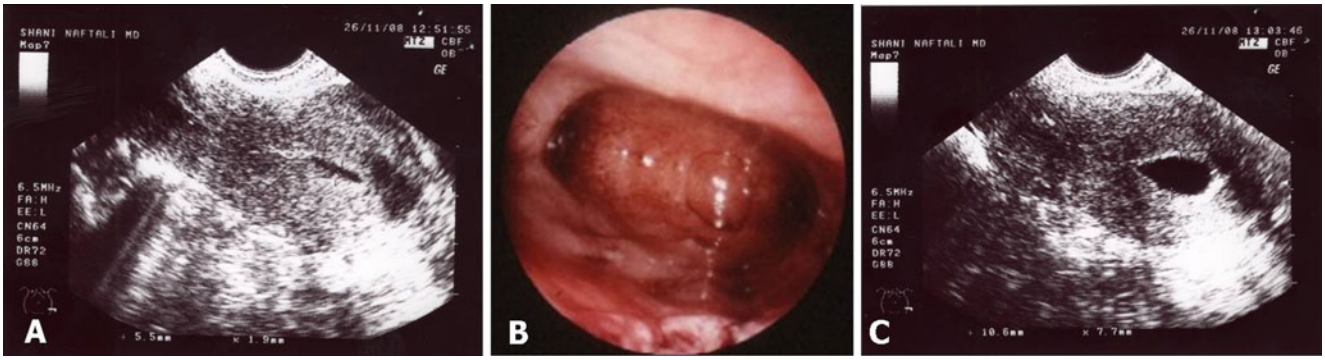

Fig. 1 **a** Preprocedure transvaginal ultrasound scan of the uterus. **b** Hysteroscopic evaluation of the uterine cavity revealing a thick isthmal adhesion obliterating further access to the cavity. **c** Hydrosonography immediately after hysteroscopy revealing uterine cavity distal to the adhesion

that it could be attributed to the immediate insertion of the US vaginal probe right after the removal of the hysteroscope without changing the patient's position.

Our modified technique, hysterohydrosonoscopy (HHSS), is simple and devoid of the cost and discomfort of a second procedure. With this method of imaging, the only modification needed to the set up of HS is a 2DUS machine with a TV transducer.

Significance

The data collected by the complementary HSG included measurements of the intracavitary lesion, transforming the nonquantitative hysteroscopic impression into a quantitative one. The size of a polyp and a fibroid as well as the length of a septum may have important clinical relevance. For example, the size of an asymptomatic endometrial polyp is considered a prognostic parameter for its malignancy potential [14–16]; thus, a small size (<15 mm), asymptomatic polyp may just be followed as an alternative to its removal [14–16]. Endometrial polyps may impact implantation and pregnancy rates after IVF depending on their size [17, 18].

The size of a submucous fibroid and its encroachment into the lumen may determine the surgical approach for its excision [19–22]. The size of a submucous fibroid may also impact pregnancy rates in infertile women [23].

The length of the uterine septum (>1 cm) dictates the need for hysteroscopic septectomy in order to prevent unfavorable pregnancy outcome [24–27].

Complementary HSG may also add valuable information where visualization of the cavity by HS is limited because of poor access into the uterus, e.g., retroverted uterus, or where thick isthmal adhesions are present. In these cases, further delineation of the luminal contour of the uterus can be achieved with complementary HSG. In the case of isthmal adhesions, neither HS nor HSG alone could reveal the true state of the uterine cavity as the integrated method HHSS does. In this way, a better planning of the operative procedure could be achieved.

This study should be addressed as pilot considering the small number of recruited patients, which limits the conclusions. Further investigation may be needed to confirm our findings in a larger series.

"Do two walk together unless they are agreed?" (Amos 3:3). We advocate that especially when the two are not

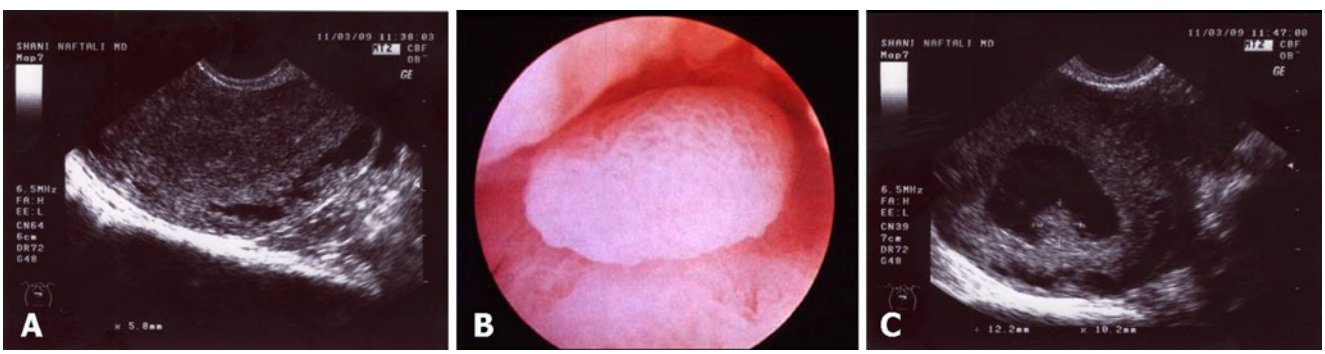

Fig. 2 **a** Preprocedure transvaginal ultrasound scan of the uterus. **b** Hysteroscopic evaluation of the uterine cavity revealing an endometrial polyp. **c** Hydrosonography immediately after hysteroscopy enabled measurements of the lesion 10.2×12.2 mm

agreed, they should go together. We suggest that HHSS, a combination of diagnostic HS followed by HSG, could serve as a simple "one-stop" approach for full evaluation of the uterine cavity.

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References

1. Saidi MH, Sadler RK, Theis VD, Akright BD, Farhart SA, Villanueva GR (1997) Comparison of sonography, sonohysterography, and hysteroscopy for evaluation of abnormal uterine bleeding. J Ultrasound Med 16:587–591
2. Schwärzler P, Concin H, Bösch H, Berlinger A, Wohlgenannt K, Collins WP, Bourne TH (1998) An evaluation of sonohysterography and diagnostic hysteroscopy for the assessment of intrauterine pathology. Ultrasound Obstet Gynecol 11:337–342
3. Krampl E, Bourne T, Hurlen-Solbakken H, Istre O (2001) Transvaginal ultrasonography sonohysterography and operative hysteroscopy for the evaluation of abnormal uterine bleeding. Acta Obstet Gynecol Scand 80:616–622
4. Epstein E, Ramirez A, Skoog L, Valentin L (2001) Transvaginal sonography, saline contrast sonohysterography and hysteroscopy for the investigation of women with postmenopausal bleeding and endometrium>5 mm. Ultrasound Obstet Gynecol 18:157–162
5. Kelekci S, Kaya E, Alan M, Alan Y, Bilge U, Mollamahmutoglu L (2005) Comparison of transvaginal sonography, saline infusion sonography, and office hysteroscopy in reproductive-aged women with or without abnormal uterine bleeding. Fertil Steril 84:682–686
6. Leone FP, Carsana L, Lanzani C, Vago G, Ferrazzi E (2007) Sonohysterographic endometrial sampling and hysteroscopic endometrial biopsy: a comparative study. Ultrasound Obstet Gynecol 29:443–448
7. Gumus II, Keskin EA, Kiliç E, Aker A, Kafali H, Turhan NO (2008) Diagnostic value of hysteroscopy and hysterosonography in endometrial abnormalities in asymptomatic postmenopausal women. Arch Gynecol Obstet 278:241–244
8. Van den Bosch T, Verguts J, Daemen A, Gevaert O, Domali E, Claerhout F, Vandenbroucke V, De Moor B, Deprest J, Timmerman D (2008) Pain experienced during transvaginal ultrasound, saline contrast sonohysterography, hysteroscopy and office sampling: a comparative study. Ultrasound Obstet Gynecol 31:346–351
9. van Dongen H, de Kroon CD, van den Tillaart SA, Louwé LA, Trimbos-Kemper GC, Jansen FW (2008) A randomised comparison of vaginoscopic office hysteroscopy and saline infusion sonography: a patient compliance study. BJOG 115:1232–1237
10. Farquhar C, Ekeroma A, Furness S, Arroll B (2003) A systematic review of transvaginal ultrasonography, sonohysterography and hysteroscopy for the investigation of abnormal uterine bleeding in premenopausal women. Acta Obstet Gynecol Scand 82:493–504
11. Leone FP, Lanzani C, Ferrazzi E (2003) Use of strict sonohysterographic methods for preoperative assessment of submucous myomas. Fertil Steril 79:998–1002
12. Makris N, Skartados N, Kalmantis K, Mantzaris G, Papadimitriou A, Antsaklis A (2007) Evaluation of abnormal uterine bleeding by transvaginal 3-D hysterosonography and diagnostic hysteroscopy. Eur J Gynaecol Oncol 28:39–42
13. Cheng YM, Lin BL (2002) Modified sonohysterography immediately after hysteroscopy in the diagnosis of submucous myoma. J Am Assoc Gynecol Laparosc 9:24–28
14. Ben-Arie A, Goldchmit C, Laviv Y, Levy R, Caspi B, Huszar M, Dgani R, Hagay Z (2004) The malignant potential of endometrial polyps. Eur J Obstet Gynecol Reprod Biol 115:206–210
15. Shushan A, Revel A, Rojansky N (2004) How often are endometrial polyps malignant? Gynecol Obstet Invest 58:212–215
16. Ferrazzi E, Zupi E, Leone FP, Savelli L, Omodei U, Moscarini M, Barbieri M, Cammareri G, Capobianco G, Cicinelli E, Coccia ME, Donarini G, Fiore S, Litta P, Sideri M, Solima E, Spazzini D, Testa AC, Vignali M (2009) How often are endometrial polyps malignant in asymptomatic postmenopausal women? A multicenter study. Am J Obstet Gynecol 200:235.e1–235.e6
17. Isikoglu M, Berkkanoglu M, Senturk Z, Coetzee K, Ozgur K (2006) Endometrial polyps smaller than 1.5 cm do not affect ICSI outcome. Reprod Biomed Online 12:199–204
18. Stamatellos I, Apostolides A, Stamatopoulos P, Bontis J (2008) Pregnancy rates after hysteroscopic polypectomy depending on the size or number of the polyps. Arch Gynecol Obstet 277:395–399
19. Lasmar RB, Barrozo PR, Dias R, Oliveira MA (2005) Submucous myomas: a new presurgical classification to evaluate the viability of hysteroscopic surgical treatment—preliminary report. J Minim Invasive Gynecol 12:308–311
20. Kolankaya A, Arici A (2006) Myomas and assisted reproductive technologies: when and how to act? Obstet Gynecol Clin North Am 33:145–152
21. Bettocchi S, Siristatidis C, Pontrelli G, Di Spiezio SA, Ceci O, Nappi L, Selvaggi L (2008) The destiny of myomas: should we treat small submucous myomas in women of reproductive age? Fertil Steril 90:905–910
22. Sankaran S, Manyonda IT (2008) Medical management of fibroids. Best Pract Res Clin Obstet Gynaecol 22:655–676
23. Varasteh NN, Neuwirth RS, Levin B, Keltz MD (1999) Pregnancy rates after hysteroscopic polypectomy and myomectomy in infertile women. Obstet Gynecol 94:168–171
24. Fedele L, Bianchi S, Marchini M, Mezzopane R, Di Nola G, Tozzi L (1996) Residual uterine septum of less than 1 cm after hysteroscopic metroplasty does not impair reproductive outcome. Hum Reprod 11:727–729
25. Rackow BW, Arici A (2007) Reproductive performance of women with Müllerian anomalies. Curr Opin Obstet Gynecol 19:229–237
26. Ozgur K, Isikoglu M, Donmez L, Oehninger S (2007) Is hysteroscopic correction of an incomplete uterine septum justified prior to IVF? Reprod Biomed Online 14:335–340
27. Bozdag G, Aksan G, Esinler I, Yarali H (2008) What is the role of office hysteroscopy in women with failed IVF cycles? Reprod Biomed Online 17:410–415