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Original Article

The Diagnostic Accuracy of Two- vs Three-Dimensional Sonohysterography for Evaluation of the Uterine Cavity in the Reproductive Age

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ABSTRACT **Study Objective:** To compare 2-dimensional sonohysterography (2D SHG) vs 3-dimensional sonohysterography (3D SHG) using saline solution infusion, with outpatient hysteroscopy as the gold standard, for evaluation of the uterine cavity in women of reproductive age.

Design: Comparative observational cross-sectional study (Canadian Task Force classification II-2).

Setting: University hospital.

Patients: One hundred twenty women of reproductive age with abnormal uterine bleeding, infertility, or recurrent pregnancy loss and with clinically and/or ultrasongraphically suspected intrauterine lesions.

Interventions: All patients underwent 2D SHG and 3D SHG using saline solution infusion followed by outpatient hysteroscopy. Sonographic findings were compared with hysteroscopic findings.

Measurements and Main Results: For 2D SHG, sensitivity was 71.2%; specificity, 94.1%; positive predictive value, 90.2%; negative predictive value, 81.0%; and overall accuracy, 84.2%. For 3D SHG, sensitivity was 94.2%; specificity, 98.5%; positive predictive value, 98.0%; negative predictive value, 95.7%; and overall accuracy, 96.7%. Thus, 3D SHG was superior to 2D SHG ($p = .02$) and comparable with outpatient hysteroscopy ($p = .12$) for diagnosis of intrauterine lesions.

Conclusion: 3D SHG can be used in the initial evaluation of the uterine cavity in women of reproductive age, with accuracy comparable to that of hysteroscopy. Journal of Minimally Invasive Gynecology (2014) ■, ■–■ © 2014 AAGL. All rights reserved.

Keywords: 2D ultrasound; 3D ultrasound; Intrauterine lesions; Outpatient hysteroscopy; Sonohysterography

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Evaluation of the uterine cavity is necessary when abnormal bleeding develops and/or reproduction is impaired [1]. Transvaginal sonography (TVS) remains the most common method for imaging of the female pelvis. It is used as a first-step investigation because it is quickly performed, widely available, and relatively inexpensive, However, reports on the diagnostic accuracy of TVS are conflicting [2,3]. TVS can result in a large number of equivocal findings, and more invasive investigations may be necessary for evaluation of the uterine cavity [4].

The gold standard for diagnosis of intrauterine abnormalities is diagnostic hysteroscopy combined with histologic analysis of endometrial aspiration or biopsied tissue [5,6]. However, compared with ultrasound-based diagnostic tools, hysteroscopy is expensive and invasive, and in the 50% of women who have a normal uterine cavity, it is, in retrospect, unnecessary [7].

Between these 2 diagnostic tools, sonohysterography (SHG) seems to be a good compromise [3]. Two-dimensional sonohysterography (2D SHG) is usually performed in women with excessive menstrual blood loss and/or fertility problems. However, 2D SHG does not enable

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detailed examination of the uterine cavity [8]. Three-dimensional sonohysterography (3D SHG) enables reliable evaluation of the uterine contour, adhesions, and focal disease [9]. It enables simultaneous demonstration of the 3 perpendicular planes, which gives access to planes unobtainable via 2 SHG. Furthermore, in 3D SHG, after distending the cavity using saline solution, there is clear visualization of the inner surface of both sides of the endometrium [9,10]. Compared with conventional diagnostic hysteroscopy, 3D SHG is less invasive, less expensive, and does not require general anesthesia [11].

Few studies have evaluated the additional value of 3D SHG compared with 2D SHG and have reported 3D SHG to be of additional value; however, the differences were small and not significant [12,13]. Therefore, more data are needed to establish the additional value of 3D SHG over 2D SHG in daily practice.

The objective of the present study was to evaluate and compare the diagnostic value of 2D SHG vs 3D SHG, using office hysteroscopy as the gold standard, for assessment of intrauterine abnormalities in women of reproductive age.

Material and Methods

This comparative, observational, cross-sectional study was conducted at the Department of Obstetrics and Gynecology, Faculty of Medicine, Cairo University. The Research Ethics Committee approved the study protocol, and informed consent was obtained from all candidates. The study population consisted of 120 women of reproductive age with infertility, menstrual disorders, or recurrent pregnancy loss, and clinically or ultrasonically suspected intrauterine abnormalities. Exclusion criteria included marked cervical stenosis, recent or current pelvic inflammatory disease, known cervical malignancy, pregnancy, profuse uterine bleeding, or recent uterine perforation.

Sonohysterography was performed using a 3D ultrasound system (Voluson 530; Kretz Technik AG, Zipf, Austria) with a 5- to 7-MHz transvaginal transducer. The women were placed in the lithotomy position, with an empty bladder. A sterile vaginal speculum was inserted, and the cervix was cleansed using antiseptic solution.

An 8F pediatric Foley catheter was used off-label. Before insertion into the uterine cavity, the catheter was prefilled with saline solution to minimize air artifact. Then the catheter was guided into the uterine cavity using long atraumatic forceps, and the balloon was inflated using 1 to 2 mL sterile saline solution for stabilization and occlusion of the internal cervical os. Then the speculum was carefully removed, and the transvaginal probe was inserted into the posterior fornix of the vagina. A plastic syringe containing 20 mL sterile saline solution was attached to the catheter; the position of the catheter in the uterine cavity was ascertained before instillation of the saline solution was begun. Sterile saline solution was then slowly injected into the catheter under continuous sonographic visualization. Usually, 5 to 15 mL fluid was required for uterine distention.

At this stage, the architecture of the uterine cavity could be observed using 2D SHG followed by 3D SHG, which was accomplished by another operator who was blinded to the results of 2D SHG. Uterine lesions (e.g., endometrial polyps, submucous myomas, intrauterine adhesions, uterine septum) were evaluated including site, size, shape, echogenicity, and relation to the uterine cavity. The examination result was considered normal if the outline of the endometrium was not distorted and no intrauterine lesion was observed.

Outpatient hysteroscopy was performed by a third operator, who was blinded to the results of both 2D SHG and 3D SHG, using a rigid hysteroscope (continuous flow; 30-degree forward oblique view) assembled in a 4-mm diameter diagnostic sheath with an atraumatic tip (Karl Storz Endoscopy, Tuttlingen, Germany). A high-intensity cold light source and fiberoptic cable were used to illuminate the uterine cavity. Normal saline solution was used as the distention medium, keeping the pressure between 100 and 120 mm Hg using a pressure-adjustable cuff system, with the objective to use the lowest pressure required to distend the uterine cavity adequately. The vaginoscopic ''no touch'' technique was followed; no speculum or tenaculum was used. The hysteroscope with its light source and flowing fluid was gently introduced into the vagina, enabling gradual distention, and guided into the endocervical canal following the small microcavity produced by the fluid in front of the endoscope. On entering the uterine cavity, a systematic inspection was performed, including the uterine cornua, tubal ostia, uterine fundus, and lateral, anterior, and posterior uterine walls for presence of intrauterine lesions (polyps, myomas, adhesions, congenital anomalies).

Statistical Analysis

Data are given as mean (SD) or as frequency and percentage. Sonographic findings were compared with hysteroscopic findings, and the accuracy of 2D SHG and 3D SHG in the diagnosis of intrauterine lesions was calculated using sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy. The Fisher exact test was used to compare categorical data. A p value (2-tailed) $<.05$ was considered significant. Statistical analysis was performed using commercially available software (SPSS version 16; SPSS, Inc., Chicago, IL).

Results

Patient clinical data are given in Table 1. A total of 120 eligible women with suspected intrauterine lesions were finally included in the study. Their age ranged from 21 to 37 years (mean [SD], 28.5 [2.7]), and parity ranged from 0 to 5 (0.97 [0.32]). Twenty-three patients (19.2%) had previously delivered via cesarean section. Fifty-eight women