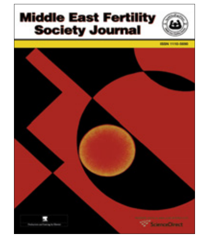
Middle East Fertility Society Journal (2011) **16**, 67–71

Middle East Fertility Society

Middle East Fertility Society Journal

www.mefsjournal.com
www.sciencedirect.com



ORIGINAL ARTICLE

A comparative study of 2-dimensional sonohysterography versus 3-dimensional sonohysterography in infertile patients with uterine cavity lesions and abnormalities

M.M. Aboulghar [a,*], I.K. Shoeir [a], M. Momtaz [a], M. El Mohammady [b], H. Ezzat [c]

[a] *Department of Obstetrics and Gynecology, Cairo University, Fetal Medicine Unit, Cairo, Egypt*
[b] *Department of Obstetrics and Gynecology, Beny Suif University, Egypt*
[c] *Departement of Obstetrics and Gynecology, Hurghada General Hospital, Egypt*

Received 19 August 2010; accepted 10 December 2010
Available online 6 January 2011

KEYWORDS

2D sonohysterography;
3D sonohysterography;
Infertility;
Uterine abnormalities

Abstract *Objective:* To compare 2-dimensional sonohysterography to 3-dimensional sonohysterography in detection of uterine cavity abnormalities in infertile patients.
Design: Prospective controlled study.
Patients and methods: Seventy seven infertile patients underwent the following transvaginal ultrasound techniques; 2D and 2D sonohysterography, 3D and 3D sonohysterography. Sensitivity, specificity, PPV, NPV, accuracy of 2D sonohysterography and 3D sonohysterography were calculated and compared to the gold standard of hysteroscopy laparoscopy.
Results: All 77 patients were studied using all four techniques. Both techniques of 2D and 3D sonohysterography were effective in reaching correct diagnosis. The overall sensitivity, specificity, PPV, NPV and accuracy of 2D sonohysterography was; 87.2, 100, 100, 84.2, 92.4, and 89.3 and that of 3D sonohysterography was; 100, 100, 86.4, and 93.6. The highest accuracy was obtained in diagnosis of endometrial polyps (98.7 and 100) and Mullerian anomalies (98.7 and 100) and the least with intrauterine synechiae (93.4 and 94.7).

* Corresponding author. Tel.: +20 237491299; fax: +20 23383049.
E-mail address: monaaboulghar71@gmail.com (M.M. Aboulghar).

Peer review under responsibility of Middle East Fertility Society.
doi:10.1016/j.mefs.2010.12.001

Production and hosting by Elsevier

Conclusion: 2D and 3D sonohysterography perform similarly in the diagnosis of uterine abnormalities as compared to hysteroscopy laparoscopy. If 3D technology is not available, 2D sonohysterography performs just as well.

1. Introduction

Abnormalities of the uterine cavity do affect fertility and pregnancy outcome. It is known that the incidence of abnormalities including myomas, polyps, Mullerian anomalies and intrauterine synechiae are more frequent in infertile patients and those with reproductive failure (1). Transvaginal ultrasound (TV) is the standard diagnostic technique used for detection of uterine abnormalities in infertile patients (2). Three dimensional ultrasound techniques need availability of the technology and experience in handling of the 3D volumes obtained. In addition it is more expensive.

The technique of sonohysterography is easy, simple and cheap. It has improved sensitivity, specificity, PPV, and NPV in diagnosing uterine abnormalities (3,4). An added advantage of 3D ultrasound is the ability to examine the coronal plane of the uterus (5), and this is improved and becomes clearer with injection of saline. In addition, an examination takes a shorter duration of time as the 3D volumes can be stored for later study and this leads to less discomfort of the patient (6). Similar results of sonohysterography and hysteroscopy have been documented in diagnosis of fibroids and polyps and Mullerian anomalies (7,8). However, few studies have compared 2D sonohysterography with 3D sonohysterography (3).

The easiest diagnostic technique with the highest sensitivity and specificity should be used to diagnose uterine cavity abnormalities before embarking on fertility treatment.

The aim of our study was to compare the accuracy of 2D sonohysterography to 3D sonohysterography in the diagnosis of uterine cavity abnormalities in infertile females, in comparison to the gold standard of hysteroscopy/laparoscopy.

2. Methods

Infertile patients with the assumption of harboring a uterine abnormality were included in this prospective comparative study. In the period from January 2009 to August 2009. This was suspected after completing investigations that included; hysterosalpingography HSG and 2D ultrasound. Failure to visualize a uniform endometrial lining in sagittal and transverse planes was the reason for this assumption. Patients were recruited from the Gynecology outpatient clinic at Cairo University Hospital. Ethics committee approval was obtained as well as informed consent from each patient after explaining the investigative procedures that were part of her infertility work up.

A full history, general and pelvic examination were performed for all patients. All cases were subjected to the following investigations; 2D Transvaginal ultrasound (TV US), 3D TV US, 2D Sonohysterography, 3D sonohysterography and hysteroscopy. Patients with Mullerian anomalies had a laparoscopy as well. All procedures were performed in the early follicular phase. Hysteroscopy was considered the gold standard for diagnosis of intracavitary lesions.

Trans-vaginal ultrasound examination was done using one of two ultrasound machines available; Accuvix, Sonoace 9900, (Medisson Korea) using an endovaginal probe 5/8 MH Z or Voluson 730 (GE USA) machine with a vaginal probe using 5.5 MHz transducer.

The uterus was examined first by 2D ultrasound documenting any suspected lesion, such as myomas, polyps, adenomyosis, site and size of each lesion and relation to the endometrium was recorded.

Three dimensional U/S examinations were then performed by applying the 3D volume acquisition box to the region of interest to include the whole endometrium. Acquisition of the 3D volume was done and the three sectional planes of the multiplaner view were displayed on the same screen. The volume obtained was stored for later analysis. Analysis and examinations were performed by one examiner, the first author (MMA).

This was followed by the procedure of sonohysterography. A speculum was placed to view the cervix, it was painted with an antiseptic solution (Povidone iodine), then a non-balloon embryo transfer catheter (Labotect Cook) was introduced through the external os into uterine cavity just passing the internal os. The speculum was then carefully removed so as not to dislodge catheter and the TV probe was reinserted into vagina. A 10 cc syringe with Saline was attached to the catheter. Saline was injected into the uterine cavity under ultrasound vision. Usually no more than 10 cc were needed to adequately distend the cavity and antibiotic administration was not required. This was followed by acquisition of a 3D volume as previously described. The study was considered normal when serial views of the distending media failed to reveal any endometrial distortion, cavity defects or undistended regions. Failure of distension of the cavity during saline instillation or echogenic bridging bands of tissues distorting the uterine cavity suggested intrauterine adhesions. Spherical lesions with

Figure 1 Endometrial polyp by 2D sonohysterography.

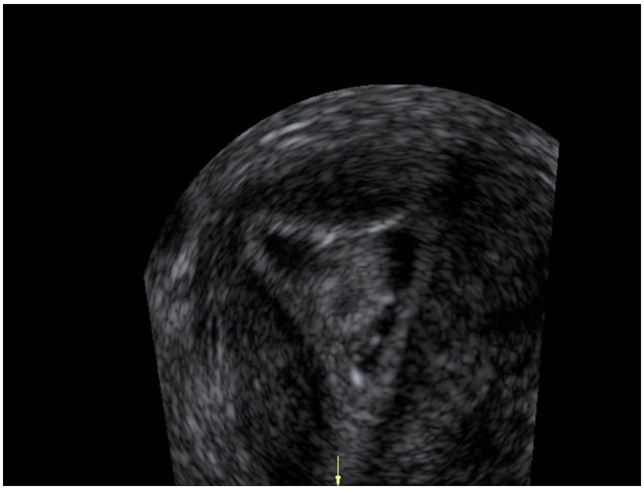


Figure 2 Endometrial polyp 3D sonohysterography.

heterogeneous echogenic appearance either distorting or disrupting the myometrial–endometrial interphase were considered submucous myomas. Hyperechoic intraluminal lesions not distorting endometrial myometrial interphase were considered polyps. On coronal view of fundus, a V shaped echogenic midline extension into the endometrial cavity dividing it into two cavities and smooth fundal uterine contour suggested a septum, whereas evidence of two endometrial cavities separated by a fundal defect of myometrium suggested a bicornuate uterus. No sedation or analgesia was required during the procedure.

All patients underwent hysteroscopy in the operating theater of Obstetrics and Gynecology department at Cairo University hospital under general anesthesia. The hysteroscopy used was a rigid continuous flow diagnostic hysteroscopy (Tuttligen, Karl Storz, and Germany). It has a 30° panoramic optic which is 4 mm in diameter and the diagnostic continuous flow outer sheath is 6.5 mm in diameter. Examination was considered normal if the endometrial cavity was easily distended by the medium with complete separation of its walls and vision of both tubal ostia. Agglutination of the uterine walls or the presence of thick bands extending across the cavity or occlusion of ostial area or upper cavity indicated intrauterine adhesions (IUAs). A longitudinal filling defect extending from the fundus downwards to a variable level indicated a uterine septum. Any other pathological lesions such as polyps, submucous myomas were described according to their site, size and vascularity. Any abnormality was dealt with during the same setting. Patients with diagnosed Mullerian anomalies had laparoscopy performed at the same setting.

3. Statistical analysis

Data were statistically described in terms of frequencies (number of cases) and percentages. Accuracy was represented using the terms Sensitivity, Specificity, Positive predictive value, Negative predictive value, and overall Accuracy. All statistical calculations were done using computer programs Microsoft Excel 2003 (Microsoft Corporation, NY, USA) and SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 15 for Microsoft Windows.

4. Results

Seventy seven infertile patients were recruited for the study on the assumption of harboring a uterine abnormality. This was based on HSG and 2D ultrasound examination. The mean age of the Patients was 30.8 ± 6 and mean duration of infertility was 6.1 ± 3.9, 58.4% (45) had primary infertility and 41.5% (32) had secondary infertility.

Only four of the secondary infertility cases had recurrent pregnancy losses.

Sonohysterography was successful in all patients, except for four patients, in whom the cavity failed to distend, due to severe retroversion of uterus and intrauterine synechiae. None of the patients found the examination intolerable and none needed tenaculum manipulation of the cervix.

As for the hysteroscopy procedure 17 cases needed cervical dilatation prior to undergoing operative procedures such as polypectomy or myomectomy. Hysteroscopy was reliable in the diagnosis of all cases except in the cases with intramural fibroids that were confirmed by ultrasound as the fibroids were not distorting the cavity.

Fifty abnormalities were confirmed by hysteroscopy. Fourteen cases had fibroids (18.1%), only three were diagnosed by hysteroscopy as they were submucous projecting into the uterine cavity, the rest were confirmed intramural and subserous by ultrasound. Fifteen cases had endometrial polyps (19.4%) (Figs. 1 and 2), 14 had intrauterine synechiae (18.1%) (Figs. 3 and 4) and 18 had Mullerian anomalies (23.3%); 2 arcuate uteri, one unicornuate, one bicornuate and 14 subseptate uteri; these were confirmed by performing laparoscopy as well in addition to hysteroscopy.

Twenty seven patients (35%) had a completely normal cavity by hysteroscopy however 11 of them had intramural fibroids not diagnosed by hysteroscopy but by the 2D ultrasound (Table 1).

The overall sensitivity, specificity, PPV, NPV and Accuracy of all diagnostic techniques in the detection of all abnormalities are shown in Table 2. The sensitivity, specificity, PPV, NPV, and accuracy of the diagnostic techniques in diagnosing the individual abnormality are shown in Tables 3–5.

The accuracy was not calculated for fibroids as hysteroscopy is not considered the gold standard for diagnosis of

Figure 3 Intrauterine synechiae 2D sonohysterography.

Figure 4 Intrauterine synechiae 3D sonohysterography.

intramural fibroids. The accuracy was similar in both 2D sonohysterography and 3D sonohysterography and was very high with 3D sonohysterography in the diagnosis of polyps (98.7 versus 100) and Mullerian anomalies (98.7 versus 100) and least for both techniques in diagnosing of intrauterine synechiae (93.4 and 94.7).

5. Discussion

The purpose of our study was to compare 2D and 3D sonohysterography in the diagnosis of uterine abnormalities in infertile patients. Both techniques gave similar accuracy (92.4% and 93.6%) and therefore showed no added advantage of 3D sonohysterography. The highest sensitivity and specificity of these two techniques were in the diagnosis of Mullerian anomalies and least with intrauterine synechiae.

Our results were compared to the gold standard hysteroscopy and laparoscopy and this explains why intramural fibroids were not included in the overall accuracy of our diagnostic techniques. This elicits the importance of TV ultrasound as the primary diagnostic technique for uterine abnormalities such as myomas and adenomyosis.

The added benefit of saline injection sonohysterography in the diagnosis of uterine abnormalities has been well documented in our results showing a much higher accuracy of 2D sonohysterography as compared to 2D; 92.4 versus 77.2 and similarly 3D sonohysterography compared to 3D; 93.6 versus 84.8. Sonohysterography has been previously reported to have high sensitivity, specificity, NPV, and PPV of 91.4%, 92.6%, 89.3% and 94.1% (9). Better agreement has been documented

Table 2 Sensitivity, specificity, PPV, NPV, and accuracy of all four techniques.

	Sensitivity	Specificity	PPV	NPV	Accuracy
2D	61.7	100	100	64	77.2
3D	74.4	100	100	72.7	84.8
2D SHG	87.2	100	100	84.2	92.4
3D SHG	89.3	100	100	86.4	93.6

Table 3 Sensitivity, specificity, PPV, NPV, and accuracy of all four techniques in diagnosis of endometrial polyps.

	Sensitivity	Specificity	PPV	NPV	Accuracy
2D	46.67	100.00	100.00	88.57	89.61
2DSHG	93.33	100.00	100.00	98.41	98.70
3D	60.00	100.00	100.00	91.18	92.21
3DSHG	100.00	100.00	100.00	100.00	100.00

Table 4 Sensitivity, specificity, PPV, NPV, and accuracy of all four techniques in diagnosis of intrauterine synechiae.

	Sensitivity	Specificity	PPV	NPV	Accuracy
2D	50.00	100.00	100.00	89.86	90.79
2DSHG	71.43	100.00	100.00	93.94	94.74
3D	57.14	100.00	100.00	91.18	92.11
3DSHG	64.29	100.00	100.00	92.54	93.42

Table 5 Sensitivity, specificity, PPV, NPV, and accuracy of all four techniques in diagnosis of Mullerian anomalies.

	Sensitivity	Specificity	PPV	NPV	Accuracy
2D	83.33	100.00	100.00	95.16	96.10
2DSHG	94.44	100.00	100.00	98.33	98.70
3D	100.00	100.00	100.00	100.00	100.00
3DSHG	100.00	100.00	100.00	100.00	100.00

Table 1 Abnormalities detected by all diagnostic techniques.

Variable	2D	2D sonohysterography	3D	3D sonohysterography	Hysteroscopy/laparoscopy
SM fibroids	2/3	2/3	2/3	2/3	3/3
Polyps	7	14/15	9	15/15	15/15
Synechiea	7	10/14	8	9/14	14/14
Mullerian anomalies	15	17/18	18	18/18	18/18
Total abnormalities	31	43	37	44	50

between 2D sonohysterography and hysteroscopy than with 2D alone in the diagnosis of fibroids and polyps (7). Similar sensitivity was reported for both techniques of 2D sonohysterography and hysteroscopy in the diagnosis of uterine abnormalities (10,11). In a systematic review, sonohysterography and hysteroscopy performed better than transvaginal ultrasound in detecting submucous fibroids (12). In addition sonohysterography allows for better estimation of degree of projection of a submucous fibroid into the cavity (13).

The number of studies comparing 2D sonohysterography and 3D sonohysterography are few. Sylvestre (3) compared 2D sonohysterography and 3D sonohysterography in infertile women with uterine abnormalities, and both techniques had high sensitivity of 98% and 100%, respectively, which is higher than our study. The specificity of 2D sonohysterography and 3D sonohysterography in our study was 100%, denoting no false positive results and the overall NPV was; 84.2% and 86.4% for 2D and 3D sonohysterography. This was not calculated in the Sylvsetre study as hysteroscopy was not performed for the normal cases in contrast to our study, in which all patients underwent hysteroscopy.

The introduction of the 3D ultrasound has added advantages to ultrasound examination of the uterus, the most important of which is the ability to obtain the three orthogonal planes of the uterine volume. High sensitivity, specificity, NPV, PPV have been reported with 3D sonohysterography in the detection of uterine abnormalities causing bleeding (14). The only added advantage of 3D is the examination of the coronal view of the uterus that allows confirming the uniformity of the fundal contour and accurate diagnosis of Mullerian uterine anomalies (15). A recent study showed no added advantage of 3D sonohysterography over 2D sonohysterography in the diagnosis of endometrial abnormalities, the main value was in evaluation of the fundal contour (16).

Two-dimensional sonohysterography is an easy cheap and simple technique (17). From our study results, 3D sonohysterography has no added advantage over 2D sonohysterography. Since 3D ultrasound involves an expensive machine and expertise in acquiring and analyzing obtained volumes, 2D sonohysterography could do just as well. It uses available ultrasound machines without the need for the expensive 3D technology.

In conclusion 3D sonohysterography has no added advantage over 2D Sonohysterography in the detection of uterine abnormalities and therefore if the technology is not available and intra-cavitary abnormality is suspected 2D sonohysterography should be the first line of investigation.

References

(1) Tur-Kaspa I, Gal M, Hartman M, Hartman J, Hartman A. A prospective evaluation of uterine abnormalities by saline infusion sonohysterograghy in 1,009 women with infertility or abnormal uterine bleeding. Fertil Steril 2006;86(6):1731–5.
(2) Shalev J, Meizner I, Bar-Hava I, Dicker D, Mashiach R, Ben-Rafael Z. Predictive value of transvginal sonography performed before routine diagnostic hysteroscopy for evaluation of infertility. Fertil Steril 2000;73(2):412–7.
(3) Sylvestre C, Child TJ, Tulandi T, Tan SL. A prospective study to evaluate the efficacy of two- and three-dimensional sonohysterography in women with intrauterine lesions. Fertil Steril 2003;79(5):1222–5.
(4) Ragni G, Diaferia D, Vegetti W, Colombo M, Arnoldi M, Crosignani PG. Effectiveness of sonohysterography in infertile patient work-up: a comparison with transvaginal ultrasonography and hysteroscopy. Gynecol Obstet Invest 2005;59(4):184–8.
(5) Jurkovic D, Geipel A, Gruboeck K, Jauniaux E, Natucci M, Campbell S. Three-dimensional ultrasound for the assessment of uterine anatomy and detection of congenital anomalies: a comparison with hysterosalpingography and two-dimensional sonography. Ultrasound Obstet Gynecol 1995;5(4):233–7.
(6) Benacerraf BR, Shipp TD, Bromley B. Which patients benefit from 3D reconstructed coronal view of the uterus added to standard routine 2D pelvic sonography. AJR Am J Roentgenol 2008;190(3):626–9.
(7) Jansen FW, de Kroon CD, van Dongen H, Grooters C, Louwé L, Trimbos-Kemper T. Diagnostic hysteroscopy and saline infusion sonography: prediction of intrauterine polyps and myomas. J Minim Invasive Gynecol 2006;13(4):320–4.
(8) Valenzano MM, Mistrangelo E, Lijoi D, Fortunato T, Lantieri PB, Risso D, Costantini S, Ragni N. Transvaginal sonohysterographic evaluation of uterine malformations. Eur J Obstet Gynecol Reprod Biol 2006;124(2):246–9, 1.
(9) Mathew M, Gowri V, Rizvi SG. Saline infusion sonohysterograghy – an effective tool for evaluation of the endometrial cavity in women with abnormal uterine bleeding. Acta Obstet Gynecol Scand 2010;89(1):140–2.
(10) Alborzi S, Parsanezhad ME, Mahmoodian N, Alborzi S, Alborzi M. Sonohysterography versus transvaginal sonography for screening of patients with abnormal uterine bleeding. Int J Gynaecol Obstet 2007;96(1):20–3.
(11) Cepni I, Ocal P, Erkan S, Saricali FS, Akbas H, Demirkiran F, Idil M, Bese T. Comparison of transvaginal sonography, saline infusion sonography and hysteroscopy in the evaluation of uterine cavity pathologies. Aust N Z J Obstet Gynaecol 2005;45(1):30–5.
(12) Farquhar C, Ekeroma A, Furness S, Arroll B. 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(6):493–504.
(13) Lee C, Salim R, Ofili-Yebovi D, Yazbek J, Davies A, Jurkovic D. Reproducibility of the measurement of submucous fibroid protrusion into the uterine cavity using three-dimensional saline contrast sonohysterography. Ultrasound Obstet Gynecol 2006;28(6):837–41.
(14) Makris N, Kalmantis K, Skartados N, Papadimitriou A, Mantzaris G, Antsaklis A. Three-dimensional hysterosonography versus hysteroscopy for the detection of intracavitary uterine abnormalities. Int J Gynaecol Obstet 2007;97(1):6–9.
(15) Ghi T, Casadio P, Kuleva M, Perrone AM, Savelli L, Giunchi S, Meriggiola MC, Gubbini G, Pilu G, Pelusi C, Pelusi G. Accuracy of three-dimensional ultrasound in diagnosis and classification of congenital uterine anomalies. Fertil Steril 2009;92(2):808–13.
(16) Ghate SV, Crockett MM, Boyd BK, Paulson EK. Sonohysterography: do 3D reconstructed images provide additional value. AJR Am J Roentgenol 2008;190(4):W227–233.
(17) Valenzano MM, Lijoi D, Mistrangelo E, Fortunato T, Costantini S, Ragni N. The value of sonohysterography in detecting intracavitary benign abnormalities. Arch Gynecol Obstet 2005;272(4):265–8.