Role of Three-Dimensional Sonohysterography in Evaluation of Tubo-Peritoneal and Uterine Causes of Infertility

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Abstract: Background: Infertility is one of the most common health problems affecting 10 to 15% of couples. Structural abnormalities of the uterus and endometrial cavity and tubal patency may adversely affect reproductive outcome by interfering with implantation and with ovum and sperm transportation, thus cause infertility or decrease chances of successful ART. **Aim of the work:** The aim of this study is to evaluate the role of 3D versus 2D sonhysterography in evaluation of tubo-peritoneal and uterine causes of infertiliy. **Patients and Methods:** This observasional study was completed over a period of 12 months in Aswan Fertility Center. It focused mainly on young women thought to have an intrauterine lesion on transvaginal two-dimensional sonography. Patients were examined by ultrasound conventional, sonohysterography as well as three dimensional to detect the different types of tubo-peritoneal and uterine pathologies. **Results:** A total of 60 infertile women were divided into two groups (control = 2D group) & (study =3D group) of 30 cases in each. The age ranged from 20 years to 36 years in both groups with Mean ± SD 30,7 in 2D group and 29,7 in 3D group. There were 22 infertile women in the 2D group with primary infertility and 8 cases with secondary infertility but in the 3D group there were 24 infertile women with primary infertility and 6 cases with secondary infertility. **Conclusion:** 3D sonohysterography has no added advantage over 2D Sonohysterography in the detection of uterine abnormalities except in differentiation between septate, bicornute and arcute uterus. 3D sonohysterography is superior to 2D sonohysterography in detecting congenital uterine anomalies with p-value (0.006).

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1. Introduction

Infertility is one of the most common health concerns in young adults. 10 to 15% of couples report that they are unable to conceive the number of children they would like. Infertility is an unusual ‘‘health problem’’ in that it is neither visible nor life threatening. Those who are affected may or may not seek medical care ***(Wilcox, 2010).***

Structural abnormalities of the uterus and endometrial cavity and tubal patency may adversely affect reproductive outcome by interfering with implantation and with ovum and sperm transportation, thus cause infertility or decrease chances of successful ART ***(Chayanis et al., 2016).***

Evaluation of the uterine cavity is necessary when reproduction is impaired. The primary advantage of sonographic methods is their ability to provide important intracavitary and extracavity information; adnexal masses and myometrial disorders, such as intramural myomas and adenomyosis, could be detected and explain the underlying symptoms ***(ACOG, 2008).***

Although hysteroscopy is considered golden standard in diagnosing intrauterine lesions, it did not enable detection of uterine wall lesions including interstitial myomas and adenomyosis, also ovarian, adnexal, and pelvic lesions, which could be detected at sonography. Using TVUS, the uterus and ovaries can be visualized clearly, and their pathologic lesions can be identified. However, reports of the diagnostic accuracy of TVUS are conflicting. Transvaginal ultrasound can result in a high number of equivocal findings, which may require additional studies to characterize the endometrium and uterine cavity **(El-Sherbiny and Nasr, 2010).**

Sonohysterography has gained acceptance as a technique for improving imaging inside the normally collapsed uterine cavity. By instillation of contrast media (sterile saline) into the uterine cavity, the contour of the uterine cavity and the flow signals in Fallopian tubes can be visualized ***(cepni et al., 2005).***

Sonohysterography procedure is relatively inexpensive, is not time-consuming, and causes minimal discomfort to the patient. However, 2D SHG does not enable detailed examination of the uterine cavity ***(ACOG, 2008).***

Three-dimensional SHG provides more precise anatomical sections for exploring the uterine cavity, the relation of myomas to the cavity, and for detecting endometrial polyps. In addition, 3D-SHG has the advantage of simultaneous assessment of the uterine cavity and outer uterine contour, which enables differentiation between the arcuate, septate, and bicornuate uterus ***(Kupesic and Plavsic, 2007).***

Aim of the Work

The aim of this study is to evaluate the role of 3D versus 2D sonhysterography in evaluation of tubo-peritoneal and uterine causes of infertiliy.

2. Patients and Methods

This observasional study was completed over a period of 12 months, from December 2016, until December 2017 in Aswan Fertility Center.

It involved young women thought to have an intrauterine lesion on transvaginal two-dimensional sonography or hysterosalpingography.

Inclusion criteria:

- Age: from 20-37 years old.
- Recent semen analysis of their husbands with normal values to exclude the male factor of infertility.
- Normal Hormonal profile as proven by (Progesterone level on the 21st day of the cycle. LH, FSH and prolactin level levels on the 3rd day of the cycle).
- No previous history of any treatment with in the last 6 months (i.e. no history of induction of ovulation to avoid its influence on the endometrium).

Exclusion criteria:

- Marked cervical stenosis.
- Recent or current pelvic inflammatory disease.
- Known cervical malignancy.
- Pregnancy.
- Profuse uterine bleeding.
- Recent uterine perforation.
- Acute hydrosalpinx.

After taking informed oral consent from the patients, they were divided into two groups;

- **Control group:** 30 cases were examined by (2D) sonohysterography.
- **Study group:** 30 cases were examined by (3D) sonohysterography.

All patients submitted to:-

1. **Full history taking:-**
   - Detailed menstrual history
   - Sexual history
   - Obstetric history
   - Gynecological history
   - Contraceptive history
   - Past history
2. **Full clinical examination**
3. **For control group:-** transvaginal 2D ultrasound,2D sonohysterography was done.
4. **For study group:-** transvaginal 3D ultrasound, 3D sonohysterography was done.
5. **Statistical Analysis**

Data were collected, revised, coded and entered to the Statistical Package for Social Science (IBM SPSS) version 23. The quantitative data were presented as means, standard deviations and ranges when their distribution found parametric. Also qualitative data were presented as number and percentages.

3. Results

The previous table shows that there was no statistically significant difference found between 2D group and 3D group regarding age, BMI, duration of marriage, duration of infertility and type of infertility with p-value 0.382, 0.205, 0.272; 0.391 and 0.542 respectively.

Table (1): Demographic data of 2D & 3D groups: -

Demographic data		Total	2D sonohystero-graphy	3D sonohystero-graphy	Test value•	P-value	Sig.
		No.= 60	No.= 30	No.= 30			
Age	Mean ± SD Range	30.23 ± 4.39 20 – 36	30.73 ± 3.79 23 – 36	29.73 ± 4.93 20 – 36	-0.881	0.382	NS
BMI	Mean ± SD Range	26.88 ± 4.14 19 – 36.5	26.20 ± 3.32 19 – 30	27.56 ± 4.78 20 – 36.5	1.283•	0.205	NS
Duration of marriage	Mean ± SD Range	6.74 ± 4.62 1 – 20	7.40 ± 4.66 1.6 – 20	6.08 ± 4.56 1 – 20	-1.109	0.272	NS
Duration of infertility	Mean ± SD Range	6.19 ± 4.53 1 – 20	6.70 ± 4.75 1.5 – 20	5.69 ± 4.33 1 – 20	-0.864	0.391	NS
Type of infertility	Primary infertility Secondary infertility	46 (76.7%) 14 (23.3%)	22 (73.3%) 8 (26.7%)	24 (80.0%) 6 (20.0%)	0.373	0.542	NS

*: Chi-square test; NA: Non significant; S: Significant; HS: Highly significant; •: Independent t-test; *: Chi-square test; NA: Non significant; S: Significant; HS: Highly significant; P-value >0.05 Non significant; P-value < 0.05 Significant; P-value < 0.010 Highly significant

Table (2): Obstetric history of 2D & 3D groups regarding (parity, abortion, recurrent abortion, previous CS, D & C).

Obstetric history		Total	2D sonohysterography	3D sonohysterography	Test value*	P-value	Sig.
		No.= 60	No.= 30	No.= 30			
Parity	No Yes	52 (86.7%) 8 (13.3%)	26 (86.7%) 4 (13.3%)	26 (86.7%) 4 (13.3%)	0.000	1.000	NS
Abortion	No Yes	50 (83.3%) 10 (16.7%)	23 (76.7%) 7 (23.3%)	27 (90.0%) 3 (10.0%)	1.920	0.166	NS
Recurrent abortion	No Yes	56 (93.3%) 4 (6.7%)	29 (96.7%) 1 (3.3%)	27 (90.0%) 3 (10.0%)	1.071	0.301	NS
Previous CS	No Yes	58 (96.7%) 2 (3.3%)	29 (96.7%) 1 (3.3%)	29 (96.7%) 1 (3.3%)	0.000	1.000	NS
D & C	No Yes	58 (96.7%) 2 (3.3%)	29 (96.7%) 1 (3.3%)	29 (96.7%) 1 (3.3%)	0.000	1.000	NS

*: Chi-square test; NA: Non significant; S: Significant; HS: Highly significant

The previous table shows that there was no statistically significant difference found between 2D group and 3D group regarding parity, abortion, recurrent abortion, previous CS and D & C with p-value = 1.00, 0.166, 0.301, 1.000 and 1.000 respectively.

Table (3): Gynecological and menstrual symptoms in 2D and 3D groups.

Gynecological + menstrual symptoms		Total	2D sonohysterography	3D sonohysterography	Test value*	P-value	Sig.
		No.= 60	No.= 30	No.= 30			
Pelvic pain	No Yes	47 (78.3%) 13 (21.7%)	27 (90.0%) 3 (10.0%)	20 (66.7%) 10 (33.3%)	4.812*	0.028	S
Dysmenorrhea	No Yes	32 (53.3%) 28 (46.7%)	19 (63.3%) 11 (36.7%)	13 (43.3%) 17 (56.7%)	2.411	0.121	NS
Amount of cycle	Average Menorragia Oligomerorrhea	49 (81.7%) 7 (11.7%) 4 (6.7%)	26 (86.7%) 3 (10.0%) 1 (3.3%)	23 (76.7%) 4 (13.3%) 3 (10.0%)	13.27	0.515	NS

*: Chi-square test; NA: Non significant; S: Significant; HS: Highly significant

The previous table shows that there was no statistically significant difference between 2D group and 3D group regarding menstrual symptoms (dysmenorrhea & amount of cycle) with p-value = 0.121, 0.515 but it also shows that there was a statistically significant difference between 2D group and 3D group regarding gynecological symptoms (pelvic pain) with p-value =0.028.

Table (4): Uterine anatomy in 2D and 3D groups:-

Uterine pathology & position		Total	2D sonohysterography	3D sonohysterography	Test value	P-value	Sig.
		No.= 60	No.= 30	No.= 30			
Direction of the uterus	AF RVF	52 (86.7%) 8 (13.3%)	25 (83.3%) 5 (16.7%)	27 (90.0%) 3 (10.0%)	0.577	0.448	NS
Uterine polyp	No Yes	17 (45.0%) 43(55.0%)	10(33.3%) 20(66.6%)	7 (23.3%) 23 (76.7%)	0.739	0.389	NS
Cervical polyp	No Yes	58 (96.7%) 2 (3.3%)	29 (96.7%) 1 (3.3%)	29 (96.7%) 1 (3.3%)	0.000	1.000	NS
Submucous myoma	No Yes	58 (96.7%) 2 (3.3%)	29 (96.7%) 1 (3.3%)	29 (96.7%) 1 (3.3%)	0.000	1.000	NS
Intrauterine adhesions	No Yes	59 (98.3%) 1 (1.7%)	30 (100.0%) 0 (0.0%)	29 (96.7%) 1 (3.3%)	1.017	0.313	NS
Adenomyosis	No Yes	56 (93.4%) 4(6.6 %)	29(96.7%) 1 (3.3 %)	27 (90.0%) 3 (10.0%)	0.268	0.605	NS

* NA: Non significant; S: Significant; HS: Highly signific: Chi-square test

The previous table shows no statistically significant difference was found between 2D and 3D groups regarding direction of the uterus, prescense of uterine polyp, cervical polyp, submucous myoma, intrauterine adhesions and adenomyosis with p-value non significant for all.

Table (5): Congenital uterine anomalies in 2D and 3D groups:-

Congenital uterine anomalies		**Total**	**2D sonohysterography**	**3D sonohysterography**	**Test value**	**P-value**	**Sig.**
		No.= 60	**No.= 30**	**No.= 30**			
Arcute uterus	No	56 (93.3%)	30 (100.0%)	26 (86.7%)	4.286	0.038	S
	Yes	4 (6.7%)	0 (0.0%)	4 (13.3%)			
Septate uterus	No	56 (90.0%)	29 (96.7%)	27 (90.0%)	3.158	0.076	NS
	Yes	4 (10.0%)	1 (3.3%)	3 (10.0%)			
Bicornate uterus	No	59 (98.3%)	30 (100.0%)	29 (96.7%)	1.017	0.313	NS
	Yes	1 (1.7%)	0 (0.0%)	1 (3.3%)			
Didelphyus	No	59 (98.3%)	30 (100.0%)	29 (96.7%)	1.017	0.313	NS
	Yes	1 (1.7%)	0 (0.0%)	1 (3.3%)			
Total	No	50 (83.3%)	29 (96.7%)	21 (70%)	7.680	0.006	HS
	Yes	10 (16.7%)	1 (3.3%)	9 (15%)			

*: Chi-square test; NA: Non significant; S: Significant; HS: Highly significant

Total cases show significantly higher frequency of Congenital uterine anomalies in 3D group when compared to 2D group with p value= 0.006. Comparing each congenital anomaly separately reveal no significant differences between 2D and 3D groups except in arcute uterus (p value= 0.038). This may be due to small sample size.

Table (6): Tubal and peritoneal findings in 2D & 3D groups:-

Tubal+peritoneal pathology		**Total**	**2D sonohysterography**	**3D sonohysterography**	**Test value**	**P-value**	**Sig.**
		No.= 60	**No.= 30**	**No.= 30**			
Hydrosalpinx	No	53 (88.3%)	28 (93.3%)	25 (83.3%)	0.647	0.421	NS
	Yes	7 (11.7%)	2 (6.7%)	5 (16.7%)			
Peritoneal adhesions	No	58 (96.7%)	30 (100.0%)	28 (93.3%)	2.069	0.150	NS
	Yes	2 (3.3%)	0 (0.0%)	2 (6.7%)			

The previous table shows no statistically significant difference was found between 2D and 3D groups regarding Hydrosalpinx and Peritoneal adhesions was p-value 0.421, 0.150 respectively.

4. Discussion

In the present study there was no statistically significant difference between both groups as regarding:-

- Base line features: (age, body mass index, duration of marriage, Duration and type of infertility) as shown in table (1).
- Menstrual, gynecological symptoms and obstetric history as shown in table (2 and 3).
- It was noted that pelvic pain significantly present in the cases examined by 3D rather than the cases examined by 2D (p<,028).

This can be related to the causes of infertility in this group where (hydrosalpinx & peritoneal adhesions & adenomyosis) were more in this group but without significant difference.

Kaveri et al. (2014) reported that pelvic pain can be due to many varied causes like endometriosis, adhesions, chronic pelvic inflammatory disease (PID), ovarian cyst, fibroids, pelvic varicosities.

In the present study there was no statistically significant difference between 2D and 3D ability in detection of direction of the uterus as shown in table (4).

2D sonohysterography could detect 25 cases with AVF uterus and 5 cases with RVF uterus. Unlike 3D sonohysterography which could detect 27 cases with AVF uterus and 3 cases with RVF uterus.

There was no statistically significant difference between (2D sonohysterography and 3D sonohysterography) ability in detection of endometrial polyp, cervical polyp, submucous myoma, intrauterine adhesions, adenomyosis. (table 4).

But 3D detected more cases with uterine polyp although small number of patients 23 cases (76.6%) compared to 20 cases (66.6%) detected by 2D due to its better resolution and reconstruction image.

Also, both 2D & 3D sonohysterograpy could detect the same no of cases with submucous fibroid but the exact location of fibroids can be demonstrated by using simultaneous display of three perpendicular planes by 3D examination.

Using the multiplanar views, polypoid structures can be clearly visualized, allowing for the optimal plane to present their pedicle. The surface-rendering mode can suppress undesirable echoes allowing the polypoid structure to be seen in continuity with the endometrial lining**.** The difference between endometrial hyperplasia and polyps, can be detected by 3D volume measurement ***(*Kupesic and Kurjak,*2000).***

Ludwin et al. (2013) reported no substantial difference in diagnostic value between 3D SHG and 2D SHG**.**

On the countroversy ***de Kroon et al. (2004); Kowalczyk et al. (2012)*** have reported 3D SHG to be of additional value; however, the differences were small and not significant Therefore, more data are needed to establish the additional value of 3D SHG over 2D SHG in daily practice.

But, those studies differ from the present study in the study design, number of cases and the confirmation of the SHG findings with hysteroscopy.

SHG, like HSG, is of value only in cases of partial intrauterine adhesions because normal saline will not be able to enter into the uterine cavity when it is completely obscured. Sonohysterography is useful in situations were transvaginal ultrasound yields normal results but the clinical suspicion of IUAs remains high.

Three-dimensional ultrasound is helpful in delineation of intracavitary adhesions and determination of their location which assists in surgical planning. In the cases of bridging adhesions, the degree of cavity obliteration is accurately assessed. Similarly, this technique is beneficial for differentiation between small polyps and adhesions ***(Kurjak and Bajo, 2013)***.

The most important added advantages of the introduction of the 3D ultrasound examination of the uterus is the ability to obtain the three orthogonal planes of the uterine volume ***(Shawki et al., 2017).***

In table (6) total cases show significantly higher frequency of Congenital uterine anomalies in 3D group when compared to 2D group with p value= 0.006. Comparing each congenital anomaly separately reveal no significant differences between 2D and 3D groups except in arcute uterus (p value= 0.038). This may be due to small sample size.

Another important 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 **(Aboulghar et al., 2010).**

2D USG's power to detect uterine anomalies has been enhanced by saline infusion sonography (SIS), in which saline is infused to distend the uterine cavity. This method gives satisfactory information on the shape of the cavity. However, its inability to assess the external contours is still a drawback **(Engin et al., 2015*).***

These results in agreement with:

Ghate et al. (2008), recent study reported that 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.

Faivre et al. (2012); Ghi et al. (2009) have reported 100 % specificity and sensitivity for 3D USG, and a concordance of 100 and 96 %, respectively, when compared with laparoscopy and concurrent hysteroscopy. Faivre reported that 3D USG had higher concordance with laparoscopy than MRI.

Kupesic and Kurjak (2002) compared 2D US and 2D SHG in evaluation of septate uterus prior to hysteroscopic removal. The sensitivity and specificity of 2D US and 2D SHG was 98% and 100% respectively and these study differ from our study in confirmation of results with hysterocopic findings.

In a study done by ***El Ebrashy et al. (2007)*** they concluded that 3D TVS showed high sensitivity (97%) and specificity (96%) for the detection of uterine cavity anomalies. It also showed excellent NPV (99%) and PPV (92%). 3D TVS offers a reliable and standardized tool to diagnose, differentiate and quantify uterine anomalies. It has significantly added to our understanding of uterine anomalies qualifying their effect on reproductive outcome and thereby helping the clinician counsel patients accordingly and confidently.

Conclusion

It was concluded that:

- 3D sonohysterography has no added advantage over 2D Sonohysterography in the detection of uterine abnormalities except in differentiation between septate, bicornute and arcute uterus.
- 3D sonohysterography is superior to 2D sonohysterography in detecting congenital uterine anomalies with p-value (0.006).
- 2D ultrasonography's power to detect uterine anomalies was enhanced by saline infusion

sonography (SIS), However, its inability to assess the external contours was a drawback.

- 3D sonohysterography added no advantage over 2D sonohysterography in the detection of tubal or peritoneal abnormalities.

References

1. American College of Obstetricians and Gynecologists (2008): ACOG Technology Assessment in Obstetrics and Gynecology No. 5: sonohysterography. Obstet Gynecol; 112:1467–1469.
2. Cepni I, Ocal P, Erkan S, et al. (2005): Comparison of transvaginal sonography, saline infusion sonography and hysteroscopy in the evaluation of uterine cavity pathologies. Aust N Z J Obstet Gynaecol.;45:30–35.
3. De Kroon CD, Louwe LA, Trimbos JB, Jansen FW (2004): The clinical value of 3-dimensional saline infusion sonography in addition to 2-dimensional saline infusion sonography in women with abnormal uterine bleeding: work in progress. J Ultrasound Med; 23: 1433–1440.
4. El Ebrashy A, Momtaz M., Shawky O. Soliman E, Aboul Maaty Z (2004): Three Dimentional Transvaginal ultrasound in the assessment of uterine lesions: when do we really need it? Middle East Fertility Society Journal; 9(1): 79-83.
5. El-Sherbiny W and Nasr A. (2010): Value of 3-Dimensional sonohysterographyin Infertility Work-up. J Minim Invasive Gynecol 18: 54-58.
6. Faivre E, Fernandez H, Deffieux X, Gervaise A, Frydman R, Levaillant JM (2012): Accuracy of three-dimensional ultrasonography in differential diagnosis of septate and bicornuate uterus compared with office hysteroscopy and pelvic magnetic resonance imaging. J Minim Invasive Gynecol; 19:101–106.
7. Ghate SV, Crockett MM, Boyd BK, Paulson EK (2008): Sonohysterography: do 3D reconstructed images provide additional value? AJR Am J Roentgenol; 190: W227–W233.
8. Kaveri S, Manash KB, Jessy V, Gaurav M and Robin K (2014): Journal List J Clin Diagn Resv. 8(7).
9. Kowalczyk D, Guzikowski W, Wiecek J, Sioma-Markowska U (2012): Clinical value of real time 3D sonohysterography and 2D sonohysterography in comparison to hysteroscopy with subsequent histopathological examination in perimenopausal women with abnormal uterine bleeding. Neuro Endocrinol Lett; 33:212–216.
10. Kupesic S and Plavsic BM (2007): 2D and 3D hysterosalpingo-contrastsonography in the assessment of uterine cavity and tubal patency. Eur J Obstet Gynecol Reprod Biol; 133:64–69.
11. Ludwin A, Pitynski K, Ludwin I, anas T, Knafel A (2013): Two- and three-dimensional ultrasonography and sonohysterography versus hysteroscopy with laparoscopy in the differential diagnosis of septate, bicornuate, and arcuate uteri. J Minim Invasive Gynecol; 20:90–99.
12. Makris N, Kalmantis K, Skartados N, Papadimitriou A, Mantzaris G, Antsaklis A (2007): Three-dimensional hysterosonography versus hysteroscopy for the detection of intracavitary uterine abnormalities. Int J Gynaecol Obstet; 97(1):6–9.
13. Sylvestre C, Child TJ, Tulandi T, Tan SL (2003): A prospective study to evaluate the efficacy of two- and three-dimensional sonohysterography in women with intrauterine lesions. Fertil Steril; 79: 1222–1225.
14. Wilcox A (2010): Fertility and Pregnancy: An Epidemiologic Perspective. New York, NY: Oxford University Press; 123–141.

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