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ORIGINAL ARTICLE

Three-dimensional Transvaginal Ultrasound *vs* Office Hysteroscopy for Assessment of Uterine Cavity in Assisted Reproductive Program

[1]Vineet V Mishra, [2]Ushma Patel, [3]Khushali Gandhi

ABSTRACT

Introduction: The success of an assisted reproductive program (ARP) depends on the embryo quality and the intrauterine environment. It has been reported up until now that abnormal uterine findings occur in nearly 34 to 62% of infertile women worldwide. Due to this reason, uterine cavity evaluation is commonly recommended to screen for fibroids, polyps, adhesions, and mullerian abnormalities. Uterine cavity evaluation is usually accomplished with three-dimensional (3D) transvaginal ultrasound (TVS), sonohysterography, hysterosalpingography, and office hysteroscopy (OH).

Materials and methods: Uterine cavity evaluation was carried out in 239 infertile females undergoing ARP with two-dimensional (2D) followed by 3D vaginal ultrasonography on day 21 of their menstrual cycles. Later, OH was carried out on 5th or 6th day of menstrual cycles.

Results: Out of 239 women, 3D TVS was abnormal in 28 (11.71%) and OH was abnormal in 53 (22.17%). Three-dimensional TVS agreed with OH in 16 (30.18%) abnormal cases and 179 (93.71%) normal cases. False-positive results for 3D TVS were 12 (6.28%) and false-negative results were 37 (69.81%). In our study, sensitivity of 3D TVS was 30.1%, specificity was 93.7%, positive predictive value was 57.1%, and negative predictive value was 82.8%.

Conclusion: Office hysteroscopy is an easy and safe procedure and has a better diagnostic efficacy than 3D TVS for uterine cavity evaluation in women undergoing ARP.

Keywords: Adhesions, Infertility, Polyp, Septa, Submucous myoma.

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[1]Professor and Head, [2]Clinical Fellow, [3]Assistant Professor

[1-3]Department of Obstetrics and Gynecology, Institute of Kidney Diseases and Research Center, Institute of Transplantation Sciences, Ahmedabad, Gujarat, India

Corresponding Author: Vineet V Mishra, Professor and Head Department of Obstetrics and Gynecology, Institute of Kidney Diseases and Research Center, Institute of Transplantation Sciences, Ahmedabad, Gujarat, India, Phone: +919426078333 e-mail: vineet.mishra.ikdrc@gmail.com

INTRODUCTION

The success of an assisted reproductive program (ARP) depends on several factors. Out of which, embryo quality and intrauterine environment play a major role in the implantation as well as further continuation of pregnancy. It has been reported up until now that abnormal uterine findings occur in nearly 34 to 62% of infertile women worldwide.[1-3] Due to this reason, uterine cavity evaluation is commonly recommended to screen for fibroids, polyps, adhesions, and mullerian abnormalities. These uterine abnormalities are generally considered to have a negative impact on the outcome of pregnancy.[4] Uterine cavity evaluation is usually accomplished with three-dimensional (3D) transvaginal ultrasound (TVS), sonohysterography, hysterosalpingography, and office hysteroscopy (OH). Three-dimensional TVS of uterus in coronal view allows the assessment of uterine cavity. It offers examinations of adnexa and pelvis in addition to the uterus. It is performed on an outpatient basis and is a noninvasive technique. Hysteroscopic evaluation of the uterine cavity has recently become popular. It enables direct visualization of cervical canal and uterine cavity. It can be performed on an outpatient basis; however, it is a minimally invasive technique.

OBJECTIVE

To compare results of 3D TVS with OH used for the assessment of uterine cavity in ARP.

MATERIALS AND METHODS

This is an analytical prospective study conducted on 239 infertile females undergoing ARP between June 2014 and November 2014.

Study setting: Hospital-based study. An informed written consent was obtained.

Subjects: All infertile women undergoing ARP.

Detail clinical history was taken with special attention been given to infertility condition, such as duration, possible etiology, any previous investigation, or treatment taken. This was followed by complete general and local examinations to detect size and mobility of uterus and presence of any uterine, cervical, or adnexal

pathology. Two-dimensional followed by 3D vaginal ultrasonography was carried out in all patients on day 21 of their menstrual cycles with GE Voluson E8 3D system. Once the B-mode TVS was completed 3D volumes were recorded. The volumes were generated by 360° automatic rotation of the mechanical transducer. For this, the probe was kept steady, the patient was asked to hold her breath, and the volume mode was switched on. The acquired volume was in the shape of a truncated cone. Adequacy of uterine cavity and presence or absence of pathology were detected. Size and location of pathology were measured, if found. Later, OH was done on 5th or 6th day of menstrual cycles. All the patients were asked to insert Tab misoprostol 400 µg per vaginum four hours before procedure. We used a rigid continuous-flow panoramic hysteroscope, 2 mm in diameter with 12° fiber optic lens (KarlStorz, Germany). A fiber optic cable was connected to the light source and to the hysteroscope. Normal saline was used as a distension medium. The amount and pressure of the fluid were recorded. Initially, vaginoscopy was done. Once uterine cavity was entered, a panoramic view of the cavity was taken. This was followed by the examinations of anterior, posterior, and lateral walls, fundus, and bilateral ostia. Size, shape, and site of pathology, if any, were noted. Any difficulties or complications if encountered were recorded. Numerical rating scale (NRS) for pain was recorded by instructing the patients to choose a number from 0 to 10 that best describes their current pain. 0 would mean "no pain" and 10 would mean "worst possible pain." Pain score was recorded during and 15 minutes after the procedure. Single dose of oral antibiotic was administered.

Statistical Methods

Data were coded and statistically analyzed by Statistical Package for the Social Sciences (SPSS) version 20. Qualitative data were presented as number and percentage. Comparisons between groups were estimated by chi-square test. A probability value (p value) less than 0.05 was considered significant.

RESULTS

The mean age of our 239 infertile women undergoing ARP was 33 years. The duration of infertility ranged from 1 to 32 years.

There were 184 (76.98%) women with primary infertility and 55 (23.01%) with secondary infertility. Table 1 shows patient distribution according to the type of infertility.

Out of 239 women, 3D TVS was normal in 211 (88.28%) and abnormal in 28 (11.71%); OH was normal in 186 (77.82%) and abnormal in 53 (22.17%) (Table 2).

Table 1: Patient distribution according to the type of infertility

Type of infertility	*Number*	*Percentage*
Primary infertility	184	76.98
Secondary infertility	55	23.01
• Single abortion	26	47.27
• Previous pregnancy > 20 weeks	11	20
• ≥ 2 Abortions	18	32.72
Total	239	100

Table 2: Results of 3D TVS and OH

Result	*Office hysteroscopy*	*3D TVS*	*Chi-square value*	*p-value*
Normal	186 (77.82%)	211 (88.28%)	8.56	< 0.01*
Abnormal	53 (22.17%)	28 (11.71%)		
Total	239	239		

*Represents significant difference between these groups

Table 3: Three-dimensional transvaginal ultrasound findings in all women

Findings	*Number*	*Percentage*
Normal findings	211	88.28
Abnormal findings	28	11.71
Polyp	15	53.57
Submucous myoma	5	17.85
Septa	5	17.85
Adhesion	2	7.14
Unicornuate uterus	1	3.57

Table 3 shows the common abnormalities reported in 3D TVS, namely, endometrial polyp (15/28) (53.57%) followed by uterine septa (5/28) and myoma (5/28) (17.85%).

The overall common abnormalities reported during OH were endometrial polyp (20/53) (37.73%) followed by uterine septa (15/53) (28.30%) (Table 4).

On studying the comparison between the two techniques, we found that 3D TVS agreed with OH in 16 (30.18%) abnormal cases and 179 (93.71%) normal cases. False-positive results for 3D TVS were 12 (6.28%) of all normal cases. False-negative results for 3D TVS were 37 (69.81%) of all abnormal cases. Table 5 shows the comparison of 3D TVS and OH.

Sensitivity of 3D TVS was 30.1%, specificity was 93.7%, positive predictive value was 57.1%, and negative predictive

Table 4: Office hysteroscopic findings in all women

Findings	*Number*	*Percentage*
Normal findings	186	77.82
Abnormal findings	53	22.17
Submucous myoma	8	15.09
Septa	15	28.30
Polyp	20	37.73
Tubular cavity	2	3.77
Adhesions	5	9.43
Unicornuate uterus	3	5.66

Table 5: Comparison of 3D TVS and OH

	Office hysteroscopy	
3D TVS	*Abnormal*	*Normal*
Abnormal	16 (30.18%)	12 (6.28%)
Normal	37 (69.81%)	179 (93.71%)
Total	53	191

$p < 0.01$ represents significant difference between these groups; $p < 0.05$ represents statistically significant difference between these groups; $p < 0.01$ represents statistically highly significant difference between these groups; and NS represents nonsignificant difference between these groups

value was 82.8% (Table 5). Table 5 also shows the statistical significant difference between the two studied techniques. Thus, according to our study, OH was shown to be better than 3D TVS in uterine cavity evaluation.

The mean volume of distension medium used for OH was 196.9 ± 67.9 mL.

The mean of distension pressure was 100.9 ± 29.4 mm Hg.

No complications were observed during OH in our study.

The average pain score during the procedure was 0 to 2 and after 15 minutes of the procedure 0.

DISCUSSION

Uterine cavity morphological evaluation is one of the most important parameters to determine the uterine receptivity in women undergoing ARP. Three-dimensional TVS and OH are increasingly being used for this purpose.

In recent years, 3D TVS has become popular in gynecological practice. It improves the diagnosis in cases that are difficult to be evaluated by conventional 2D scanning and other diagnostic modalities.[5] Information is digitally stored, which may be, later on, reconstructed in such a way as to allow visualization of an organ in any arbiter plane and from any chosen angle.[6] However, 3D TVS is not a very accurate method for assessing very small submucous fibroids, septa, or polyp protruding into the cavity. Accuracy of the diagnosis also depends on the great expertise of the person performing it.

Hysteroscopy has been regarded as the definitive and gold standard procedure for the evaluation of uterine cavity. It is a safe and a simple procedure that can be carried out in an office setting. In addition, it has already shown good results with high patient acceptability and lower health care cost.[7] Typical complications associated with hysteroscopy are uterine perforation and cervical laceration, which can be minimized by performing an ultrasound prior to the procedure. Using saline as the distension medium also serves to minimize medium-related complications like hyponatremia and cerebral edema. Post-procedure complications like endometritis can be reduced or eliminated by pretreatment and posttreatment with antibiotic and by avoiding the procedure on patients with active vaginal infection.[8] No complications were observed during OH in our study. Additional benefits of OH have also been found. Cervical dilatation may facilitate embryo transfer and the introduction of insemination catheters[9] and irrigation of the cavity with saline may have a beneficial effect on implantation and pregnancy rates.[10] Regardless of whether these adjunctive benefits are confirmed by further study, OH still holds value as the gold standard diagnostic procedure for uterine cavity evaluation. It has gained popularity due to its ease, safety, and efficiency of simultaneous therapeutic correction of abnormalities.

Pasqualotto et al[11] while studying similar parameters on 375 patients complaining of abnormal uterine bleeding found that the sensitivities specifically for myoma and polyps for transvaginal sonography were 74 and 39%, for saline infusion sonography were 96 and 96%, and for hysteroscopy were 100 and 99%.

Haemila et al[12] in their study of females with premenopausal bleeding found that 3D TVS detected myomas in 14 (20%), polyps in 8 (11.43%), and endometrial mass in 1 while hysteroscopy detected myomas in 6 (8.57%), polyps in 11 (15.72%), and endometrial mass in 1 (1.43%). In contrast to the study above, we found that 3D TVS detected 28 (11.71%) abnormalities, out of which 15 (53.57%) were polyps, 5 (17.85%) were submucous myomas, 5 (17.85%) were septa, 2 (7.14%) were adhesions, and 1 (3.57%) was unicornuate uterus. While hysteroscopy detected 53 abnormalities, out of which 20 (37.73%) were polyps, 8 (15.09%) were submucous myomas, 15 (28.30%) were septa, 5 (9.43%) were adhesions, and 3 (5.66%) were unicornuate uteruses.

In a similar study, Haemila et al[12] found that 3D ultrasonography was comparable to hysteroscopy as shown by a sensitivity of 63.16, a specificity of 80.77, a positive predictive value of 54.55, a negative predictive value of 85.71, and an accuracy of 76.06. In contrast, by comparing the results of 3D TVS and OH in our study, we found that 3D TVS has a sensitivity of 30.1%, a specificity of 93.7%, a positive predictive value of 57.1%, and a negative predictive value of 82.8%.

Recently, a "virtual hysteroscopy" technique based on 3D hysterosonographic data was described in five patients who presented with intrauterine abnormalities (polyps, n = 2; leiomyomas, n = 3). In all the patients, intrauterine lesions were easily and reliably detected by 3D hysterosonography. Images obtained by this "virtual hysteroscopy" technique were remarkably comparable to those obtained by hysteroscopy.[13]

In a study by Niknejadi et al,[14] TVS was performed in the follicular phase of the cycle to mid-cycle (from day 5 to day 15 of cycle) and 3D ultrasound was done during the luteal phase from day 17 to day 21 of cycle similar to our study.

In our study, we did not use saline instillation to delineate uterine cavity while performing 3D TVS as in 3D hysterosonography, which may be the reason for missing minor septa, polyps, and myomas.

CONCLUSION

Office hysteroscopy is an easy and safe procedure and has a better diagnostic efficacy when compared to 3D TVS for uterine cavity evaluation in women undergoing ARP.

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