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Research Article

Virtual Hysterosalpingography Versus Office Hysteroscopy in Assessment of Uterine Cavity in Infertile Female: Egyptian Experience

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Abstract

Aim: We propose virtual hysterosalpingography with Multidetector computed tomography (VHSG-MDCT) as a non - invasive technology to assess the uterine cavity and give us information similar to that obtained by diagnostic hysteroscopy.

Study design: Prospective observational study. Material and Methods: 25 women with primary or secondary infertility were enrolled in the mid to late follicular phase of each subject`s menstrual cycle. Virtual hysterosalpingography using 64 –row Multidetector computed tomography set was performed and Office hysteroscopy was performed within few days in each patient. Diagnostic hysteroscopy was our gold standard in assessment of the uterine cavity. Results: out of 25 patients It revealed pathology in 19 patients; mullerian anomalies in 6 patients (24%), which are as follows: 3 patients arcuate uterus (12%) and 3 with patients septate uterus (12%), uterine polyp in 9 patients (36%), intra uterine adhesions in 1 patient (4%), isthmocele in 1 patient (4%), adenomyosis in 1 patient (4%), hyper plastic endometrium in 3 patients (12%), stenosed internal os in 1 patient (4%) and fibroid in 1 patient (4%). Some of our patients had more than one pathology.

Diagnostic hysteroscopy revealed pathology in the uterine cavity in 20 out of 25 patients. Of those 6 patients (24%) had mullerian anomalies which are as follows: 3 patients arcuate uterus (12%) and 3 with patients septate uterus (12%), 3 patients (12%) had uterine polyp, 2 patients (8%) had intra uterine adhesion, 1Patient (4%) had isthmocele, 1 patient (4%) had adenomyosis, 4 patients (16%) had hyper plastic endometrium and 4 patients (16%) had endometritis, 1 patient (4%) had Stenosed internal os and osteal fibrosis in 3 patients (12%). VHSG-MDCT sensitivity, specificity, positive predictive value, negative predictive value and accuracy were 75.0%, 20.0%, 78.95%, 16.67% and 64.0% respectively.

Conclusion: This study showed the value of (VHSG-MDCT) in the evaluation of different uterine cavity lesions. In addition, we suggest it to be an integral examining modality in investigating uterine cavity in infertile female.

Keywords: Hysteroscopy; Virtual Hysteroscopy; Virtual Hysterosalpingography; Virtual Endoscopy

Introduction

Intrauterine pathologies are the underlying causes of infertility in about 15% of cases of infertility [1]. It is important to assess the uterine cavity of an infertile female. Assessment of the inner surface of the uterus can be done by variable diagnostic modalities such as hysterosalpingography (HSG), transvaginal ultrasound, sonohysterography (SHG) and office hysteroscopy [2].

Abnormalities detected in the uterine cavity such as uterine septum, intrauterine adhesions, endometrial polyp and submucous myomas can interfere with implantation and may cause spontaneous abortion [3,4].

Great development of Multidetector computed tomography with increased spatial and temporal resolution and less than 1 mm slice thickness allow reconstruction of two-and three-dimensional images and virtual endoscopic views [5].

The Post processing algorithm of Virtual endoscopy allows examination of the uterine cavity and it gives information similar to that obtained from hysteroscopy [5].

Virtual hysterosalpingography is a non-invasive technique. It is a combination of conventional hysterosalpingography and advanced technology of Multidetector computed tomography [6].

Office hysteroscopy is considered the gold standard in assessment of uterine cavity [7]. But Compared with virtual hysterosalpingography diagnostic hysteroscopy is invasive and uncomfortable procedure [8].

Objective

To assess the diagnostic accuracy of virtual hysterosalpingography using 64-Row Computed Tomography in comparison with office hysteroscopy in the evaluation of uterine cavity in infertile female.

Materials and Methods

In This prospective study, we evaluated 25 females with history of primary or secondary infertility in the Diagnostic radiology department and Obstetrics and Gynecology department, faculty of medicine, Alexandria University. This study was approved by ethics committee of scientific research, faculty of medicine, Alexandria University. Informed Consent was taken from all patients before the study. virtual hysterosalpingography using 64-detector multidetector CT was done for all patients at the follicular phase between day 7 and 14 of each patient`s menstrual cycle. Diagnostic hysteroscopy was done for all patients within one or two days.

- Inclusion criteria include female diagnosed with primary or secondary infertility, age range between 18- 40years.
- Exclusion criteria was history of sensitivity to iodine- based contrast agent.

Technique of the virtual hysterosalpingography

MDCT virtual Hysterosalpingography was done using 64-detector MDCT scanner (Brilliance 64; Philips medical systems) technical parameters used for image data acquisition: 64 x 0.62; slice thickness:0.9; reconstruction interval:0.45; average scan time 4-5 s ;120kv; 120-249 mAs.

The patient was positioned supine and in lithotomy position on the CT table, perineum was cleansed with povidone-iodine. We used sterilized speculum to dilate the vagina and have access to the cervix. Then a 12-F Foley`s catheter was positioned in the cervical canal. Its balloon was inflated by 3ml of saline to fix it in place. Diluted iodinated contrast solution (2.5 ml iobitridol and 12.5ml saline solution) was instilled at a rate 0.3ml /sec using power injector. We started imaging acquisition after 45sec from the start of injection. Image data acquired were transferred to a dedicated work station (Extended Brilliance Workspace; Philips Medical Systems).

Image analysis

1. Multiplanar reconstructions (MPR) obtained and we had sagittal and coronal views.
2. Maximum intensity projections in different planes were obtained.
3. Three dimensional volume rendering reconstructions
4. Virtual endoscopy images obtained to demonstrate the cavity of the uterus and cervical canal.

Data analysis

Interpretation of the procedure of virtual hysterosalpingography was done by experienced female imaging radiologist with emphasis on the pathology detected in the uterine cavity by virtual endoscopic reconstruction data. Then the patient was referred to the department of the Obstetrics and Gynecology (infertility clinic) for evaluation of the uterine cavity by office hysteroscopy within one or two days.

Office hysteroscopy

All patient included in this study underwent office hysteroscopic examination. It was done in Obstetrics and Gynecology department, faculty of medicine, Alexandria University. Hysteroscopy done by gynecologist has good experience in endoscopic surgery. Instrument used was (26008BAC) TROPHY scope –CAMPO compact hysteroscope, HOPKINSII, 30 degree, size 2.9 mm, length 24cm with irrigation channel. Uterine cavity was distended by 5% mannitol solution. Pressure was kept between 100 and 120 mmHg using pressure adjustable -cuff system. Neither anesthesia nor sedation was needed. And there were no complication.

The hysteroscopy findings were considered as a reference standard in calculation of sensitivity, specificity and predictive values.

Statistical analysis

Results obtained by MDCT- HSG were compared with diagnostic hysteroscopy. The diagnostic accuracy in detection of different pathologies detected in the uterine cavity was calculated and expressed as sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy.

Results

The study comprised 25 patients complaining of infertility, the age range from 19 - 37 years with mean age of 26.7 ± 4.9 years. Mean duration of infertility is 3.3 ± 2.4 years. 10 patients had secondary infertility and 15 patients had primary infertility. 11 patients had irregular menstruation. Four patients had history of abortion and D&C.

Diagnostic hysteroscopy finding

In our series, diagnostic hysteroscopy revealed pathology in the uterine cavity in 20 out of 25 patients. Of those 6 (24%) patients had mullerian anomalies which are as follows: 3 patients arcuate uterus (12%) and 3 patients (12%) with patients septate uterus. 3 patients (12%) had uterine polyp. 2 patients (8%) had intra uterine adhesions. 1 patient (4%) had isthmocele. 1 patient (4%) had adenomyosis, 4 patient (16%) had hyper plastic endometrium. 4 patients (16%) patients had endometritis. 3 patients (12%) had ostial fibrosis. And 1 patient (4%) had stenosed internal os. No pathology detected in the uterine cavity of 5 patients out of 25.

Virtual hystrosalpingography finding

It revealed mullerian anomalies in 6 patients (24%), which are as follows: 3 patients arcuate uterus (12%) and 3 with patients septate (12%). uterine polyp in 9 patients (36%), intra uterine adhesions in 1 patient (4%), and isthmocele in 1 patient (4%), adenomyosis in 1 patient (4%). Uterine fibroid in 1 patient. Hyper plastic endometrium in 3 patients (12%). And stenosed internal os in 1 patient (4%). Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of virtual hystrosalpingography for detection of intra uterine pathology are 75.0%, 20.0%, 78.95, 16.67, 64.0%.

Figure 1: Sub septate uterus. Female 27 years old with 1ry infertility. (A) MDCT maximum intensity projection reveals incomplete septum 13mm indenting the uterine cavity, normal external outer contour (arrow). (B) Volume rendered image reveals acute angle between the two uterine horns.(C) Virtual endoscopy image revealing sub septum(asterisks) (D) Diagnostic hysteroscopy image revealing incomplete septum (asterisks).

Figure 2: Diffuse adenomyosis. Female, 26 years old with secondary infertility. MIP image revealing multiple irregular out pouching continuous with the uterine cavity representing glandular projections into the myometrial wall. (B) Volume rendered image shows similar findings. (C) Diagnostic hysteroscopy reveals no abnormality. (D) Virtual endoscopy reveals the openings of the diverticulae in the uterine cavity.(black arrows). Air bubble is seen (asterisks).

Figure 3: 25 years oldx patient with secondary infertility. (A) Diagnostic hysteroscopy image, (B) virtual hysteroscopy image both revealing uterine polyp projecting from anterior uterine wall into the uterine cavity.

Figure 4: C-section scar. 37 years old patient with history of cesarean section. Diverticulum like lesion at the isthmus (A) sagital maximum intensity projection. (B) Virtual endoscopy image. (C) Conventional endoscopy image.

Figure 5: Incomplete septate uterus. (A) MPR coronal image reveals normal outer contour two uterine horns are separated by incomplete septum. (B)virtual endoscopy image reveals septum(black arrow). (C) conventional hysteroscopy image reveals septum. (D) TVUS image, two uterine cavities seen(black arrows).

Figure 6: Hyper plastic endometrium. 32years old patient with primary infertility. (A)Axial MIP image reveals irregular margin of the lumen of the uterine cavity. (B) Virtual endoscopy reveals multiple pseudo polyps (arrows) with no preponderant lesion. (c) and (D) Conventional hysteroscopy images reveal psudopolyps (arrows).

Figure 7: 28 years old patient with primary infertility. Intramural fibroid on the left uterine wall, deformed uterine contour and increased uterine silhouette. (A) Coronal MPR soft tissue window. (B) Coronal MIP. (C)TVUS reveals fibroid in the left uterine wall. (D)Conventional hysteroscopy image and Virtual endoscopy image. (E) both reveal no alteration of the uterine cavity.

Figure 8: Intrauterine adhesion at the fundus, uterine septum seen in 35 years old patient with 2ndry infertility. (A) Coronal MIP. (B) Virtual endoscopy. (C) Conventional hysteroscopy.

	No. (%)
Age (years)	27.6 ± 4.8
Abortion	5 (20%)
Gravidity	
Median (Min. – Max.)	0 (0 - 4)
Mean ± SD.	0.7 ± 1
Parity	
Median (Min. – Max.)	0(0 - 2)
Mean ± SD.	0.4 ± 0.7
C.S	5 (20%)
Irregular menses	11 (44%)
Duration of infertility (years)	3.7 ± 2.6
Type of infertility	
Primary	15 (60%)
Secondary	10 (40%)
D&C	5(20%)

Table 1: Distribution of the studied cases according to demographic data (n = 25).

	Virtual	Office
Mullerian anomaly		
Arcuate	3(12%)	3(12%)
Septum	3(12%)	3(12%)
Uterine polyp	9(36%)	3(12%)
Adhesions	1(4%)	2(8.0%)
Fibroid encroaching	1(4%)	0(0%)
Isthmocele	1(4%)	1(4%)
Adenomyosis	1(4%)	0(0%)
Endometritis	0(0%)	4(16%)
Hyper plastic endometrium	3(12%)	4(16%)
Stenosed internal os	1(4%)	1(4%)
Osteal fibrosis	0(0%)	3(12%)
Complication		
Extravasation	1(4%)	0(0%)

Table 2: Uterine cavity pathologies detected (n =25).

	Virtual	Office
Hysteroscopic findings		
Normal	6(24%)	5(20%)
Abnormal	19(76%)	20(80%)

Table 3: Distribution of the studied cases according to hysteroscopic findings (n=25).

Virtual	Office		Sensitivity	Specificity	PPV	NPV	Accuracy
	No	Yes					
Mullerian anomaly	(n =19)	(n =6)					
No	19(100%)	0(0%)	100.0	100.0	100.0	100.0	100.0
Yes	0(0%)	6(100%)					
Uterine polyp	(n = 22)	(n = 3)					
No	15(68.2%)	1(33.3%)	66.67	68.18	22.22	93.75	68.0
Yes	7(31.8%)	2(66.7%)					
Adhesions	(n = 23)	(n = 2)					
No	23(100%)	1(50%)	50.0	100.0	100.0	95.83	96.0
Yes	0(0%)	1(50%)					
Fibroid encroaching	(n = 25)	(n = 0)					
No	24(96%)	0(0%)	-	96.0	0.0	100.0	96.0
Yes	1(4%)	0(0%)					
Isthmocele	(n = 24)	(n = 1)					
No	24(100%)	0(0%)	100.0	100.0	100.0	100.0	100.0
Yes	0(0%)	1(100%)					
Adenomyosis	(n = 25)	(n = 0)					
No	24(96%)	0(0%)	-	96.0	0.0	100.0	96.0
Yes	1(4%)	0(0%)					
Endometritis	(n = 21)	(n = 4)					
No	21(100%)	4(100%)	0.0	100.0	-	84.0	84.0
Yes	0(0%)	0(0%)					
Hyper plastic endometrium	(n = 21)	(n = 4)					
No	21(100%)	1(25%)	75.0	100.0	100.0	95.45	96.0
Yes	0(0%)	3(75%)					
Stenosed internal os	(n = 24)	(n = 1)					
No	24(100%)	0(0%)	100.0	100.0	100.0	100.0	100.0
Yes	0(0%)	1(100%)					
Osteal fibrosis	(n = 22)	(n = 3)					
No	22(100%)	3(100%)	0.0	100.0	-	88.0	88.0
Yes	0(0%)	0(0%)					
Complication	(n = 25)	(n = 0)					
No	24(96%)	0(0%)	-	96.0	0.0	100.0	96.0
Yes	1(4%)	0(0%)					

Table 4: Agreement (sensitivity, specificity and accuracy) for virtual.

Virtual	Office		Sensitivity	Specificity	PPV	NPV	Accuracy
	Normal (n = 5)	Abnormal (n = 20)					
Hysteroscopic findings							
Normal	1(20%)	5(25%)	75.0	20.0	78.95	16.67	64.0
Abnormal	4(80%)	15(75%)					

Table 5: Agreement (sensitivity, specificity and accuracy) for virtual.

Discussion

Carascosa., *et al*. evaluated V-HSG in a retrospective study performed to 11000 patients with infertility. V-HSG was able to detect lesions in the uterine cavity. Polyps were visualized in (34%), adhesions in (4%), adenomyosis (6%) cesarean section defect (11%), and malformation (3.5%) [9].

Vallejos J., *et al*. evaluate pathologies in the uterine cavity detected by MDCT-HSG in infertile female in comparison with diagnostic hysteroscopy. They concluded that virtual hystrosalpingography by MDCT had detected variable abnormalities in the uterine cavity such as endometrial polyps, submucosal myoma, synechiae and cesarean scar defect. In his series, all these pathologies were detected similarly by diagnostic hysteroscopy and MDCT-HSG [10]. In our series 25 patient had infertility underwent diagnostic hysteroscopy which demonstrated pathology in the uterine cavity of 20 patients, 5 patients had no intra cavitary pathology. On comparison with MDCT-HSG, which had detected no pathology in 6 patients and 19 patients, had variable intrauterine pathologies. We found that MDCT-HSG had the same accuracy of diagnostic hysteroscopy in the diagnosis of Mullerian anomalies with sensitivity, specificity, PPV and NPV all are 100% arcuate uterus was detected in 3(12%) and septate uterus in 3(12%).

We agree with Carascosa., *et al*. that one of the advantages of MDCT –HSG is its ability to visualize the external uterine contour and this can help to differentiate between septate and bicornuate. Septate uterus has flat or convex fundal contour whereas bicornuate uterus has fundal depression [9-12].

Isthmocele was diagnosed in one patient (4%) who had history of previous cesarean section; it is noted as saccular dilatation in the site of the scar in MDCT-HSG. In addition, its diagnosis was confirmed by diagnostic hysteroscopy with sensitivity, specificity 100%. We agree with Yoshihiko., *et al*. that we can get use of Multidetector CT combined with hystroslapingography in assessment of post surgical uterine diverticulum. It gives better visualization of its connection to the uterine cavity [13].

Diagnostic hysteroscopy detected intra uterine adhesions in two patients. However, MDCT-HSG detected intra uterine adhesion in only one patient (4%). It missed the diagnosis in the other patient. Intra cavitary adhesions were seen as irregular linear filling defects in volume rendering images. In Virtual endoscopy, it appeared as irregular linear bands.

MDCT-HSG was less accurate than diagnostic hysteroscopy in the diagnosis of endometrial polyps; nine cases (39%) had been diagnosed to have polyps by MDCT –HSG, but diagnostic hysteroscopy detected polyps in the uterine cavity in only three patients. MDCT-HSG Sensitivity, specificity, positive predictive value, negative predictive value and accuracy were 66.67, 68.18, 22.22, 93.75 and 68.0 respectively.

In diagnosis of endometrial polyps. This low sensitivity and specificity were attributed to filling defects due to air bubbles, mucous, and poor placement of the catheter, which can mimic filling defects of endometrial polyps in the reconstructed maximum intensity projection and virtual endoscopy images.

MDCT- HSG detected Adenomyosis in one patient (4%). Two signs of diagnosed Adenomyois, first contrast medium in the endometrium extend into the myometrium in a flame shaped or lollipop diverticulae in MIP images. Superficial openings in the uterine cavity were seen in virtual endoscopy image, which suggest disruption of endomyometrial surface.

Office did not give the same diagnosis and it reveals no pathology detected in the uterine cavity. Our explanation was that diagnostic hysteroscopy is not the gold standard imaging tool in the diagnosis of adenomyosis. Suggestive features can be detected by office. Hyper vascular endometrium and cystic hemorrhagic lesions seen directly drain in the endometrial cavity and superficial openings on the endometrial cavity, suggesting a disruption of endomyometrial surface. None of these features was detected by diagnostic hysteroscopy [14,15].

Hyper plastic endometrium or pseudo polyps was detected in four cases (16%) by diagnostic hysteroscopy, MDCT-HSG detected it in 3patients (12%) it was detected as irregular thickened mucosal folds with pseudo polyps it was also detected in multiplanar reconstruction as irregular margin of the lumen.

MDCT –HSG diagnosed a large uterine fibroid in one patient measured about 5x 6 cm. Both office hysteroscopy and MDCT-HSG had the same accuracy in diagnosing that this large fibroid did not encroach on the uterine cavity. In our series Endometritis was detected by diagnostic hysteroscopy in 4(16%) of our patients. MDCT-HSG revealed no endometritis. Chronic endometritis can be diagnosed by hysteroscopy but the gold standard in its diagnosis is Histological specimens by Identification of plasma cell in the stroma of endometrium [16,17].

Cervical canal narrowing can be focal or diffuse. In our study diagnostic hysteroscopy confirm the diagnosis of V-HSG that one patient (4%) in our series have cervical stenosis at the internal os, this is similar to Carrascosa., *et al*. she reported that virtual hystrosalpingography can detect cervical canal narrowing [11].

We agree with Carascosa., *et al*. [3] that the most frequent complication seen with MDCT-VHSG is intravasation of contrast into the venous plexus. This complication was observed in (3%) of patients. in our series, it was (4%). No complication was occurred during or after diagnostic hysteroscopy.

Conclusion

This study showed the value of (VHSG-MDCT) in the evaluation of different uterine cavity lesions. In addition, we suggest it to be an integral examining modality in investigating uterine cavity in infertile female.

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