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Original Research Article

Efficacy of transvaginal sonohysterosalpingography for evaluation of infertile women

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ABSTRACT

Background: Women with infertility may be benefitted from sonohysterosalpingography (SHSG), a transvaginal ultrasound procedure that uses a contrast medium to assess the endometrial cavity and tubal patency. It could be a safer and more viable alternative to radiographic hysterosalpingography (HSG). The aim of the study was to evaluate the uterine cavity and fallopian tube patency in infertile women by SHSG using transvaginal ultrasound.
Methods: The prospective comparative study was carried out in a total of 35 cases of infertile women between the reproductive age of 20-40 years following the inclusion and exclusion criteria, from July 2016 to June 2017. Detailed history and physical examinations were carried out and appropriate management was instituted as per the needs of the individual patient.
Results: In the present study, 41.2% of the women belonged to the age range of 25-29 years. Out of 35 women, 50% women were in the state of primary infertility and remaining were in a secondary infertility state. Holding the SHSG both tube blockage as positive findings the sensitivity of SHSG was found at 100%, specificity was 96.88% and accuracy was 97.14%, while positive predictive value was 80.49% and negative predictive value was 100%.
Conclusions: Transvaginal SHSG as a first-line method for evaluation of endometrial cavity and tubal patency is effective and time convenient. Before going to the more invasive gold standard methods, i.e. Hysteroscopy and Laparoscopy, this may be a simple, safe, and well-tolerated technique with a low risk of adverse effects and severe complications.

Keywords: Sonohysterosalpingography, Endometrial cavity, Tubal patency, Hysteroscopy, Laparoscopy

INTRODUCTION

Infertility is defined as the failure of a couple to achieve conception after one year of unprotected sexual intercourse.[1] It affects 10-15% of couples seeking children.[2] The main aetiological factor is found in females in about 40% of infertile couples.[1] The uterine abnormalities that can adversely affect fertility include congenital anomalies, leiomyoma, intrauterine adhesions, and endometrial polyps.[2] Tubal and peritoneal pathology is among the most common causes of infertility, and the primary diagnosis in approximately 30-35% of both younger and older infertile women.[3] Hysterosalpingography (HSG) is the most commonly used method for the assessment of endometrial cavity and tubal patency.[4] Compared to laparoscopy, the gold standard method, HSG has only moderate sensitivity (65%) in detecting tubal patency.[5,6] When HSG reveals obstruction, there is still a relatively high probability (approximately 60%) that the tube is patent.[2] Injection of contrast in HSG may cause

cornual spasm (uterine contractions that transiently close the interstitial segment and prevent distal perfusion) that can be interpreted as proximal tubal occlusion. In recent years, however, there have been developments in new imaging modalities and advances in the management of various causes of Infertility. While vaginal sonography has revolutionized the approach to infertility, transvaginal ultrasonography alone provides no information about tubal patency which is very important for the investigation of infertility. Various contrast media have been used to increase the sensitivity of ultrasound and to reduce the need for additional investigations. Sterile saline provides an echo-free or negative contrast medium. Normal saline given through the cervix with gentle positive pressure flows along the tubes and a spill into the peritoneal cavity occurs if there is no outflow obstruction. The negative contrast provided by the saline helps in visualizing the uterine cavity and fallopian tubes by transvaginal ultrasound. Small intracavitary lesions of the uterus are better visualized as well. Saline Infusion SonohysteroSalpingography has been found to be superior to HSG in terms of sensitivity and negative predictive value.[7] Sonohystero-salpingography (SHSG) and hysterosalpingo-contrast sonography (HyCoSy) have replaced HSG for evaluation of the uterine cavity and tubal patency in many centers worldwide.[8]

METHODS

This prospective comparative study with transvaginal SHSG was done with a total of 35 cases of infertile women aged between 20-40 years, from July 2016 to June 2017. The study population consisted of infertile patients attending the outpatient and in-patient department of the reproductive endocrinology and infertility unit of Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. Inclusion criteria for patient selection were infertile women aged 20-40 years with no sign of active pelvic infection and duration of infertility >1 year for women aged 20-35 years and >6 months for women aged 36-40 years. Exclusion criteria were patients aged <20 years and >40 years, patients having signs/symptoms of active pelvic infection, patients having a history of ectopic pregnancy, or patients having uterine bleeding and presence of free fluid in the cul-de-sac in the baseline Transvaginal scan. Detailed history and physical examination findings were carried out and appropriate management was instituted as per individual patients' needs. The procedure was performed during the follicular phase, 2-3 days after the end of menstruation. The patient was placed in a lithotomy position. Vulva, vagina, and cervix were washed with povidone iodine. Then a speculum was inserted to visualize the cervix. A no.8 Fr Foley's/Nelaton catheter was inserted into the lower part of the uterine cavity. The balloon of the catheter was inflated with 2 ml of normal saline to prevent retrograde flow of the saline into the vagina. A baseline TVS scan was performed before the instillation of saline through the cervix. The speculum was then removed and a transvaginal probe was inserted for imaging. The sterile saline was introduced focusing the TVS probe at first along the longitudinal axis of the uterus to visualize the endometrial cavity, and then in between the uterine cornu and ovary on each side. Spillage of saline through the fallopian tube into the periovarian recess/peritoneal cavity was taken as patency of the tube on the respective side. The collection of fluid in the cul-de-sac was considered a supportive finding for saline spillage. After visualization of the tubal spillage, the balloon of the catheter was deflated and the catheter was taken out. The participants were subsequently evaluated by hysteroscopy and laparoscopic chromo-perturbation to compare the findings of SHSG with those of the gold standard methods. As laparoscopic chromo-perturbation and hysteroscopy combined are considered the gold standard tools for evaluation of uterine and tubal conditions, the same patients were taken as a control to compare the results of SHSG to that of laparoscopy and hysteroscopy. As the study was done to observe infertility detection, diagnosis of infertility was recognized as a positive finding in this study. The single blinding method was followed. The surgeon doing the hysteroscopy and laparoscopic chromo-perturbation did not know the findings of SHSG to avoid influencing the findings. Results were recorded in the respective datasheets. Statistical analysis of the results was obtained by using windows-based computer software devised with statistical packages for social sciences (SPSS-24). Sensitivity, specificity, positive predictive value, and negative predictive value of SHSG were detected in comparison to laparoscopic chromo-perturbation. The statistical significance threshold was set to <0.05.

RESULTS

The prospective comparative study with transvaginal SHSG was done in 35 cases of infertile women aged between 20-40 years. Among the respondents, 14 (41.2%) belonged to the age group of 25-29. The majority of the women 15 (41.1%) completed their education up to the SSC level. The most frequent occupations among the women were found as health workers 8 (23.5%), and service holders 8 (17.6%). 50% of the participating women were found to be in primary infertility cases, while the remaining 50% were secondary infertility cases. Duration of infertility was 1-5 years for 47.1% of the participants, 6-10 years for 38.2%, and over 11 years for the remaining participants (Table 1). In SHSG, among the incidental findings' polycystic ovary, fibroid uterus, and ovarian follicle were found most frequently, in 2 (5.9%) each (Table 2). In hysteroscopy findings, a normal endometrial cavity was observed in 22 (62.85%) (Table 3). In laparoscopic chromo-perturbation findings, both tubes were found patent in the case of 19 (55.9%) women (Table 4). SHSG findings of the endometrial cavity were compared with hysteroscopic findings in the study. It was observed that in SHSG findings normal endometrial cavity was found in 25 (73.5%) women and abnormalities in the endometrial cavity were revealed in 9 (26.5%) women. Whereas in hysteroscopy findings normal endometrial cavity was found in the case of 21 (61.8%) women and

abnormalities in the endometrial cavity were revealed in the case of 13 (38.2%) women (Table 4). For comparison of tubal patency in SHSG findings with laparoscopic chromo-perturbation findings, in SHSG both tubes were found patent in 17 (50.0%) women, both tubes blocked 4 (11.76%), only right tube 7 (20.59%), only left tube 7 (20.59%) was found patent in women, both tubes patent 21 (61.76%), both tubes were found blocked in 3 (8.82%) cases whereas laparoscopic chromo-perturbation findings revealed that only right tube patent 5 (14.71) and only left tube patent 6 (17.64) were found patent in women (Table 5). Holding the blockage of both fallopian tubes as positive and holding laparoscopic chromo-perturbation findings as the gold standard, it can be seen that there were 3 true positive cases, 1 false positive case, 0 false negative cases, and 31 true negative cases according to SHSG findings (Table 6).

Table 1: Socio-demographic features of the study population.

Variable	N	%
Age group (years)		
20-24	6	14.7
25-29	14	41.2
30-34	10	29.4
35-40	5	14.7
Mean±SD=28±4.5, minimum=20, maximum=38		
Education		
Primary	2	2.9
SSC	15	44.1
HSC	12	35.3
Graduation	6	17.6
Occupation		
Housewife	2	2.9
Lawyer	2	5.9
Business	3	8.8
Student	4	11.8
Teacher	5	14.7
Garments worker	5	14.7
Service holder	6	17.6
Health worker	8	23.5
Type of infertility		
Primary infertility	18	50
Secondary infertility	17	50
Duration of infertility (in years)		
1-5	17	47.1
6-10	13	38.2
11 and above	5	14.7

Table 2: SHSG incidental findings of the respondents.

SHSG incidental findings	N	%
Polycystic ovary	2	5.71
Bicornuate uterus	1	.86
Fibroid uterus	2	5.71
Ovarian follicle	2	5.71
Ovarian cyst	1	2.86
Endometrial bands	1	2.86

Using the TP, TN, FP, and FN cases, the sensitivity, specificity, and accuracy of MRI in the selected patients were determined. Sensitivity was found at 100%, specificity was 96.88% and accuracy was 97.14%, while positive predictive value was 80.49% and negative predictive value was 100% (Table 7).

Table 3: Hysteroscopy findings of the respondents (n=35).

Hysteroscopy findings	N	%
Normal endometrial cavity	22	62.85
Uterine synechiae	4	11.42
Endometrial polyp	2	5.71
Endometrial flakes	5	14.29
Small bony part	1	2.86
Bicornuate uterus	1	2.86

Table 4: Comparison of SHSG findings of the endometrial cavity with hysteroscopy findings (n=35).

	SHSG	Hysteroscopy
	N (%)	N (%)
Normal	26 74.28)	22 (62.85)
Abnormal	9 (25.71)	13 (37.14)

Table 5: Comparison of tubal patency in SHSG findings with laparoscopic chromo-perturbation findings (n=35).

Tubal patency	SHSG N (%)	Laparoscopy N (%)
Both tubes patent	17 (50.0)	21 (61.76)
Both tubes blocked	4 (11.76)	3 (8.82)
Only right tube patent	7 (20.59)	5 (14.71)
Only left tube patent	7 (20.59)	6 (17.64)

Table 6: Validity of SHSG evaluation with laparoscopy as the gold standard (n=35).

SHSG	Laparoscopy		Total
	Positive	Negative	
Positive	3 (TP)	1 (FP)	4
Negative	0 (FN)	31 (TN)	31
Total	3	32	35

Table 7: Sensitivity, specificity, and accuracy of SHSG in comparison with hysteroscopy and laparoscopic chromo-perturbation findings (n=35).

Incident	SHSG with laparoscopy (%)
Sensitivity	100
Specificity	96.88
PPV	80.49
NPV	100
Accuracy	97.14

DISCUSSION

For the study of tubal patency, sonosalpingography has been recognized as a possible first-line method during the past few years. The morphologically altered tubes and even normal salpinx could be visualized rarely except for the interstitial part by transvaginal sonography. For the treatment of infertility, it is very crucial to establish that the fallopian tubes are patent.[9] In the present study, a majority (41.2%) of the women belonged to the age range of 25-29 years, while the mean±standard deviation (SD) was 28±4.5 years. Out of 35 women, the education level of 15 (41.1%) women were up to secondary school level while 8 (23.5%) women were healthcare workers and 6 (17.6%) women were service holders. Almost half the participants had primary infertility while the other half had secondary infertility at the time of admission. The duration of infertility was 1-5 years for 47.1% of the participants, 6-10 years for 38.2%, and over 11 years for the remaining participants. Another similar study revealed that all the respondents were in the age range between 25-42 years where the majority of patients 13 (41.9%) were in the 30-34 years of age group and the mean age was 31.2 years. In that study. out of 30 patients, the education level of 14 patients (45.1%) was up to the primary level and 20 (64.5%) patients were housewives, while only 8 (25.8%) patients were service holders.[9] Another study narrated that majority (48%) of the women were in the 25-29 age group, while the mean age of respondents was 27 years.[10] In the present study, a normal endometrial cavity was observed in 21 (61.8%) cases, whereas hysteroscopy revealed various findings among the remaining participants. Out of 35 respondents, a normal uterus was observed in 21 (61.8%), uterine synechiae in 4 (11.8%), endometrial polyp in 2 (5.9%), endometrial flakes were observed in 5 (14.7%), small bony part and bicornuate uterus were found in 1 (2.9%) women in hysteroscopy finding. In laparoscopic findings, both tubes were found patent in the case of 21 (61.76%) women, one tube was found patent in 11 (31.43%) women, and both tubes were found blocked in 9 (25.71%) women. Within the incidental findings, polycystic ovary, fibroid uterus, and ovarian follicle were found most frequently in 2 (5.9%) cases of women whereas bicornuate uterus, ovarian cyst, cervical stenosis, and endometrial bands were found in cases of 1 (2.9%) women each. A study expressed that 82.2% of women had bilateral tubal patency in SHSG, and the same number was enrolled later by HSG. SHSG showed bilateral tubal occlusion in 33 (15%), whereas HSG was described only in 10% and a tubal block was seen in 8.18% of women by HSG. The pathological findings stated that polycystic ovaries were found in 15%, endometrial polyps in 2 cases, fibroid uterus 5%, ovarian cysts in 2%, and uterine cysts with hydrosalpinx in 4%.[11] In another study of 98 cases, SIS/SHG showed abnormal uterine findings in 27% of cases, and HSG detected abnormal uterine findings in 11% of cases, adhesions were found in 12%, fibroid in 8%, polyp in 5%, septate/ bicornuate uterus in 1% cases.[12] Another study narrated a total of 24 infertile women, where 87.5% of women had suffered from primary infertility and 12.5% from secondary infertility level. The most common age group in that study was found between 20-30 years observed at 58.3%. The most common pathology seen in hysteroscopy was uterine synechia (16.6%) and in laparoscopy, it was pelvic adhesion (33.33%) along with polycystic ovaries (20.8%).[13] Infertility was described as the failure to conceive during one year of unprotected frequent intercourse in a study. This study report included the leading causes of infertility including tubal disease, ovulatory disorders, male factor infertility, uterine or cervical factors, and endometriosis.[14] In a study done in Ahmedabad in the institution of NHL Municipal Medical College Ellisebridge, a total of 100 women were enrolled and their ages ranged from 19 to 38 years and their mean age was 26.6 years. Abnormal laparoscopic findings were revealed in 77% of cases where some form of abnormality was established through hysteroscopy. In 40% of cases where the bilateral tubal blockage was found in 3% and one tube patent was found in 13% of cases. Among the 100 women, endometrial polyps were stated in 5% where 12% had polycystic ovarian syndrome (PCOS) and pelvic adhesions were found in 25% of patients.[15] Another study noted that among 1024 infertile women in an infertility clinic, 42 patients with HSG findings of bilateral proximal tubal obstruction were included. Of the respondents, 32 patients (80%) had at least one patent fallopian tube, and 8(20%) women were revealed to have both tubal obstructions. Those 8 patients with SHG records of both tubal obstructions underwent laparoscopy, summarily the results narrated 6 of those were laparoscopically proved to have both tubal obstructions.[16] In the present study, comparison of SHSG findings of the endometrial cavity with hysteroscopy findings, it was found that in SHSG, the normal endometrial cavity was found in 26 (74.3%) women and an abnormal endometrial cavity was observed in 9 (26.5%) women whereas in hysteroscopy findings normal endometrial cavity was revealed in case of 21 (61.8%) women and an abnormal endometrial cavity was found in case of 13 (38.2%) women. For comparison of tubal patency, in SHSG findings with laparoscopy findings, SHSG both tubes were found patent in 17 (48.6%) women, left and right tubes were found patent in 14 (40%) women, both tubes were found blocked in 4 (11.4%) cases whereas laparoscopy findings revealed that both tubes were found patent in 21 (60%) women, left and right tubes were found patent in 11 (41.43%) women and both tubes were found blocked in 3 (8.57%) case of women. Diagnostic accuracy (sensitivity and specificity) of sono-salpingography/SSG was found more accurate and effective than hysterosalpingography for both patency and abnormality detection in all infertile women.[12,16] Holding the laparoscopy findings as the gold standard, the SHSG findings of this study had 100% sensitivity, 96.88% specificity, 97.14% accuracy, 80.49% positive predictive value, and 100% negative predictive value. SSG was an equally efficient system as HSG with many advantages. SSG was a simple, safe, and well-tolerated procedure with a low risk of unwilling impact and complications, eliminating inessential exposure of the female pelvis to

ionizing radiation by avoiding the use of iodinated contrast material.[16,17] Different findings were noted in the initial assessment of tubal patency that revealed SSG was a better choice for infertility than HSG as an indirect, outdoor, non-invasive procedure with minimal radiation hazards. As a gold standard procedure, laparoscopy could be considered for infertility assessment despite its invasiveness along with its out-of-pocket expenditure due to its detailed findings, but SHSG is a great choice for an initial assessment.[18] Laparoscopy could be performed after a detailed initial workup and could be restricted to selective women.[19] SSG was more acceptable than HSG as a screening test for tubal patency regarding the overall discomfort during HSG and the overall satisfaction rate.[20]

Limitations

The study was done in a single national-level institute. Multiple centers could not be included.

CONCLUSION

Transvaginal SHSG as a first-line method for evaluation of endometrial cavity and tubal patency is effective and time convenient. Before going to the more invasive gold standard methods, i.e. hysteroscopy and laparoscopy, this may be a simple, safe, and well-tolerated technique with a low risk of adverse effects and severe complications.

Recommendations

This study can serve as a pilot to much larger research involving multiple centers that can provide a nationwide picture, validate regression models proposed in this study for future use and emphasize points to ensure better management and adherence.

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