

Evaluation of hysterosalpingography (HSG) for imaging the tubes and uterine cavity and its comparison with hysteroscopy and laparoscopy in infertile women

¹Dr Kiran Pande, Assistant Professor, Dept of Obstetrics and gynecology, MM College of Medical Sciences & Research, Sadopur, Ambala, Haryana

²Dr. Sushil Dalal, Professor, Dept of Community Medicine, MMIMSR, Mullana. Ambala, Haryana

³Dr. Aditi Gore, Assistant Professor, Dept of Obstetrics and gynecology, Smt.Kashibai Navale Medical College, Pune

⁴Dr. Swapna S Kadam, Professor, Dept of Community Medicine, MMIMSR, Mullana. Ambala, Haryana

⁵Dr. Bhagwant Payghan, Professor, Dept of Community Medicine, MMIMSR, Mullana. Ambala, Haryana

Corresponding Author: Dr. Swapna S Kadam, Professor, Dept of Community Medicine, MMIMSR, Mullana. Ambala, Haryana

Citation this Article: Kiran Pande, Sushil Dalal, Aditi Gore, Swapna Kadam, Bhagwant Payghan, “Evaluation of hysterosalpingography (HSG) for imaging the tubes and uterine cavity and its comparison with hysteroscopy and laparoscopy in infertile women”, IJMSIR- August - 2023, Vol – 8, Issue - 4, P. No. 35 – 42.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: The elevated prevalence of infertility stands as a significant yet often overlooked issue in global reproductive health. Peritoneal pathology accounts for 40-50% of the significant factors leading to infertility, while ovulatory dysfunction contributes to 30-40%, tubal and uterine pathology to 15%-20%, and male factors contribute to 30%-40%. While HSG has functioned as the primary initial diagnostic test for assessing both the uterine cavity and tubal patency, hysteroscopy enables a comprehensive view of the uterine cavity and facilitates direct biopsy of lesions. Thus increasing precision and accuracy in diagnosis of intra uterine condition. By the same time laparoscopy is an important method of evaluation, combining with hysteroscopy in one sitting may obsolete the need for HSG in this subset of infertile women. Aim: To assess the efficacy of HSG in evaluation of tubes and uterine

cavity in infertile patient and to compare results with Hyster laparoscopy.

Materials and Method: It was a diagnostic study carried out in department of Obstetrics and Gynecology, Ruby Hall clinic Pune. From April 2014 to March 2015. The study population comprised of infertile women with primary and secondary infertility and the sample size came out to be 140.

Result: Out of 140 patients 72% were primary and 27 % were secondary infertility and mean age of infertility was around 30 years. The sensitivity and specificity of HSG in demonstrating uterine pathology were 19.6% and 97.4% respectively as compared to hysteroscopy. The positive predictive value was 85.7% and negative predictive value was 63%. Sensitivity and specificity of HSG as compared to laparoscopy for detecting bilateral or unilateral block was 73.5% and 80.2% respectively. The positive predictive value was 54.4% and negative

predictive value was 90.4%. The observed agreement between two was 78.6%.

Conclusion: HSG, being a less expensive could be used as screening tool, but Hyster laparoscopy should be recommended for all infertile women early enough to aid with the decision for assist reproduction when the women is young and will benefit from the treatment. **Keywords:** Infertility, Hysterosalpingogram, Hysteroscopy, Laparoscopy, sensitivity, specificity.

Keywords: HSG, Hyster laparoscopy, Hysterosalpingogram.

Introduction

Infertility is characterized as the inability to attain a successful pregnancy following 12 months of consistent unprotected sexual activity (1). It affects approximately 10-15% of couples. Among the major causes of infertility peritoneal pathology contribute 40-50%, ovulatory dysfunction 30-40% tubal, uterine pathology 15%-20% while male factor contribute 30%-40% (2). The anatomical/functional evaluation of female pelvic organs plays a key role in the clinical assessment of infertility in infertile couples. The clinical evaluation of a great number of infertile /sub fertile women (7-16%) might be based on an evaluation of the risk/benefits and costs/benefits ratio of diagnostic tools. Therefore, a low cost and risk methodological approach should be addressed as a “first choice” investigation, later followed by more complex or invasive procedures¹.

Every method has its own merits and demerits. HSG and laparoscopy are complimentary to each other in providing information (3). The HSG has functioned as the initial diagnostic tool for assessing both the uterine cavity and tubal patency. It is a relatively straightforward and cost-effective procedure that can be carried out on an outpatient basis. Nonetheless, multiple studies have highlighted inadequate outcomes of the HSG in

identifying intrauterine abnormalities (4,5). HSG may have some therapeutically value but it also is often uncomfortable or painful and involves some radiation exposure and has risk of infectious complications that can further impair fertility (6).

Laparoscopy provides detailed information of pelvic anatomy including adhesions, endometriosis and ovarian pathology, can be therapeutic at the same time but is more invasive, requires general anesthesia, provides no information about uterine cavity until hysteroscopy is performed simultaneously and involves the usual risks of surgery. Hysteroscopy on the other hand allows direct visualization of uterine cavity such as polyps, submucous myomas, and endometrial adhesions. However, hysteroscopy is inadequate to assess the tubal patency. Keeping this in view the present study has been designed to compare HSG with Hyster laparoscopy for their efficacy in evaluation of infertility.

Aims and Objectives:

To assess the efficacy of HSG in evaluation of tubes and uterine cavity in infertile patient and to compare results with Hyster laparoscopy.

Materials and Methods

It was a diagnostic study carried out in department of Obstetrics and Gynecology, Ruby Hall clinic Pune from April 2014 to March 2015 after taking approval of institutional ethical committee. The study population comprised of infertile women with primary and secondary infertility and the sample size came out to be 140 according to sample size formula. Inclusion criteria for the study were diagnosis of infertility as per WHO definition and women's age 19-42 years, whereas exclusion criteria were active genital infection (active PID), Hypersensitive to contrast and medical disorder contraindication for GA or laparoscopy. Informed written consent was taken after enrolment. Infertility defined as

one year of unprotected intercourse without any pregnancy. This is further classified as primary infertility, in which no previous pregnancies have occurred, and secondary infertility, in which a prior pregnancy, although not necessarily a live birth has occurred. Detailed history, general physical and gynaecological examination of patient was done and recorded in pre designed proforma.

Basic test like complete blood examination, urine examination, random blood sugar, hepatitis and hormonal profile, husbands' semen analysis, ultrasonography was carried out and the study group was selected with regard to appropriate inclusion and exclusion criteria. HSG and Hyster laparoscopy were carried out in each patient. First HSG was done then Hyster laparoscopy within four months of HSG done. The Patient, who will have recent HSG (within six month) from outside, underwent Hyster laparoscopy straightway. HSG was performed in the preovulatory phase of the menstrual cycle (day 6-11, preferably D-8) as an OPD procedure. Three supine radiograms were taken, one during filling up of uterus, second during filling up of tubes and third during peritoneal spill. Hysterosalpingograms were evaluated by radiologists.

Hyster laparoscopy: The procedure was carried out in the follicular phase of the menstrual cycle (day 7-8) as in patient under GA as one step procedure.

Laparoscopy Laparoscope (10 mm diameter) was introduced after creating pneumoperitoneum infraumbilical and thorough inspection of uterus, anterior and posterior cul-de-sacs, fallopian tubes, ovaries, ovarian fossae and rest of the pelvic peritoneum, appendix and liver surface was performed and any abnormality was noted down including adhesions if any. Chromopertubation was done in all cases.

Hysteroscopy

Hysteroscope (4mm diameter) was used for diagnostic hysteroscopy. Any abnormality found was noted. The data was entered in Microsoft office excel 2007. It was analysed using Epi info version 7.1.5 software. Since this is a diagnostic study Sensitivity, specificity, positive predictive value, negative predictive value, and observed agreement were all calculated. However statistical test such as Chi square routinely used in hypothesis testing were not employed.

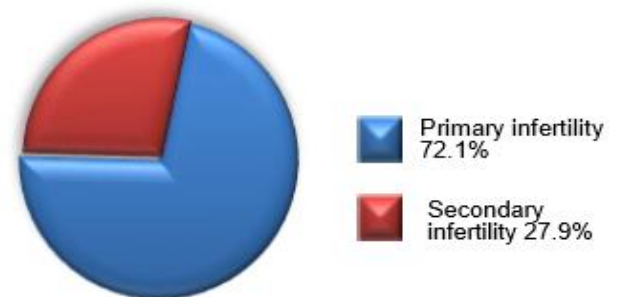
Results

In the time duration from April 2014 to March 2015 total number of 140 infertile women underwent HSG and Hyster laparoscopy in the department of Gynecology & Obstetrics and radiology of Ruby Hall Clinic hospital.

Table 1: Demographic data of the studied group

Characteristics	No (140)	(%)
Mean age (years)	29.2±3.5	-
Duration of infertility (years)	2.7±1.1	-
Primary	101	72.1
Secondary	39	27.9%

Fig 1: Showing distribution of primary and secondary infertility.



As per Table 2, about 126 out of 140 women (90%) showed normal uterine finding. Whereas 14 women (10%) showed abnormal uterine cavity. The abnormalities were filling defect (5.7%), septate uterus (2.9%), unicorn ate and bicornuate uterus (0.7%) each.

Table 2: Uterine findings on HSG

Uterine Finding on HSG	No	%
Normal	126	90.0
Abnormal	14	10.0
Filling defect	8	5.7
Septate	4	2.9
Bicornuate uterus	1	0.7
Unicornuate uterus	1	0.7
Total	140	100

94 out of 140 patients (67.1%) had both tubes showing free spill whereas 28 patients (20%) had unilateral free spill. Both the tubes were found blocked in 18 (12.9%) patients. Additional findings like hydrosalpinx were present in 8 patients out of which one had free spill. (Table 3). 78 out of 140 women (55.7%) had normal uterine cavity whereas 62 women had one or more abnormalities and the most common abnormality was blocked ostia (14.3%) whereas Polyp & intrauterine adhesion were the second most common cause and other abnormalities were uterine malformation i.e., septate (8.6%) & unicorn ate uterus (0.7%). (Table 4)

Table: 3 Tubal patency on HSG

Tubal Findings On HSG	No (140)	%
Bilateral tubes Patent blocked	94	67.1%
	18	12.9%
Unilateral tube patent	16	11.4%
	12	8.6%
Additional findings		
Bilateral hydrosalpinx (fs=1)	4	2.9%
Unilateral hydrosalpinx(fs=0)	4	2.9%

Table 4: Uterine findings on Hysteroscopy

Uterine Findings Hysteroscopy	(No)	%
Normal	78	55.7%
Abnormal*	62	44.3%
Polyp	16	11.4%
Intrauterine adhesion	16	11.4%
Unilateral ostia blocked/Flimsy adhesions	13	9.3%
Bilateral ostia blocked	07	5%
Septum/Sub septum	12	8.6%
Unicornuate uterus	1	0.7%

*Findings alone or in combination.

106 out of 140 women (75.7%) had patency of both tubes by chromopertubation whereas 27 women (19.2%) had unilateral tube patent and 7 women (5%) had both tubes blocked. Out of 34 tubal blocks 16 had cornual block, 18 had fimbrial /middle segment block. (Table 5)

Table 5: Tubal patency on laparoscopy CPT.

Tubal patency on laparoscopy CPT	No	%
Bilateral tubes	106	75.7%
	07	5.0%
Unilateral tube patent	15	10.7%
	12	08.6%

Table 6a: Comparison of uterine finding on HSG versus Hysteroscopy

HSG UTERINE FINDING	UTERINE FINDINGS ON HYSTEROSCOPY		
	Abnormal	Normal	Total
Abnormal	12 (8.5%)	2	14(10%)
Normal	50 (35.7%)	76	126
TOTAL	62	78	140

HSG was unable to detect abnormalities in uterine cavity in 50 (35.7%) patients (false negative).by the same time HSG detected abnormalities in uterine cavity in 14(10%) patients out of those only 12(8.5%) were truly abnormal

(true positive). Sensitivity of HSG was (19.4%) specificity was (97.4%). Positive predictive value was (85.7%) and negative predictive value was (60.3%). False positive rate calculated was 2.6% and false negative rate 80.4% and the observed agreement between two was 62.9%. (Table 6a)

Table 6b: Uterine findings on HSG versus Hysteroscopy

Uterine Findings ON HSG	Hysteroscopy Uterine Findings				
	Normal	Intrauterine adhesion	Polyp	Uterine malformation (septate congenital abnormalities)	Total
Normal	76	15	11	7	109
Filling defect	2	1	5	0	8
Uterine malformation	0	0	0	6	6
TOTAL	78	16	16	13	123

* HSG not done in 17 patients with unilateral and bilateral blocked ostia

HSG and hysteroscopy both showed normal uterine finding in 76 patients whereas dissimilar findings found in 64 patients. Out of these 64 patients' comparison was not applicable for unilateral and bilateral blocked ostia (17 Patients) as they could not be analyzed on HSG. 93% of adhesions, 68% of polyps and 53.8% of uterine malformation missed on HSG. (Table 6b)

Table 7(a): Tubal status detected by HSG & Laparoscopy.

HSG tubal findings	Laparoscopy tubal patency			Total
	Bilateral tube blocked	Bilateral tube patent	Unilateral tube blocked	
Bilateral tube block	4(tp)	9(fp)	5(fp)	18
Bilateral tube patent	2(fn)	85(tn)	7(fn)	94
Unilateral tube blocked	1(fn)	12(fp)	15(tp)	28
Total	7	106	27	140

As shown in Table 7(a), HSG had detected patency in both the tubes correctly in 85 out of 140 patients (60.7%). Whereas Bilateral blocked tubes were identified

correctly in 4 patients in HSG by the same time HSG falsely diagnosed bilateral block in 9 patients and identified both tubes as blocked whereas only one of them was blocked in 5 patients and HSG also falsely diagnosed bilateral patency in 2 patient and unilateral patency in 8 patients.

Table 7(b): Comparison of tubal patency on HSG versus Laparoscopy

HSG tubal findings	Tubal patency on laparoscopy		
	Blocked (unilateral+ bilateral tube)	Patent (bilateral tube)	Total
Blocked (unilateral+ bilateral tube)	25	21	46
Patent (bilateral)	9	85	94
Total	34	106	140

Sensitivity of HSG for detection of tubal block (unilateral and bilateral) was 73.5% and the specificity achieved an 80.2% rate, while the positive predictive value stood at 54.4%, and the negative predictive value reached 90.4%. False positive rate was 19.8% and false negative rate 26.5% and the observed agreement between two was 78.6%. (Table 7(b))

As shown in Table 8, about 56 out of 140 patients (40%) undergone hysteroscopic intervention. Hysteroscopic cannulations, Adhesiolysis & Polypectomy were the most common procedure. Whereas septum resection done in (7.9%) of the patients.

Additional findings were observed in 62 out of 140 women (44.3%), Endometriosis was the most common finding and Pelvic adhesions were present in (8.5%) whereas Tubal abnormalities like TO mass, hydrosalpinx, fimbrial cyst and phimosis were present in 7% women. (Table 9)

In 62 patients' abnormal findings were found. For endometriosis, fulguration (17.9%) and endometriotic

cyst excision (6.4%) were done. Whereas Adhesiolysis was done in (7.1%), Salpingectomy was required in (2.1%) patients for damaged tube and Myolysis and myomectomy (2.8%) were done in same sitting Adhesiolysis was not done in two patients because of dense adhesions.

Table 8: Hysteroscopic intervention

Hysteroscopic Intervention	Frequency	Percent
Hysteroscopic cannulation	13	9.3%
Adhesiolysis	14	10%
Polypectomy	14	10%
Septum resection	11	7.9%
Polypectomy & Adhesiolysis	1	0.7%
Polypectomy & Hysteroscopic cannulation	1	0.7%
Hysteroscopic cannulation & Adhesiolysis	1	0.7%
Hysteroscopic cannulation & Septum resection	1	0.7%

Table: 9 Additional findings on laparoscopy

Additional Findings	No. of Patients	%
Pelvic Endometriosis	31	22.1%
Endometrioma	9	6.4%
Pelvic adhesion	12	8.5%
PCO	10	7.1%
Myoma	5	3.6%
Hydrosalpinx	3	2.1%
TO mass	2	1.4%
Fimbrial /parafimbrial cyst	2	1.4%
Fimbrial phimosis	2	1.4%
Accesory rt ovary	1	0.7%
Rudimentary rt uterine horn	1	0.7%

*Findings alone or in combination.

Table 10: Laparoscopic interventions

Laparoscopic intervention	No	%
Fulguration of endometriotic deposits	25	17.9
Ovarian drilling	10	7.1
Adhesiolysis	10	7.1
Endometriotic cyst excision	9	6.4
Salpingectomy	3	2.1
Myolysis	2	1.4
Myomectomy	2	1.4
TO mass excision	2	1.4
Fimbrial dilatation	2	1.4

*More than one procedure performed per patient.

Table 11: Successful intervention in establishing tubal patency

Interventions	Percentage of patients
Hysteroscopic cannulation (7/16)	43.7%
Laparoscopic fimbrial dilatations (1/2)	50%

Hysteroscopic cannulation was done in 16 patients (7 bilateral & 6 unilateral) out of which seven blocks could be successfully opened Laparoscopic fimbrial dilatation was successful in one patient (1/2). (Table 11)

Discussion

Infertility evaluation should be conducted in systemic, expeditious and cost-effective manner so as to identify all relevant factors with initial emphasis on least invasive method for detection of most common cause of infertility. The pace and scope of the assessment should consider factors such as the couple preferences, the age of the patient, the duration of infertility, and distinctive aspects of medical history and physical examination. HSG and laparoscopy are two classic methods for the evaluation of tubal pathology and are complimentary rather than mutually exclusive, each provides useful information that the other does not & each has

advantages and disadvantages. Whereas HSG is good screening procedure for uterine abnormalities, hysteroscopy is used for confirmation and treatment of either found on HSG or in those cases with normal HSG finding that has no improvement in fertility for at least six months.

The purpose of this study was to evaluate patterns of abnormalities detected on HSG in infertile women and to compare them with hysteroscopy and laparoscopy finding. All women were subjected to both HSG and Hyster laparoscopy with in four-month period. It has been said that fertility in the women peaks between as ages of 20-24 years and decreases relatively little until approx age of 30-32 years and then declines progressively the mean age of women in our study came out to be 29.2 ± 3.5 yrs with a mean duration of infertility of 2.7 ± 1.1 yrs. Women with primary and secondary infertility were included with as many as 72% having primary infertility.

Our study showed that HSG exhibited a sensitivity of 19.6%, while displaying a specificity of 97.4%. Additionally, it demonstrated a positive predictive value of 85.7% and a negative predictive value of 60.3%, it had false positive rate of 2.6% and false negative rate of 80.4% (table 6a). The agreement between two procedure was 62.9%. This was contrary to the finding by Snowden et al⁽⁷⁾ where a false positive rate of 31% and false negative rate of 1.3% was reported. Though similar results were demonstrated by La Sala et al⁽⁸⁾ with a low false positivity of 10% and high false negativity of 26%. In a recent study done by Vaid et al⁽⁹⁾ obtained false positive rate of 2.4% and false negative rate of 82.7% and agreement between two was 62.9%. Another study done by Taskin et al⁽¹⁰⁾ evaluated a diagnostic value of HSG for intracavitary and structural uterine pathology in comparison with hysteroscopy in patients undergoing

ICSI-embryo transfer, reported false positive rate of 16.2% and false negative rate of 78.4%. In our study, when examining tubal patency using both HSG and laparoscopy, the sensitivity of HSG in identifying either unilateral or bilateral blockages stood at 73.5%. The specificity was 80.2%, the positive predictive value was 54.4%, and the negative predictive value was 90.4%. The false positive rate was 19.8%, and the false negative rate was 26.5%. The level of agreement between the two methods was measured at 78.6%.

Snowden et al⁽⁷⁾ showed that HSG had false negative rate of 13% and false positive rate of 16% in the diagnosis of tuboperitoneal disease. In their respective studies, Otubu et al. (11) achieved a 9% false positive rate and an 8% false negative rate. Hourvitz et al. (12) documented a false positive rate of 12% and a false negative rate of 19%. Foroozanfard et al. (13) reported a false positive rate of 47% and a false negative rate of 22.2%. Furthermore, Vaid et al. (9) found that the sensitivity of HSG for detecting bilateral tubal block was 80.6%, with a specificity of 81.5%.

Conclusion

HSG is still a useful screening test for detection of tubal patency. Where as in our study we found that detection of uterine factor HSG lacks sensitivity, leading to the overlooking of numerous minor intrauterine lesions that could significantly contribute to reproductive issues, including adhesions, polyps, or submucous myomas. More over other pelvic abnormalities which may be the cause of infertility such as endometriosis, adhesions, tuberculosis may not be detected by HSG. Laparoscopy combined with hysteroscopy is a valuable method in the diagnosis and treatment of female infertility. Under one anesthesia they can examine the pelvis and uterine cavity directly and accurately, determine the cause of infertility, then treatment, and most important thing is that it can

markedly increase the rate of pregnancy. HSG, being a less expensive could be used as screening tool, but Hyster laparoscopy should be recommended for all infertile women early enough to aid with the decision for assist reproduction when the women is young and will benefit from the treatment.

References

1. Practice Committee of the American Society for Reproductive Medicine, Definition of Infertility and Recurrent Pregnancy Loss. *Fertil Steril* 2008; 90 (Supp15): S60.
2. Rice JP, London SN, Olive DL. Re-evaluation of hysterosalpingography in infertility investigation. *Obstet Gynaecol* 1986; 67(5):718-21.
3. Luttjeboer F, Harada T, Hughes E, Johnson N, Lilford R, Mol BW. Tubal flushing for subfertility. *Cochrane Database Syst Rev* 2007 ; CD 003718.
4. Prevedourakis C, Loutradis D, Kalianidis C et al. Hysterosalpingography and hysteroscopy in female infertility. *Hum Reprod* 1994;(9): 53-55.
5. Wang CW, Lee CL, Lai M et al. Comparison of hysterosalpingography and hysteroscopy in female infertility. *J Am Assoc Gynecol Laparosc.* 1996;(3):581-84.
6. Speroff L, Fritz MA. Clinical gynaecologic endocrinology and infertility. 8th ed. Philadelphia: Lippincott Williams and Wilkins; 2005. Chapter 27, Female Infertility; p.1137-90
7. Snowden EU, Jasset JC, Dawood MY. Comparison of diagnostic accuracy of laparoscopy, hysteroscopy and hysterosalpingography in evaluation of female infertility. *Fertile Steril* 1984; 41 (5) : 709 – 13.
8. La Sala GB, Sacchetti F, Degl'incerti-Tocci F, Dessanti L, Torelli MG. Complementary use of hysterosalpingography hysteroscopy and laparoscopy in 100 infertile patients: Results and comparison of their diagnostic accuracy. *Acta Eur Fertil* 1987; 18 (6) : 369 –
9. Vaid K, Mehra S, Verma M, Jain S, Sharma A, Bhaskaran S. Pan Endoscopic Approach “Hysterolaparoscopy” as an Initial Procedure in Selected Infertile Women. *J Clin Diagn Res.* 2014 Feb; 8(2): 95–98.
10. Taskin EA, Berker B, Ozmen B, et al. Comparison of hysterosalpingography and hysteroscopy in the evaluation of the uterine cavity in patients undergoing assisted reproductive technique. *Fertil Steril* 2011; 96 (2) : 39–52.
11. Otubu J A, Saqay AS, Dauda S, et al. Hysterosalpingogram, laparoscopy and hysteroscopy in the assessment of the infertile Nigerian female. *East Afr Med J* 1990; 67 (5) : 370 – 72.
12. Hourvitz A, Ledee N, Gervaise, Fernandez H, Frydman R, Olivennes F. Should diagnostic hysteroscopy be a routine prodedure during diagnostic laparoscopy in women with normal hysterosalpingography? *Reprod Biomed Online* 2002; 4 (3): 256 – 60.
13. Foroozanfard F, Sadat Z. Diagnostic Value of Hysterosalpingography and Laparoscopy for Tubal Patency in Infertile Women. *Nurs Midwifery Stud.* 2013;2(2):188-92.