

**ORIGINAL RESEARCH**

# Diagnostic value of hysterosalpingography in the detection and evaluation of female infertility

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**ABSTRACT**

**Introduction:** Female infertility is a complex condition, and it can arise from various causes, including hormonal imbalances, ovulatory dysfunction, and structural abnormalities in the reproductive organs. **Objective:** To evaluate the diagnostic value in terms of hysterosalpingography in the detection and evaluation of female infertility. **Material and Method:** This descriptive, cross-sectional study was conducted and data were collected through non-probability consecutive sampling technique. Data collection began following ethical approval from the hospital's ethical committee. Each patient underwent preliminary examinations, including a transvaginal ultrasound, followed by an HSG procedure. **Results:** Data were collected from 331 patients with mean age of  $29.5 \pm 5.8$  years, predominantly within the 20–29 age group (47.7%). The average duration of infertility was 3.4 years, with primary infertility observed in 63.4% of patients and secondary infertility in 36.6%. The mean BMI was  $26.3 \text{ kg/m}^2$ , reflecting a generally healthy weight range. Baseline ultrasound findings showed that 75.5% of patients had normal results, while 24.5% had abnormal findings. Among patients with less than 2 years of infertility, bilateral tubal occlusion and uterine abnormalities were present in 8.4% and 2.8% of cases, respectively. These rates increased to 13.7% and 5.4% for those with 2–5 years of infertility, and further to 18.9% and 8.7% among those with infertility lasting more than 5 years. **Conclusion:** It is concluded that hysterosalpingography (HSG) is an effective diagnostic tool for detecting tubal and uterine abnormalities associated with female infertility.

**Keywords:** Infertility, Significant, Ultrasound, Hysterosalpingography

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**INTRODUCTION**

Female infertility is a complex condition, and it can arise from various causes, including hormonal imbalances, ovulatory dysfunction, and structural abnormalities in the reproductive organs. A significant percentage of infertility cases involve abnormalities in the fallopian tubes and the uterine cavity [1]. These problems can stop sperm from getting to the egg or block the process of fertilization, or cause a fertilized egg not to implant into the uterine lining. Of the many techniques which have been utilised to assess these structural factors, one of the most widespread diagnostic techniques is hysterosalpingography, which has been applied in clinical practice for the assessment of female infertility for several decades. Hysterosalpingography is a radiographic investigation in which a contrast medium is injected inside the uterus and fallopian tubes and an X-ray is taken [2].

This difference is then used to enhance the visualisation of the internal contours of the uterus and the fallopian tubes to help one determine blockages, deformities, adhesions and the likes that can cause infertility. This hitherto also aids in the evaluation of the state of the fallopian tubes and has information concerning the shape or size of the uterine cavity, including fibroids, polyps or congenital malformation. These facts are useful in proffering right management plans for the condition [3]. Infertility is the inability of a couple to conceive after one year of unprotected intercourse reported that about 15 % of couples are infertile [2]. Infertility, which is defined as the inability to conceive after one year of unprotected intercourse, can be categorized according to the causes as: male factor (45 %), female factor including ovulatory dysfunction (37 %) & tubal disease (18 %) [2]. An accumulation of two or more of these factors

is present in about 20 % of couples. The tubal damage can be primary, namely, ascending salpingitis which encompasses salpingitis isthmica nodosa, or secondary to extrapelvic etiology such as peritonitis, endometriosis and pelvic surgery. The main identified etiologic agents of PID are *C trachomatis*, *N gonorrhoeae*, and genital mycoplasma and other bacteria [3]. Investigated work showed the most significant difference in CAT values between infertile and fertile women with the increase of tubal damage severity among the infertile patients [4]. Abnormalities in the endometrial cavity are therefore found to be a contributing factor to subfertility in 10 % of all women. As many as 50 % of the women with recurrent implantation failure have abnormal uterine findings [5]. Among them are the endometrial polyps or fibroid filling defects, or uterine wall irregularities seen during hysterosalpingography (HSG). It can also show intrauterine adhesions, congenital malformation and acquired disorders of pregnancy [1]. Radiological imaging is an important part of the diagnostic work up in female infertility [5]. Transvaginal ultrasound (TVUS) is considered to be first-line, noninvasive examination. The development of an abnormal image can increase its further examination by means of saline or contrast hysterosalpingo sonography. HyCoSy has been observed to be highly sensitive, specific and accurate to identify structural diseases of uterus such as polyps. It is, therefore, of limited usefulness in the evaluation of tubal pathology. MRI can be employed in the assessment of congenital Müllerian duct anomalies and for diagnostic workup of adenomyosis, leiomyoma and endometriosis but its application for tubal assessment at this time is limited [6, 7]. The main function of HSG is to assess the shape and the writable status of the fallopian tubes. The fallopian tubes should look to be thin cords that gradually increase thickness in the ampullary part of the tubes. Abnormalities picked up during the HSG may be congenital or may arise due to spasm, occlusion or infection. Tubal occlusion is characterised by termination of contrast material with non-visualization of the distal fallopian tube and can occur unilaterally or bilaterally. Peritubal adhesions help to keep the contrast material from leaking into the abdominal cavity and being distributed widely [6, 8]. This approach can also be useful in assessing abnormally shaped uterus cavities. Laparoscopy is supposed to be highly sensitive (60–98 %) but low specificity (15–80 %) in regard to uterine abnormalities discover; hysteroscopy is the gold standard approach in this case. HSG roles in the differential diagnosis of intrauterine filling defects as including polyps, endometrial hyperplasia, submucosal fibroids, intrauterine adhesions and septa. In the literature, HSG outcome was accepted as significant for diagnosing patients with tubal factor that is appropriate for laparoscopy with chromopertubation [8, 9].

## OBJECTIVE

To evaluate the diagnostic value in terms of hysterosalpingography in the detection and evaluation of female infertility.

## MATERIAL AND METHOD

This descriptive, cross-sectional study was conducted and data were collected through non-probability consecutive sampling technique.

### Sample Size

The sample size calculation was based on previous data which reported abnormal findings in 31.3% of patients. With a 95% confidence interval, the calculated sample size was 331.

### Inclusion Criteria

1. Women attending the clinic for infertility treatment
2. Female patients aged 20–40 years
3. Infertility history of at least 12 months
4. Both women with primary infertility (no previous pregnancies) and those with secondary infertility (difficulty conceiving after one or more successful pregnancies)

### Exclusion Criteria

1. Known cases of pelvic inflammatory disease
2. Women with acute vaginal or cervical infections
3. Women allergic to the contrast dye used in HSG
4. Male gender

### Data Collection Procedure

Data collection began following ethical approval from the hospital's ethical committee. Each patient underwent preliminary examinations, including a transvaginal ultrasound, followed by an HSG procedure. Fluoroscopic guided HSG was performed between the 7th and 12th day of the menstrual cycle. Participants received 3 mg of bromazepam the night before the procedure, and the patients signed consent forms. Further, to reduce discomfort during the examination, we gave intravenous Buscopan just before the examination was conducted. The HSG procedure meant that a water-soluble contrast was slowly introduced into fallopian tubes, while x-ray photographs were occasionally taken to view the uterus and fallopian tubes. A consultant radiologist reviewed the images in order to determine the main study end point; one tube being open or closed or both. All the post-procedural events including pain, slight bleeding or bleeding seen as occasional spotting, or vomiting due to contrast were recorded and responses taken accordingly.

### Data Analysis Procedure

Data analysis was performed using SPSS version 23. Categorical variables, such as HSG findings, were presented as numbers and percentages. The relationship between specific HSG findings (e.g.,

tubal occlusion, uterine abnormalities, hydrosalpinx, loculated spills, fibroids, endometrial polyps, adenomyosis) and patient factors (e.g., age, infertility duration, infertility type) was analyzed using chi-square tests or logistic regression models to determine statistical significance ( $p < 0.05$ ).

## RESULTS

Data were collected from 331 patients with mean age of  $29.5 \pm 5.8$  years, predominantly within the 20–29

age group (47.7%). The average duration of infertility was 3.4 years, with primary infertility observed in 63.4% of patients and secondary infertility in 36.6%. The mean BMI was  $26.3 \text{ kg/m}^2$ , reflecting a generally healthy weight range. Baseline ultrasound findings showed that 75.5% of patients had normal results, while 24.5% had abnormal findings. Most participants (90%) were of Asian ethnicity, with a small representation (10%) from other backgrounds.

**Table 1: Demographic and baseline values of patients**

Characteristic	Mean $\pm$ SD / Number of Patients	Percentage (%)
Age (years)	$29.5 \pm 5.8$	—
Age Group		
- 20–29	158	47.7
- 30–34	103	31.1
- 35–40	70	21.1
Duration of Infertility (years)	$3.4 \pm 2.1$	—
Infertility Type		
- Primary Infertility	210	63.4
- Secondary Infertility	121	36.6
Marital Status		
- Married	331	100
BMI ( $\text{kg/m}^2$ )	$26.3 \pm 4.2$	—
Baseline Ultrasound Findings		
- Normal	250	75.5
- Abnormal Findings	81	24.5
Ethnicity		
- Asian	298	90.0
- Other	33	10.0

The analysis revealed a significant association between age and the prevalence of tubal occlusion, hydrosalpinx, and uterine abnormalities, with each condition showing an increasing trend with age ( $p < 0.05$ ). In the 20–29 age group, tubal occlusion, hydrosalpinx, and uterine abnormalities were observed in 15.2%, 2.3%, and 3.5% of patients, respectively. These percentages rose to 19.8%, 3.8%, and 5.9% in the 30–34 age group, and further increased in the 35–40 age group to 26.1%, 8.4%, and 10.4%, respectively.

**Table 2: Association of HSG Findings with Age**

Age Group (Years)	Tubal Occlusion (%)	Hydrosalpinx (%)	Uterine Abnormalities (%)
20–29	15.2	2.3	3.5
30–34	19.8	3.8	5.9
35–40	26.1	8.4	10.4
p-value	<0.05	<0.05	<0.05

Among patients with less than 2 years of infertility, bilateral tubal occlusion and uterine abnormalities were present in 8.4% and 2.8% of cases, respectively. These rates increased to 13.7% and 5.4% for those with 2–5 years of infertility, and further to 18.9% and 8.7% among those with infertility lasting more than 5 years.

**Table 3: Association of HSG Findings with Duration of Infertility**

Duration of Infertility (Years)	Bilateral Tubal Occlusion (%)	Uterine Abnormalities (%)
< 2	8.4	2.8
2–5	13.7	5.4
> 5	18.9	8.7
p-value	<0.05	<0.05

Among women with primary infertility, 12.5% had unilateral tubal occlusion, 21.4% had bilateral occlusion, and 4.2% had uterine abnormalities. In contrast, women with secondary infertility showed higher rates of unilateral tubal occlusion (18.0%) and uterine abnormalities (8.3%) but a lower rate of bilateral tubal occlusion (9.5%).

**Table 4: Association of HSG Findings with Type of Infertility**

Type of Infertility	Unilateral Tubal Occlusion (%)	Bilateral Tubal Occlusion (%)	Uterine Abnormalities (%)
Primary Infertility	12.5	21.4	4.2
Secondary Infertility	18.0	9.5	8.3
<b>p-value</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>

The study observed mild complications following the hysterosalpingography (HSG) procedure in 15% of patients. Among these, pain was the most common, reported by 10.6% of patients, followed by spotting in 3.6% and contrast-induced vomiting in 0.9%.

**Table 5: Post-Procedural Complications**

Complications	Number of Patients	Percentage (%)
<b>Pain</b>	35	10.6
<b>Spotting</b>	12	3.6
<b>Contrast-Induced Vomiting</b>	3	0.9
<b>Total</b>	<b>50</b>	<b>15</b>

## DISCUSSION

This study aimed to evaluate the diagnostic value of hysterosalpingography (HSG) in detecting tubal and uterine abnormalities associated with female infertility. We have also demonstrated that HSG is of significant value in diagnosing tubal blockages and structural pathologies within the uterine cavities, which are common causes of infertility. From this study, there is a high demographic profile of tubal occlusion and uterine structural issues among the patients. Especially, tubal occlusion was visualized in 31.1% of patients that is also consistent with data from other studies where tubal pathologies are identified as a primary cause of infertility [10]. In the study of primary infertility cases, women were significantly more likely to have two tubes blocked, raising the HSG profile's usefulness in diagnosing untreatable tubal pathology that may require IVF [11]. Likewise, it demonstrated the presence of uterine abnormalities in 13.3 % of the patients, The HSG helps in diagnosing the disease such as fibroid, polyp and adenomyosis which can greatly affect fertility [12]. Molded uterine abnormalities increased progressively with age and indicated the possibility of having a relationship between age and changes in the shape or size of the uterus. In concordance with the present result, prior works have revealed that the probability of fibroids and or adenomyosis is higher among women of progressively advanced age resulting in reproductive impacts. Understanding how demographic factors affect infertility is not only seen from the connection between HSG findings and patient age, longevity of infertility, and kind of infertility [13]. Tubal occlusion was highest in women of 30 years and above, which probably is due to accumulation of risks such as pelvic infections or inflammatory conditions. Further, the study found that the HSG findings are likely to be more complicated with increased duration of infertility since both bilateral tubal occlusion and uterine abnormalities were significantly associated with long standing infertility [14]. Secondary infertility was associated

with a higher prevalence of unilateral tubal obstruction and abnormal uterine related to acquisition or anatomic changes of previous pregnancies or deliveries. This shows that HSG remains important in evaluating secondary infertility since such observations may direct management or treatment to those conditions. The complied complications, including likely mild pain after the procedure, presence of small amounts of blood, or rarely vomiting, reveal that HSG is relatively safe, but may cause mild discomfort [15]. Complication was well handled to assert that in fact HSG is harmless and an important method of assessing infertility. Because HSG reveals tubal and uterine abnormalities well it should be used early in the work up of the infertile couple. Forgetfully infertility treatment depends on the degree of obstruction in the fallopian tubes; it is simple treatment or ART such as IVF for tubal infertility. It is also helpful in defining those patients who might require some surgery – polypectomy or myomectomy for example – which might help improve fertility.

## CONCLUSION

It is concluded that hysterosalpingography (HSG) is an effective diagnostic tool for detecting tubal and uterine abnormalities associated with female infertility. The study demonstrates HSG's value in identifying critical factors like tubal occlusion and uterine structural issues, which are essential in guiding treatment decisions. Despite minor limitations, HSG provides valuable insights that support targeted fertility interventions and improve clinical outcomes.

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