

# A Study Evaluation of Tubal Factors of Infertility by Hysterosalpingography and Diagnostic Laparoscopy

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## Abstract

**Background:** Reproductive endocrinologist, consider a couple to be infertile if the couple has not conceived after 12 months of contraceptive free intercourse if the female is under the age of 34 years. The incidence of infertility in any community varies between 10-15 %. Tubal occlusion is one of the most frequent causes of infertility in women (20-40 %). The evaluation of the fallopian tube is necessary to determine the management plan for infertility. The two most diagnostic procedures which are used for the evaluation of tubal patency are hysterosalpingography and laparoscopy<sup>1</sup>. **Aims of this study were:** To study the validity of hysterosalpingography, in detecting tubal factors in infertility, as compared to diagnostic laparoscopy. **Material and Method:** This descriptive study was conducted in the Department of Obstetrics and Gynecology in a tertiary health care center attached to a Medical College. A total number of 114 primary as well as secondary infertility patients were evaluated for tubal factors of infertility. All the infertility cases underwent HSG on day 8<sup>th</sup>, 9<sup>th</sup> and 10<sup>th</sup> day of the menstrual cycles. Laparoscopic chromopertubation was done during proliferative phase of the next menstrual cycle. Statistical analysis was done using statistical package for social sciences ver.18. The result was expressed in mean and standard deviation. "Z" test for the difference between the two means were used. For qualitative data proportion and "Chi" test were used. For assessing the validity of HSG in diagnosing in tubal factors of infertility laparoscopy was used as a gold standard. For the purpose of this study, 95% confidence limit was chosen and corresponding p-value <0.05 was taken as statistically significant. **Conclusion:** In our study we found that Hysterosalpingography is simple, inexpensive, safe and rapid diagnostic modality for tubal patency then laparoscopy. Laparoscopy is considered the Gold Standard for diagnosing tubal and peritoneal disease. HSG and Laparoscopy are not alternative, but complimentary methods in the examination of tubal patency in case of infertility.

**Keywords:** Hysterosalpingography, Laparoscopy, Tubal Factors

## 1. Introduction

The incidence of infertility in any community varies between 10-15 %.

Reproductive endocrinologist, consider a couple to be infertile if;

1. The couple has not conceived after 12 months of contraceptive free intercourse if the female is under

the age of 34 years. 12 months is the lower reference limit.

2. The couple has not conceived after 6 months contraceptive free intercourse if the female is over the age of 34 years<sup>1,2</sup>

The major causes of infertility include;

1. Male factors (20-30 %)

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2. Female factors (40-55 %)
3. Both male and female factors (10-40 %)
4. Unexplained infertility (10-20 %)<sup>3</sup>

Infertility is classified into two types:

1. Primary infertility in which no previous pregnancies have occurred.
2. Secondary infertility in which a prior pregnancy, although not necessarily a live birth has occurred.

The important causes of female infertility are:

1. Tubal factors (20-40 %)
2. Ovulatory dysfunction (20-40 %)
3. Miscellaneous causes (10-15 %)<sup>4</sup>

Tubal factors account for (20-40 %) of infertility. The mechanism responsible for tubal factor infertility involves anatomic abnormalities that prevent the union of sperm and ovum. Proximal tubal obstructions prevents sperm from reaching the distal fallopian tube where fertilization normally occurs. Distal tubal occlusions prevent ovum capture from the adjacent ovary whereas the proximal tubal obstruction is an all or none phenomenon.

Laparoscopy has emerged in recent years as an accurate method of assessing, evaluating and testing infertility. Direct visualization of the abdominal and pelvic organs in laparoscopy allow a definitive diagnosis to be made in many conditions where clinical examination and less invasive procedures such as HSG fail to identify the problem.

Hence this study was done to evaluate the tubal factors in an infertile patient by HSG and Laparoscopy.

## 2. Aims of this Study were

- To study the validity of hysterosalpingography, in detecting tubal factors in infertility, as compared to diagnostic laparoscopy.

## 3. Materials and Methods

In the present study 114 infertile patients were studied who presented themselves with either primary or secondary infertility during a period from August 2012 to December 2014. Detailed history, examination, required investigations for both the partners was taken. All

patients were subjected to Hysterosalpingography and Diagnostic Laparoscopy. Diagnostic laparoscopy with chromopertubation was carried out postmenstrually during proliferative phase of the next menstrual cycle.

### Inclusion criteria:

1. All cases of infertility undergoing hysterosalpingography and diagnostic laparoscopy both.

### Exclusion criteria:

1. Any contraindications to Hysterosalpingography procedure like:-
  - a. Acute lower genital infection.
  - b. Genital Koch's.
  - c. Abnormal uterine bleeding.
  - d. Suspected pregnancy.
2. Any contraindications to Diagnostic Laparoscopy procedure like Severe Cardiopulmonary Disease, Generalized Peritonitis, Intestinal Obstruction, Anti Coagulation Therapy etc

A complete history of couple was taken. General physical examination and systemic examination was done.

### 3.1 HSG Procedure

All HSG were done on outpatient basis. HSG appointment was given on postmenstrual dates. (8 to 10<sup>th</sup> day). Inj. Atropine 0.6 mg. i.m. was given ½ hour before actual procedure as premedication. Aseptic precautions were observed in all stages of the procedure. Bladder was emptied. Patient was put in a lithotomy position and the part was painted and draped. With the help of Sims speculum, and anterior vaginal wall retractor, cervix was visualised and held in position with a vulsellum forceps. A 20 cc syringe filled with the dye Urografin 60%, (Diatrizoate Meglumine and Diatrizoate Sodium injection USP) was attached to Leech Wilkinson's cannula. Leech Wilkinson's cannula filled with the dye was threaded along the cervical canal till the tip was just beyond the internal os. Tenaculum was attached to the anterior lip of the cervix and vulsellum forceps was removed. Sims speculum removed. Keeping cannula and syringe in place, patient was given dorsal position and initially 2cc of dye was injected under fluoroscopy image intensifier. The initial x-ray was taken after injecting 2-3 cc of dye. The second film was taken after injecting 5-7 cc of dye, only after tubal filling confirmed on image intensifier. After the

procedure patient was followed for 2 hours for immediate complications<sup>5</sup>.

### 3.2 Diagnostic Laparoscopy Procedure

All patients were admitted for the laparoscopic examination during proliferative phase of the menstrual cycle. Preoperative management and anesthesia fitness was taken. Patients were kept NBM for at least 12 hours. Written informed consent was taken. Inj. Atropine 0.6 mg i.m. ½ hr. before laparoscopy. General anaesthesia was given to all of the cases. Lithotomy position was given. Painting and draping of the abdomen and genital region was performed with betadine and spirit. Sims speculum inserted. Anterior cervical lip was held with vulsellum. The Leech Wilkinson's cannula was threaded through the external os and the cervix now was held with the tenaculum forceps. Through a small transverse incision at the lower margin of the umbilicus, the Veres needle was passed into the abdominal cavity. After confirming the proper placement of the needle, pneumoperitoneum was created by connecting the needle to a tube which permitted CO<sub>2</sub>. 1-2 litre of the gas was introduced so as to obliterate liver dullness. The trocar and cannula was inserted by directing the trocar towards the centre of the pelvis at an angle of 45 degrees. Once in the peritoneal

cavity, the trocar was removed from the cannula and replaced by Karl Storz laparoscope. Double puncture was undertaken for visualizing the under surface of the ovaries or tubes and pouch of Douglas. Trendelenberg position was given which allowed the intestinal loops to fall away from the anterior abdominal wall. The uterus, both tubes along the whole length with fimbriae, both ovaries and the peritoneal cavity were examined serially for any pathology. Diluted methylene dye was used for chromoperturbation to determine tubal patency, if the diluted dye was seen in the tubes and definitive spill was observed from the fimbrial ends of the tubes, the tubes were considered patent. The cannula was removed after the air in peritoneal cavity was removed. The incision was sutured with a single mattress suture with ethilon 2-0 reverse cutting. Postoperative management was done with antibiotics and IV fluids and analgesic. Analgesics were given when required<sup>6</sup>. Results: A descriptive clinical study consisting of 114 infertility

**Table 1.** Distribution of cases according to type of infertility

Infertility	N	%
Primary	67	58.8%
Secondary	47	41.2%
Total	114	100.0%

**Table 2.** Age wise distribution of primary and secondary infertility cases

Age Group	Infertility		Total
	Primary N (%)	Secondary N (%)	
20-25	15 (22.39%)	1 (2.13%)	16 (14.04%)
26-30	43 (64.18%)	20 (42.55%)	63 (55.26%)
>31	9 (13.43%)	26 (55.31%)	35 (30.70%)
Total	67 (100.00%)	47 (100.00%)	114 (100.00%)

p-value < 0.05

**Table 3.** Mean age, duration and married life of primary and secondary infertility patients

Variables	Infertility	N	Mean	SD	Unpaired t
Age (years)	Primary	67	27.4	2.4	t=7.63 p<0.001
	Secondary	47	31.7	3.3	
Duration of infertility (years)	Primary	67	4.5	1.8	t=3.32 p<0.01
	Secondary	47	5.6	1.7	
Married life (years)	Primary	61	4.6	1.7	t=14.22 p<0.001
	Secondary	47	8.6	2.3	

patient's consisting of primary and secondary infertility is undertaken in evaluation of tubal factors of infertility by Hysterosalpingography and Diagnostic Laparoscopy.

Of all the 114 cases investigated 63 (55.26%) of the cases were in the age group of 26-30 years. Out of all 67 primary infertility cases most of the cases were from the age group

of 26-30 years i.e. 43 cases (64.18%). While out of all 47 secondary infertility cases most of the cases were from the age group of 31 years or more that is 26 (55.31%) (Table 2, 3).

In this study sensitivity of HSG in detecting tubal factors of infertility was found to be 63.64%, and specificity to be 82.86%. In this study the Positive Predictive Value

**Table 4.** Fallopian tube patency on HSG

Fallopian Tubes - HSG	Infertility		Total	
	Primary	Secondary		
Patent	56 (83.58%)	24 (51.06%)	80 (70.18%)	$\chi^2= 13.96,$ df = 1, p < 0.05
Blocked	11 (16.42%)	23 (48.94%)	34 (29.82%)	

**Table 5.** Tubal factors detected on HSG

HSG - Fallopian Tubes	Infertility		Total	p-value
	Primary	Secondary		
Tubal Block – Right Cornu	8 (11.94%)	6 (12.77%)	14 (12.28%)	0.89
Tubal Block - Left Cornu	8 (11.94%)	7 (14.89%)	15 (13.16%)	0.65
Tubal Block - Right Mid Segment	0 (0.00%)	4 (8.51%)	4 (3.51%)	< 0.05
Tubal Block - Left Mid Segment	1 (1.49%)	2 (4.26%)	3 (2.63%)	0.32
Tubal Block - Right Terminal	1 (1.49%)	5 (10.64%)	6 (5.26%)	< 0.05
Tubal Block - Left Terminal	1 (1.49%)	6 (12.77%)	7 (6.14%)	< 0.05
Beaded Appearance	1 (1.49%)	3 (6.38%)	4 (3.51%)	0.18
Abnormal Finding	6 (8.96%)	3 (6.38%)	9 (7.89%)	0.44

**Table 6.** Detection of Tubal Patency on Laparoscopy

Fallopian Tubes	Infertility		Total	
	Primary	Secondary		
Patent	56 (83.58%)	25 (53.19%)	81 (71.05%)	$\chi^2= 12.40,$ df = 1, p = 0.0004
Blocked	11 (16.42%)	22 (46.81%)	33 (28.95%)	

**Table 7.** Distribution of abnormal Tubal factors of infertility by Laparoscopy

Laparoscopic Findings - Fallopian Tubes	Infertility		Total	p-value
	Primary N-67 n(%)	Secondary N-47 n(%)		
Abnormal Size	15 (22.39%)	29 (61.70%)	44 (38.60%)	< 0.05
Hydrosalpinx	4 (5.97%)	8 (17.02%)	12 (10.53%)	0.06
T-O Mass	3 (4.48%)	3 (6.38%)	6 (5.26%)	0.65
U/L Patent	5 (7.46%)	14 (29.79%)	19 (16.67%)	< 0.05
B/L Patent	56 (83.58%)	25 (53.19%)	81 (71.05%)	< 0.05
B/L Blocked	5 (7.46%)	8 (17.02%)	13 (11.40%)	0.11
Tubo-Peritoneal Factors (Tb - 2 cases each)	4 (5.97%)	9 (19.15%)	13 (11.40%)	< 0.05

**Table 8 A.** Validity of HSG in Diagnosing Tubal Factors of Infertility

HSG - Fallopian Tubes	Laparoscopy - Fallopian Tubes		Total
	Abnormal	Normal	
Abnormal	28 (63.64%)	12 (17.14%)	40 (35.09%)
Normal	16 (36.36%)	58 (82.86%)	74 (64.91%)
Total	44 (100.00%)	70 (100.00%)	114 (100.00%)

**Table 8 B.** Validity of HSG in Diagnosing Tubal Factors of Infertility

Sensitivity	63.64%
Specificity	82.86%
PPV	70.00%
NPV	78.38%
Accuracy	75.43%

Principal author	Year	Sample size	Type of infertility	
			Primary	Secondary
GokhanGoynumer et al. <sup>7</sup>	2008	100	69.00%	31.00%
FatemehForoozanfard et al. <sup>8</sup>	2013	62	69.30%	30.70%
Neerja,JainKuldeep. <sup>9</sup>	2011	200	75.00%	25.00%
M Heis et al. <sup>10</sup>	2011	281	42.30%	57.60%
In this study	2014	114	58.80%	41.20%

of HSG was found to be 70.00%, and Negative Predictive Value to be 78.38%. In our study the accuracy of HSG in detecting tubal factors of infertility was 75.43%.

## 4. Discussion

In this study 114 cases of primary and secondary infertility were studied at a Medical College and Research Centre.

### 4.1 Type of Infertility

In our study of 114 infertility patients; 67 (58.80%) were of Primary infertility while 47 (41.20%) cases were of secondary (Table 1).

Similar study conducted by various authors; had following findings which were comparable with the present study.

In most of these studies the occurrence of primary infertility was more than the occurrence of secondary infertility. This finding was similar to our study.

### 4.2 Age Distribution

In this study out of all the 114 cases investigated 63 (55.26%) of the cases were in the age group of 26-30 years. In this study mean age for primary infertility was found to be  $27.4 \pm 2.4$  years. Similarly the mean age for secondary infertility was found to be  $31.7 \pm 3.3$  years. The mean duration of infertility for a primary infertility patient in this study was  $4.5 \pm 1.8$  years and that of secondary infertility was  $5.6 \pm 1.7$  years. The average married life of a primary infertility patient was  $4.6 \pm 1.7$  years and that of secondary infertility was  $8.6 \pm 2.3$  years. In similar study conducted by Foroozanfard F et al.<sup>8</sup> the average age in subjects of primary infertility was 26.25 years and in subjects of secondary infertility was 29.73 years. Mean duration of primary infertility was  $5.79 \pm 3.19$  years and for secondary infertility was  $5.97 \pm 3.36$  years. Maximum number of cases had duration of infertility between 1 to 4 years. In a similar study conducted by M Heis et al.<sup>10</sup>, overall the mean age (SD) was 31.5 (5.9) years, with maximum occurrence in 18-46 years. Mean (SD) duration of infertility was 4 (3.4) years. In a similar study conducted

by Ben W.J. Mol et al.<sup>11</sup> mean age was 29.6 years and mean duration of infertility was 3.5 years.

### 4.3 HSG Findings

In our present study, out of 46 (40.35%) cases with tubal abnormality 34 (29.82%) had either unilateral or bilateral tubal blocks detected on HSG (Table 4). Out of 34 (29.82%); 23 (48.94%) cases of tubal blocks were from secondary infertility and 11 (16.42%) were from primary infertility suggesting that more tubal blocks were from secondary infertility which was found to be significant in our study with “p” value less than 0.05. In a similar study conducted by Foroozanfard et al.<sup>8</sup> found that 35 (56.5%) had bilateral tubal patency, 7(11.3%) had unilateral tubal patency, 3 (4.8%) had bilateral tubal patency. In a similar study conducted by RafetDuraker et al.<sup>12</sup> found 38.80% of cases with unilateral tubal occlusion and 58.80% of the cases with bilateral tubal occlusion. Also in a similar study conducted by Ben W.J. Mol et al.<sup>11</sup> found that 57.00% of the cases had bilateral tubal patency, 9.00% of the cases had unilateral tubal patency 10.00% of the cases had bilateral tubal blocks.

Both false- negative and false positive results occur, the former being much more common than the latter. Injection of contrast may cause “cornual spasm” (uterine contraction that may transiently close the interstitial segment and prevent distal perfusion) that can be misinterpreted as proximal tubal occlusion. HSG may reveal unilateral patency and contralateral proximal occlusion<sup>13</sup>.

### 4.4 Laparoscopic Findings

#### 4.4.1 Tubal Factors of Infertility on Laparoscopy

Diagnostic laparoscopy in our study detected 33 (28.95%) cases with either unilateral or bilateral tubal pathology. Out of which 11 (16.42%) cases were from primary infertility and 22 (46.81%) were from secondary infertility.

In our study tubal abnormalities detected by laparoscopy 12 (10.53%) had hydrosalpinx, 6 (5.26%) had TO mass, 19 (16.67%) had unilateral tubal patency, 13 (11.40%) had bilateral tubal block, 81 (71.05%) had bilateral patency and 13 (11.40%) had tuboperitoneal factors (Table 5). In a similar study conducted by Foroozanfard et al.<sup>8</sup> Laparoscopy showed bilateral tubal patency in 72.6% and unilateral or bilateral tubal patency in 27.40% (Table 6). In a similar study conducted by M Heis et al.<sup>10</sup> found that 6.04% had bilateral tubal occlusion and 5.69% had unilateral tubal occlusion whose findings

were different from ours. Also In a similar study conducted by Ben W J Molet al.<sup>11</sup> showed 12.00% had one sided tubal occlusion and 12.00% also with two sided tubal occlusion had different findings (Table -7).

### 4.5 Validity of HSG in Detecting Tubal Factors of Infertility taking Laparoscopy as Gold Standard

In this study 58 cases had normal tubal findings on HSG and Laparoscopy. 16 cases had normal HSG findings but abnormal Tubal findings on Laparoscopy. 28 cases had abnormal tubal findings on HSG as well as on Laparoscopy. On diagnostic Laparoscopy 12 cases had normal tubal findings but showed abnormality on HSG (Table 8 A, 8 B).

In this study sensitivity of HSG in detecting tubal factors of infertility was found to be 63.64%, and specificity to be 82.86%. The Positive Predictive Value of HSG was found to be 70.00%, and Negative Predictive Value to be 78.38%.

The possible reason for the difference in results might be due to tubal spasms and endometrial polyp in the area of uterine opening of the tubes, also anatomic variations in the tubes. There might be limitations to this study due to interpretation and ability of the radiologist involved.

## 5. Conclusion

Hysterosalpingography is simple, inexpensive, safe and rapid diagnostic modality for tubal patency than laparoscopy.

Laparoscopy is considered the Gold Standard for diagnosing tubal and peritoneal disease. It provides both panoramic view of the pelvic reproductive anatomy and a magnified view of the uterine, ovarian, tubal and peritoneal surfaces. Consequently, it can identify milder degree of distal tubal occlusive disease, pelvic, peritubal, adhesions and endometriosis that adversely affect fertility, which cannot be diagnosed on HSG. Most importantly

Principal Author	year	HSG	
		Sensitivity	Specificity
Broeze KA et al. <sup>14</sup>	2011	53.00%	87.00%
Robabeh et al. <sup>15</sup>	2012	92.00%	70.00%
Foroozanfard F et al. <sup>8</sup>	2013	77.80%	52.90%
In this study	2013	63.64%	82.86%

laparoscopy offers the opportunity to treat disease at the time of diagnosis. On the other hand Laparoscopy is expensive, carries more risk, is invasive and has more complications than HSG.

Nevertheless, it is felt that the findings at Laparoscopy are usually easier to interpret and are more conclusive than those obtained by HSG. It is noteworthy, however that both tests also provided valuable data on other factors affecting fertility. It is obvious that those differences observed derive mainly from the fact that laparoscopy exhibits surface diseases and HSG detects more of lumen diseases of the pelvic organs. Therefore in our opinion, neither procedure can be replaced by the other. Both procedures should be used to obtain a reliable picture of the fallopian tubes.

Thus, in the final decision we conclude that HSG and Laparoscopy are not alternative, but complimentary methods in the examination of tubal patency in case of infertility.

## 6. References

1. Padubidri VG, Daftary SN. Shaw's Text Book of Gynecology, 14th edition, Reed Elsevier India pvt- Ltd; 198.
2. Fritz MA, Speroff L. Clinical Gynecology Endocrinology and Infertility, 8th edition, chapter 27; 1137.
3. Berek JS, Rinehart RD, Hillard PA, Adashi EY. Novak's Gynecology, 15th edition, Walters Kluwer India Pvt Ltd, chapter 32; 1139.
4. Dutta DC. Text Book of Gynecology, 6th edition, New Central Book Agency pvt Ltd. Chapter 10; 136 – 7.
5. Lakhkar BN. Radiological Procedures a Guidline 2nd Edition, Arya Publications Pvt. Ltd. Chapter 12; 131–5.
6. Rock JA, Jones HW. TeLinde's Operative Gynecology, 10th edition, Lippincott Williams and Wilikins, chapter 17; 319.
7. Goynumer G, Yetim G, Gokcen O et al. Hysterosalpingography, Laparoscopy or both in the Diagnosis of Tubal Disease in Infertility. World Journal of Laparoscopic Surgery, 2008 May-Aug; 1(2):23–6.
8. Foroonzanfor F, Sadat Z. Diagnostic Value of Hysterosalpingography and Laparoscopy for tubal patency in infertile women. Nurs Midwifery Stud. 2013; 2(2):188–92.
9. Neerja JK et al. Comparitive Status of Hysterosalpingography and laparoscopy in evaluation of Infertile Women. Journal of Advance Research in Biological Sciences. 2012; 4(10):41–3.
10. Heis M, Amarin Z et al. Uterine and Tubal anatomical abnormalities in infertile women: diagnosis with routine hysterosalpingography prior to selective laparoscopy. SA Journal of Radiology. 2011 Dec; 121–2.
11. Mol BWJ, Collins JA, Burrows EA, van der Veen F et al. Comparison of hysterosalpingography and laparoscopy in predicting fertility outcome. Human Reproduction. 1999; 14(5):1237–42.
12. Duraker R, Demir B et al. Comparison of hysterosalpingography and laparoscopy results in the diagnosis of tubal occlusion. *J Turk Soc Obstet Gynecol*. 2011; 8: 40–3.
13. Swart P, Mol BW, Bossuyt PM, van der Veen F et al. The accuracy of hysterosalpingography in the diagnosis of tubal pathology: a meta-analysis. *Fertil Steril*. 1995; 64:486.
14. Broeze KA, Opmeer BC et al. Are patient characteristics associated with the accuracy of hysterosalpingography in diagnosing tubal pathology? An individual patient data meta- analysis. *Human Reprod Up-date*. 2011; 17(3):293–300.
15. Robabeh M, Roozbeh T. Comparison of Hysterosalpingography and laparoscopy in infertile Iranian women with tubal factors. *Ginekol Pol*. 2012 Nov; 83(11):841–3.