

# A comparative study of conventional and magnetic resonance hysterosalpingography in assessing tubal patency at a tertiary care center

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## Abstract

**Background:** Infertility is defined as the inability to conceive after 12 months of regular unprotected sexual intercourse. Evaluation of uterotubal factors is an essential step in infertility management. Hysterosalpingography (HSG) is the most widely used method but this method is invasive and inconvenient to women. MRI-hysterosalpingography (MR-HSG) in addition to conventional MRI (with or without contrast) is effectively used in diagnosing the tubal and uterine cause of infertilities. Present study was aimed to compare conventional HSG and magnetic resonance hysterosalpingography in assessing tubal patency in patients with infertility. **Material and Methods:** Present study was prospective, observational study conducted in patients, referred for evaluation of tubal patency as a workup for infertility (primary or secondary) or for postoperative evaluation, following reversal of tubal ligation. **Results:** After applying inclusion and exclusion criteria total 48 patients were included in present study. 29 patients had primary infertility, while 19 patients had secondary infertility. Sensitivity, specificity, positive predictive value, negative predictive values of MR HSG in comparison with X-ray HSG were 100%, 96.9%, 93.5%, 100% respectively. **Conclusion:** In evaluation of tubal patency MR-HSG is a simple, safe, sensitive tool, which also helps to assess uterus, ovaries and extra-uterine structures, important for evaluation of female infertility. Better assessment of this promising technique will be possible after wide-spread availability and use.

**Key Words:** female infertility, tubal patency, X-ray HSG, MR-HSG.

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Potential causes of infertility can be divided into male and female causes and include endocrine, anatomic, genetic, and behavioural conditions. Approximately 15 % of couples have infertility<sup>1</sup>. Some common causes of infertility are male factor (45 %), ovulation disorders (37 %) and tubal damage (18 %)<sup>2</sup>. Tubal factors affect fertility in 18% to 81% of female infertile patients, depending on population<sup>3</sup>. Hence, evaluation of tubal patency is essential in investigation of female infertility. The prevalence of pelvic inflammatory disease, genital tract tuberculosis, and chronic infection is increasing and hence higher incidence of tubal factor is noted in infertile women<sup>4</sup>. Evaluation of uterotubal factors is an essential step in infertility management. There are various invasive and noninvasive diagnostic procedures to evaluate uterine and/or tubal pathology. The noninvasive or minimally invasive modalities are ultrasonography,

## INTRODUCTION

Infertility is defined as the inability to conceive after 12 months of regular unprotected sexual intercourse. A variety of factors may affect normal fertility including patient age, anatomy, ovulatory status, and sperm quality.

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sonosalpingography and magnetic resonance imaging. The invasive modalities are hysterosalpingography (HSG), hysteroscopy and laparoscopy. Hysterosalpingography (HSG) is the most widely used method but this method is invasive and inconvenient to women. Many patients request anesthesia to perform HSG. Laparoscopy is also commonly used, requires proper anaesthesia. MRI-hysterosalpingography (MR-HSG) in addition to conventional MRI (with or without contrast) is effectively used in diagnosing the tubal and uterine cause of infertilities. Present study was aimed to compare conventional HSG and magnetic resonance hysterosalpingography in assessing tubal patency in patients with infertility.

### MATERIAL AND METHODS

Present study was prospective, observational study conducted in Department of Radiodiagnosis, Oxford Medical college Hospital. Duration of study was 1 year (from September 2018 to August 2019). Local institutional ethical committee clearance was taken for present study.

#### Inclusion criteria

Study was conducted in patients, were referred by the department of Obstetrics and Gynecology for  
 - evaluation of tubal patency as a workup for infertility (primary or secondary)  
 - for postoperative evaluation, following reversal of tubal ligation.

#### Exclusion criteria

- Uncooperative patients
- Patients with active pelvic inflammatory disease
- Patients with contraindications to MRI [pacemaker and cochlear implants]

After initial evaluation and written informed consent, patients were called on Day 7–Day 10 of the menstrual

cycle. Tablet mefenamic acid was prescribed three times a day and a course of antibiotics [combination of ofloxacin and metronidazole] as premedication starting on the day before and continued two days post procedure. Under strict aseptic precautions, MRI-compatible plastic HSG 5 - F microcatheter with inflatable bulb was inserted into the lower uterine cavity. The bulb was inflated with 3 cc of distilled water. Patient shifted to MRI scan. T2 W (TR: 7120 ms, TE: 90 ms, flip angle 90, slice thickness 5 mm, matrix 256 × 256) axial, sagittal, and coronal sequences were done. Dynamic T1 Cube Coronal 5 phases were taken. (TR: 3.8 ms, TE: 1.8 ms, TI: 7 ms, flip angle 120, slice thickness 3.4 mm, matrix 256 × 256). (PLZ CONFIRM IT) The first phase was imaged prior to saline infusion. Then, 10 ml of gadodiamide [1:100 dilution with 0.9% saline] was instilled and four successive phases were obtained. Corresponding subtracted images were generated automatically. The patients were immediately mobilized to the fluoroscopy room and 10 ml of iodinated contrast iohexol [Omnipaque; 350 mg/ml] was instilled through the same catheter. The spot film was taken after which the balloon was deflated and the catheter was removed. In patients with unilateral or bilateral tubal blocks, a diagnostic sos operative hystero-laparoscopy was planned in their next menstrual cycle as a part of routine subsequent evaluation and the findings were confirmed simultaneously. In patients with bilateral patent fallopian tube, who were either unable to conceive after 6 months or had some other factors also posted for diagnostic sos operative hystero-laparoscopy. The findings were confirmed during the procedure. All details (demographic, clinical, radiological and operative findings) were collected in a proforma in a Microsoft excel sheet. Statistical analysis was done using descriptive statistics.

### RESULTS

After applying inclusion and exclusion criteria total 48 patients were included in present study. 29 patients had primary infertility, while 19 patients had secondary infertility.

Age distribution of patients is shown in table 1.

**Table 1:** Age distribution of patients

Age (in years)	Primary infertility	Secondary infertility
20-25	4	0
26-30	15	8
31-35	6	5
>35	4	6
<b>Total</b>	<b>29</b>	<b>19</b>

Results of MR HSG and X-ray HSG are shown in table 2. Whenever required and indicated diagnostic sos operative hystero-laparoscopy was performed and findings were confirmed. Results of tubal patency with MR HSG were identical to findings in diagnostic hystero-laparoscopy.

**Table 2:** comparison of MR HSG and X-ray HSG

	Magnetic resonance hysterosalpingography	X-ray hysterosalpingography
Bilateral tubal patent	35	31
Right tubal block	4	5
Left tubal block	3	5
Bilateral tubal block	6	7

Total 96 tubes were evaluated during study for tubal patency. Results of MR HSG vs X-ray HSG are compared in table 3.

**Table 3:** MR HSG vs X-ray HSG – results for bilateral tubes

	Magnetic resonance hysterosalpingography		X-ray hysterosalpingography	
	Positive	Negative	Positive	Negative
Positive	28	1	29	
Negative	0	51	51	
<b>Total</b>	<b>28</b>	<b>52</b>	<b>80</b>	

Sensitivity, specificity, positive predictive value, negative predictive values of MR HSG in comparison with X-ray HSG were 100%, 96.9%, 93.5%, 100% respectively.

**Table 4:** Statistical analysis of MR HSG in comparison with X-ray HSG

Sensitivity	100% CI=(100% , 100%)
Specificity	96.9% CI=(92.5% , 101.2%)
positive predictive value	93.5%, CI={85.6% , 101.4%}
Negative predictive value	100%, CI=(100% , 100%)

## DISCUSSION

In the past two decades there was lot of advancement in the medical technology and management of infertility. Evaluation of tubal patency is necessary because any treatment, such as induction of ovulation and artificial insemination, given without making sure that the tubes are patent may be a futile effort. There has been a rising demand for accurate and non-invasive diagnostic procedures, and this has fostered significant innovations in the technique and equipment used for evaluating infertility. We noted sensitivity, specificity, positive predictive value, negative predictive values of MR HSG in comparison with X-ray HSG were 100%, 96.9%, 93.5%, 100% respectively. Fatemeh *et al.* in their study stated that the sensitivity and specificity of HSG in detecting bilateral tubal patencies or tubal blocks were 92.1% and 85.7%, respectively. The PPV, NPV, and diagnostic accuracy were 97.2%, 66.7%, and 91.1%, respectively<sup>5</sup>. Jagannathan and Hithaya noted sensitivity, specificity, positive predictive value [PPV], negative predictive value [NPV], and diagnostic accuracy of MR HSG and cHSG were 100%, 98.08%, 100%, 96.5%, and 98.75%, respectively, our results are similar with above studies<sup>6</sup>. There are many benefits in MR-HSG, such as use of nonionizing radiation, not dependent on operator, helps to evaluate the other causes of infertility and assessing the adjacent organs, excellent resolution and multiplanar imaging and helps in evaluation of distal tubal pathology and possible peritubal adhesions. In trained facilities selective tubal catheterization is possible during the procedure. Hysterosalpingo-contrast-

sonography (HyCoSy) is also a good option for evaluation of tubal patency and other factors for female infertility. But procedure is operator dependant and it has a long learning curve. Some technical difficulties in interpreting the sonographic picture after contrast injection, for eg. in women with increased body mass index (BMI), acutely retroverted or oblique uterine position, ovaries situated either in close proximity to the uterus (usually in the pouch of Douglas) or laterally in the pelvis (at the extremes of the penetration depth of the transvaginal probe) or in whom there are multiple loops of overlying, gaseous bowel<sup>7,8</sup>. Various recent advances increase the diagnostic accuracy of HyCoSy i.e. color doppler duplex scan, contrast tuned imaging, 3D-Power Doppler HyCoSy and 4D-HyCoSy to overcome the shortcomings of conventional 2 D HyCoSy<sup>7,8</sup>. Even though other studies have analyzed MR-HSGs potential for tubal patency assessment and have already yielded good results, the use of a flawed gold standard, such as conventional HSG, left margin for a reasonable doubt in respect to its true potential, thus precluding solid evidence-based recommendation<sup>9,10</sup>. Nevertheless, if we compare our results to those published (which compare MR-HSG to conventional HSG alone or conventional HSG in combination with laparoscopy), we can observe a high degree of agreement in that positive spillage is correctly diagnosed with specificities near or at 100%<sup>11,12</sup>.

## CONCLUSION

In evaluation of tubal patency MR-HSG is a simple, safe, sensitive tool, which also helps to assess uterus, ovaries

and extra-uterine structures, important for evaluation of female infertility. Better assessment of this promising technique will be possible after wide-spread availability and use.

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