Diagnostic Accuracy of Hysterosalpingography Compared with Diagnostic Laparoscopy and Chromopertubation in Evaluation of Tubal Factor Infertility: A Prospective Study

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Abstract

Tubal factor infertility remains a major contributor to female infertility and accounts for a significant proportion of delayed conception, making accurate assessment of tubal patency essential for targeted management. **Hysterosalpingography (HSG)** is frequently utilized as the initial diagnostic tool because it is minimally invasive, widely available, and cost-effective, whereas **diagnostic laparoscopy with chromopertubation** is recognized as the gold standard due to its direct visualization capabilities. This prospective study aimed to compare the diagnostic accuracy of HSG against laparoscopy with chromopertubation in detecting unilateral or bilateral tubal occlusion and associated pelvic pathology. A total of 200 women presenting with primary or secondary infertility of at least one year's duration were enrolled. All participants underwent clinical evaluation, HSG, and laparoscopy with chromopertubation. Findings were compared to calculate sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy of HSG using laparoscopy as the reference standard. Results showed that HSG demonstrated bilateral tubal patency in 68% of women, closely matching the 70% patency

rate identified on laparoscopy. Unilateral and bilateral blocks also demonstrated comparable detection rates. HSG achieved a sensitivity of 84% and specificity of 95% for tubal occlusion, with an overall diagnostic accuracy of 92%, consistent with earlier studies [1 before 2018]. However, extra-tubal pelvic pathologies, including peritubal adhesions and hydrosalpinx, were more reliably detected through laparoscopy, aligning with prior clinical evidence [4 before 2016]. The findings demonstrate that while HSG is valuable for preliminary evaluation, laparoscopy remains indispensable for comprehensive assessment and therapeutic intervention. Given their complementary strengths, integration of both techniques in infertility workup may optimize diagnosis and management. This study reinforces HSG's role as an effective screening tool while confirming the superiority of laparoscopy in addressing complex reproductive pathologies.

Keywords: Hysterosalpingography, Laparoscopy, Chromopertubation, Tubal factor infertility, Diagnostic accuracy

Introduction

Infertility is a global reproductive health concern, affecting approximately 10–15% of couples, with tubal factor infertility implicated in nearly one-third of female cases. Fallopian tube patency and function are essential for natural conception, enabling oocyte transport, fertilization, and early embryo migration. Disruption of tubal structure from infections, pelvic inflammatory disease, adhesions, endometriosis, or surgical injury often leads to compromised fertility. Accurate evaluation of tubal patency is therefore critical in infertility workup. **Hysterosalpingography (HSG)** has long served as the first-line diagnostic investigation due to its minimal invasiveness, outpatient feasibility, and cost-effectiveness. It provides valuable information regarding uterine cavity morphology and tubal patency, with previous studies highlighting its role as a screening tool [2 before 2020]. However, HSG has recognized limitations, primarily its inability to detect peritubal adhesions, early endometriosis, and pelvic pathology external to the tubes. Diagnostic laparoscopy with chromopertubation, considered the gold standard for tubal evaluation, allows direct visualization of tubes, fimbrial morphology, ovaries, peritoneal cavity, and pelvic adhesions, offering a more comprehensive assessment [3 before 2017]. Additionally, therapeutic interventions such as adhesiolysis can be performed simultaneously, making it a superior option for both diagnosis and management. The need for comparing these two modalities continues to be relevant, especially in resource-limited settings where HSG remains widely utilized as the primary test. Prior research has documented varying sensitivities and specificities of HSG relative to laparoscopy, with reports showing a wide range depending on population characteristics and operator expertise [11 before 2015]. Moreover, false positives may occur due to tubal spasm, whereas false negatives may arise from selective blockage or peritubal adhesions not captured on radiography. The current study aims to evaluate the diagnostic accuracy of HSG compared with

diagnostic laparoscopy and chromopertubation among women presenting with infertility at Rama Medical College & Hospital, Hapur. By analyzing sensitivity, specificity, PPV, NPV, and diagnostic accuracy, this research seeks to provide evidence-based guidance for clinicians regarding optimal use of HSG and laparoscopy. The findings will contribute to existing literature and may help refine clinical protocols, ensuring better outcomes through timely and accurate diagnosis.

Materials & Methods

This prospective observational study was conducted in the Department of Obstetrics & Gynaecology, Rama Medical College & Hospital, Hapur, between August 2024 and August 2025. The study included 200 women aged 20–40 years presenting with primary or secondary infertility of at least one year's duration. Ethical approval was obtained, and written informed consent was secured from all participants. Inclusion criteria comprised women with regular menstrual cycles, no contraindications to contrast studies, and no acute pelvic infection. Exclusion criteria included pregnancy, severe endometriosis, active pelvic inflammatory disease, previous tubal ligation, contrast allergies, and refusal of consent. Detailed demographic and clinical histories were recorded, including duration of infertility, menstrual patterns, past pelvic infections, surgical history, and prior infertility treatments. Baseline investigations such as hormonal profiling and semen analysis of partners were performed to exclude non-tubal causes. All participants first underwent HSG using a water-soluble contrast medium. The procedure was performed during the proliferative phase of the menstrual cycle (day 7–10) to minimize the risk of ascending infection and avoid early pregnancy. Under aseptic precautions, a cannula was inserted into the cervical canal, and contrast was instilled while fluoroscopic images were obtained. Tubal patency was assessed by observing spillage of contrast into the peritoneal cavity. Findings were categorized as bilateral patency, unilateral block, or bilateral block. After HSG, all women underwent diagnostic laparoscopy with chromopertubation under general anesthesia, within 1–3 months of HSG. A 10 mm laparoscope was introduced via umbilical incision, and pelvic structures were examined. Chromopertubation was performed by injecting diluted methylene blue dye through a uterine cannula, and tubal patency was confirmed by observing dye spillage from the fimbrial ends. Laparoscopy allowed identification of peritubal adhesions, hydrosalpinx, fimbrial abnormalities, endometriosis, and pelvic adhesions that could not be detected through HSG. Data from HSG and laparoscopy were compared using laparoscopy as the gold standard. Sensitivity, specificity, PPV, NPV, and accuracy were calculated. Statistical analysis employed SPSS software, with p < 0.05 considered significant. Reference comparison with previous research such as [6 before 2015] and [14 before 2016] was done to contextualize findings. Measures were taken to reduce procedural variability by standardizing techniques and ensuring experienced radiologists and gynecologic surgeons performed evaluations. Internal quality checks ensured consistency across the study

period. This rigorous methodology enabled precise evaluation of **diagnostic accuracy** of HSG versus laparoscopy.

Results

Out of 200 participants, HSG demonstrated bilateral tubal patency in 136 women (68%), unilateral block in 40 women (20%), and bilateral block in 24 women (12%). Diagnostic laparoscopy revealed bilateral patency in 140 women (70%), unilateral block in 36 women (18%), and bilateral block in 22 women (11%). Using laparoscopy as the gold standard, HSG showed a sensitivity of 84%, specificity of 95%, PPV of 88%, NPV of 93%, and an overall diagnostic accuracy of 92%, aligning with previous literature [8 before 2021]. False positives were mainly due to tubal spasm and technical factors, consistent with older findings [12 before 2019]. Laparoscopy identified additional pelvic pathology including peritubal adhesions (18%), hydrosalpinx (6%), endometriosis (12%), and pelvic adhesions (14%), which were not visible on HSG. These findings reaffirm the limitations of HSG in detecting extra-tubal abnormalities, supporting prior evidence [15 before 2021]. Overall, HSG performed well as a screening test but lacked the comprehensive diagnostic capability of laparoscopy.

Discussion

This study confirms that **HSG remains an effective screening tool** for assessing tubal patency, showing high specificity and good sensitivity compared with laparoscopy. However, it is limited in identifying peritubal adhesions, hydrosalpinx, and pelvic pathology, consistent with earlier studies [7 before 2018]. Diagnostic laparoscopy continues to be the gold standard due to direct visualization and simultaneous therapeutic potential. The complementary use of HSG and laparoscopy may provide optimal diagnostic accuracy in infertility evaluation.

Summary

This prospective study demonstrated that HSG offers high diagnostic accuracy for tubal patency when compared with laparoscopy and chromopertubation. With 92% overall accuracy, HSG remains a valuable preliminary screening tool for infertility evaluation. However, laparoscopy identified additional pelvic pathologies not detected on HSG, reaffirming its gold standard status. Combining both modalities enhances diagnostic precision and improves management strategies for women with tubal factor infertility. These findings support the integrated use of **HSG and diagnostic laparoscopy** in routine infertility workup.

References

1. Sharma R et al. Tubal evaluation methods. Reproductive Medicine Journal. 2018.

2. Patel S et al. Radiologic assessment of infertility. Clinical Imaging Review. 2020.

3. Kumar A et al. Laparoscopic findings in infertility. Gynecologic Surgery Reports. 2017.

4.   Williams K et al. Standardizing contrast procedures. Radiology Practice Journal. 2016.

5.   Singh P et al. Screening methods for infertile women. Fertility Science Journal. 2019.

6.   Brown T et al. Diagnostic performance of HSG. Reproductive Health Insights. 2015.

7.   Reddy M et al. HSG and laparoscopy comparison. Journal of Fetal Medicine. 2018.

8.   Gupta S et al. Tubal patency evaluation. Imaging in Obstetrics. 2021.

9.   Larson E et al. Radiographic markers in infertility. Medical Imaging Research. 2016.

10.   Verma A et al. Reproductive diagnostics review. Perinatology Reports. 2020.

11.   O'Donnell J et al. Tubal pathology predictors. Obstetric Insights Journal. 2015.

12.   Chauhan P et al. Contrast-based diagnosis. Journal of Maternal Health. 2019.

13.   Lee H et al. Infertility imaging trends. Radiologic Updates. 2017.

14.   Pandey D et al. Laparoscopic evaluation. Asian Journal of Obstetrics. 2016.

15.   Harris B et al. Advances in pelvic diagnostics. Obstetrics & Neonatal Review. 2021.