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Diagnostic Accuracy of Hysterosalpingography as Compared to Laparoscopy in Detecting Tubal Factors of Infertility

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ABSTRACT

Background & objective: Fallopian tube abnormalities are a common cause of female infertility. In resource-limited settings like Bangladesh, Hysterosalpingography (HSG) is the preferred initial screening tool, though Laparoscopy remains the definitive "gold standard." This study was to determine the diagnostic accuracy of HSG in detecting tubal occlusion and peritoneal factors compared to Laparoscopy.

Methods: This cross-sectional study was conducted on 49 infertile women (aged 18–38 years) who were admitted to Sir Salimullah Medical College Mitford Hospital, Dhaka for laparoscopy and who had their previous HSG report available. Patients with active pelvic inflammatory disease (PID) or a history of pelvic tuberculosis or tubal surgery between the HSG and laparoscopy were excluded. HSG findings were validated against laparoscopic chromopertubation.

Results: HSG showed high sensitivity (91.7%) but inappreciably poor specificity (23.1%) for tubal factors. Laparoscopy identified peritubal adhesions and tubo-ovarian distortions in over 40% of cases that were undetectable by HSG.

Conclusion: HSG is an effective screening tool; however its high false-positive rate necessitates laparoscopic confirmation for definitive diagnosis and therapeutic planning.

Keywords: Diagnostic Performance, Hysterosalpingography, Laparoscopy, Evaluation, Tubal

ORIGINAL ARTICLE

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INTRODUCTION

Infertility is a global health issue, defined by the failure to conceive after 12 months or more of regular, unprotected sexual intercourse.[1] The global pooled estimate for the lifetime prevalence of infertility stands at approximately 17.5%.[2] Among female-related factors, disorders of the fallopian tube-including damaged or blocked tubes-account for 20% to 35% of cases.[3,4] Consequently, assessing tubal patency is an integral part of the evaluation of female fertility.[5]

The diagnostic assessment of female infertility relies heavily on imaging techniques. Hysterosalpingography (HSG) is a contrast-enhanced fluoroscopic radiographic procedure used to assess the endometrium, uterine cavity, and fallopian tubes.[6] It is frequently utilized as a first-line investigation due to its comparatively low cost & outpatient nature.[7] However, laparoscopic surgery is considered the gold standard for evaluation, as it allows for both diagnostic visualization and therapeutic intervention.[4] Unlike HSG, laparoscopy enables the visualization of periadnexal adhesions and endometriosis.[8] However, it is more expensive and undoubtedly more invasive than HSG with potential risk of surgical complications being 0.13%.[5]

However, there is limited study in Bangladesh, which compares the diagnostic performance of Hysterosalpingography and Laparoscopy for tubal evaluation. This study was undertaken to compare these two procedures in detecting tubal factors in infertile women. Findings from the study may assist the clinicians to adopt the minimally invasive Hysterosalpingography procedure in the diagnosis of infertility and thereby to intimate proper treatment without much delay.

METHODS

This cross-sectional study was conducted in the Department of Obstetrics and Gynaecology, Sir Salimullah Medical College Mitford Hospital, Dhaka, Bangladesh, from June 2023 to May 2024. A total of 49 infertile women aged 18–38 years were consecutively included. All participants had an available HSG report & were subsequently admitted for laparoscopy. Patients with active pelvic inflammatory disease (PID) or a history of pelvic tuberculosis between the HSG and laparoscopy were excluded.

The key variables were operationalized to ensure uniformity in data collection. Accordingly, a woman was considered to have primary infertility, if she had never conceived, while secondary infertility was defined as the incapability of the woman to conceive who have had at least one successful conception in the past. Fallopian tubes were considered patent if the dye passed through the whole tube reaching ovaries and to the peritoneum resulting in spillage; if the dye did not pass through the entire fallopian tube freely, it was considered partially patent; if it did not pass through the fallopian tube at all then it was considered blocked. Tubal factor was the presence of partial (either proximal or distal) or total occlusion of the fallopian tubes. Peritubal adhesion was the presence of adhesion around the fallopian tubes. A distorted tubo-ovarian relationship was referred to abnormal anatomical changes that affected the normal positioning and function of the fallopian tubes and ovaries leading to pelvic inflammatory disease (PID), endometriosis or pelvic surgery.

Data were analyzed using SPSS. While categorical variables were summarized using frequencies with corresponding percentages, quantitative data were presented means with standard deviations (SDs) from the means. Diagnostic performance of HSG against laparoscopic chromopertubation, (the gold-standard diagnostic modality) was evaluated in terms of sensitivity, specificity, positive and negative predictive values (PPV and NPV) using the following metrics:

- Sensitivity: TP / (TP + FN)
- Specificity: TN / (TN + FP)
- Positive Predictive Value (PPV): TP / (TP + FP)
- Negative Predictive Value: TN / (TN + FN)
- Accuracy: (TP + TN) / (TP + TN + FP + FN)

RESULTS

The mean age of the participants was 29.2 ± 5.1 years, with one-third (32.7%) falling within the 26–30 years age group. Over half (55.1%) of the

women was urban resident. Primary infertility was observed in 53.1% of the study population, while 46.9% presented with secondary infertility. The mean duration of infertility was 7.1 ± 3.8 years. While more than 55% did not have any history of abortion, 28.6% had one and 16.3% had two or more histories of abortion (Table I).

HSG identified tubal blockages in 77.6% of right tubes and 75.5% of left tubes. However, laparoscopic findings identified a significantly higher rate of patency while uncovering peritoneal factors undetectable by HSG. While laparoscopy did not find any uterine anomalies, HSG identified anomalies in 2(4.1%) cases. Laparoscopy found peritubal adhesion in more than 40% cases and distorted tubo-ovarian relationship in about 45% of the cases (Table 2).

HSG suggested abnormal tubal factors in 43 cases, of which only 33 were confirmed by laparoscopy (True Positives). In detecting abnormal tubal factors, HSG demonstrated an optimal sensitivity of 92%, with an extremely poor specificity of 23%. The positive and negative predictive values (PPV and NPVs) of the test was 76.7%, and 50% respectively with an overall accuracy of 73.5% (Table 3).

Table 1: Distribution of Demographic and Obstetric Variables (n = 49)

Demographic and Obstetric Variables	Frequency	Percentage
Age* (years)		
18 – 25	13	26.5
26 – 30	16	32.7
31 – 35	14	28.6
> 35	6	12.2
Residence		
Urban	27	55.1
Rural	22	44.9
Infertility Type**		
Primary	26	53.1
Secondary	23	46.9
History of Abortion		
None	27	55.1
One	14	28.6
Two or More	8	16.3

***Mean age** = 29.2 ± 5.1 years. ****Mean duration of infertility** = 7.1 ± 3.8 years

Table 2: Findings Revealed by HSG vs. Laparoscopy (n = 49)

Anatomical locations	Diagnostic Performance	
	HSG (n = 49*)	Laparocopy (n = 49*)
Right Tube		
Patent	11(22.4)	29(59.2)
Blocked	38(77.6)	20(40.8)
Peritubal adhesion	11(22.4)	22(44.9)
Distorted Tubo-ovarian		
Relationship	38(77.6)	2142.9)
Left Tube		
Patent	12(22.4)	28(57.1)
Blocked	37(75.5)	20(40.8)
Absent	1(2.0)	1(2.0)
Peritubal adhesion	--	20(40.8)
Distorted Tubo-ovarian		
Relationship	--	22(44.9)
Uterine anomaly		
No anomaly	47(95.9)	49(100.0)
Anomaly present	2(4.1)	0(0.0)

***Figures in the parentheses denote corresponding percentage**

Table 3: Diagnostic performance of hysterosalpingography in detection of tubal factors

Tubal factors	Tubal Factors Detected by Laparoscopy		Total
	Abnormal	Normal	
Abnormal	33 (TP)	10 (FP)	**43**
Normal	3 (FN)	3 (TN)	**6**
Total	**36**	**13**	**49**

HSG	Sensitivity	Specificity	PPV	NPV	Accuracy
	91.7%	23.1%	76.7%	50%	73.5%

***Figures in the parentheses denote corresponding percentage**

DISCUSSION

This study found that while HSG is a highly sensitive screening tool (91.7%), it suffers from a low specificity (23.1%). This high rate of false positives (23.2%, 10/43) may be attributed to tubal ostium spasms during contrast injection or the presence of intrauterine debris.[9] (Our sensitivity findings are consistent with previous studies,[10] but the low specificity highlights the risk of over-diagnosis when using HSG in isolation.

A critical limitation of HSG is its inability to detect peritubal adhesions and distorted tubo-ovarian relationships, which were detected in over 40% of

cases during laparoscopy. These peritoneal factors are significant contributors to infertility even when tubes are patent.[11] As noted by Heavey,[12] the "significance" of a diagnostic result must be grounded in its literal importance to the patient; therefore, relying solely on HSG may lead to "disappointing" clinical outcomes if peritoneal factors are missed.

While this study provides valuable insights into the diagnostic landscape of infertility in Bangladesh, several limitations must be acknowledged. First, the sample size of 49 participants is relatively small, which may affect the generalizability of the findings and the precision of the specificity estimates. Second, the potential for operator bias exists in the interpretation of HSG films, as radiological findings can be subjective depending on the expertise of the radiologist. Finally, as a cross-sectional study, we could not follow these patients to assess their eventual pregnancy outcomes, which would have provided a more definitive measure of the clinical significance of the "tubal factors" identified by both HSG and laparoscopy.

Future research should focus on prospective longitudinal trials with larger cohorts to establish more robust Minimum Important Differences (MID) in tubal diameter or contrast spill density. Moreover, incorporating sonohysterosalpingography (ultrasound-based patency testing) alongside HSG & laparoscopy could offer a more comprehensive, multi-modal approach to diagnosing female infertility without the risks of ionizing radiation.

CONCLUSION

Hysterosalpingography remains a valuable, minimally invasive first-line screening tool for tubal patency in low-resource settings due to its high sensitivity and moderate accuracy. However, given its low specificity and high false-positive rate, it should be considered a complementary investigation rather than an alternative to laparoscopy. Laparoscopic confirmation is recommended to definitively assess tubal factors and identify peritoneal pathologies before initiating advanced fertility treatments.

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