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EVALUATING DIAGNOSTIC ACCURACY OF HYSTEROSALPINGOGRAPHY VERSUS LAPAROSCOPY FOR TUBAL INFERTILITY IN BANGLADESH

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Abstract

Background: Tubal pathology is a major contributor to female infertility, particularly in developing countries. Hysterosalpingography (HSG) is widely used as a first-line diagnostic tool because of its availability and low cost; however, its accuracy remains debatable. Laparoscopy is the gold standard for evaluating tubal and pelvic pathologies. This study aimed to evaluate the diagnostic accuracy of HSG compared to laparoscopy in assessing tubal infertility among women in Bangladesh.

Methods: A cross-sectional observational study was conducted at the Department of Obstetrics and Gynaecology (Infertility), Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, from January to December 2009. A total of 150 infertile women underwent HSG and laparoscopy. Data on tubal patency and pelvic findings were compared using laparoscopy as a reference standard. The sensitivity, specificity, predictive values, and diagnostic accuracy of HSG were calculated. SPSS version 25.0 was used for data analysis, with a significance threshold of $p \leq 0.05$.

Results: HSG detected tubal blockage in 90 women, whereas laparoscopy confirmed blockage in only 50 cases. The sensitivity, specificity, positive predictive value, and negative predictive value of HSG were 76.0%, 48.0%, 42.2%, and 80.0%, respectively, with an overall diagnostic accuracy of 57.3%. Laparoscopy identified additional pelvic abnormalities in 31 patients, including adhesions (18.7%), endometriosis (5.3%), and genital tuberculosis (4.7%).

Conclusion: HSG demonstrated moderate sensitivity but poor specificity for detecting tubal blockage. Laparoscopy remains essential for a comprehensive evaluation, especially in cases with abnormal HSG or suspected pelvic pathology.

Keywords: Hysterosalpingography, Laparoscopy, Tubal Infertility, Diagnostic Accuracy, Infertility, Bangladesh

INTRODUCTION

Infertility is a major issue in terms of the proportion of couples in the world and is considered as inability to become pregnant after a year of unprotected and regular intercourse. The World Health Organization assumes that about 8 % to 12 % of couples in the world are affected by infertility, and developing countries have even higher prevalence, which is caused by infections, difficulties in getting healthcare, and late recognition [1,2]. Social and emotional ill effects of infertility are substantial in Bangladesh, and they are more commonly fraught to women because of their social and iconographical demands as far as reproduction is concerned [3].

Though there are many causes of female infertility, the tubal factors are the most important ones, which can result in almost 30-40% of the cases [4,5]. Infections, pelvic inflammatory disease, genital tuberculosis, endometriosis and postoperative adhesions are the common causes of tubal infertility. Therefore, proper diagnosis of the tubal pathology in time is vital in terms of its efficacy in planning treatment and deciding on childbearing issues.

Hysterosalpingography (HSG) has been traditionally used after the patient has undergone a tubal patency test with hysterosalpingography as a first-line test. HSG is a form of radiography where fluid containing contrast media is dripped into the uterus with the hope of seeing the contour of the uterus and the fallopian tube on a fluoroscopy. It involves minimal invasiveness, is affordable, and available, especially within a low-resource setting [6,7]. Nevertheless, HSG possesses certain drawbacks, such as a false-positive rate because of tubal spasms, identification failure of peritubal adhesions, as well as scant data on extra-tubal abnormalities of the pelvis [8,9].

By comparison, photoperturbation laparoscopy is regarded as the gold standard on tubal patency and pathology of the pelvis [10]. It directly visualizes the female anatomy of the pelvis, which makes it possible to diagnose conditions such as peritubal adhesions, endometriosis, and uterine congenital abnormalities that are commonly overlooked by the HSG [11]. Nevertheless, laparoscopy is an invasive procedure, allows the use of anaesthesia and is more expensive compared with radiology, and it may not be applicable in every healthcare facility because of a shortage of resources and patient preferences [12].

A number of studies have tried to compare the diagnostic accuracy of HSG and laparoscopy with mixed results. Some authors have indicated that the sensitivity and specificity of HSG are satisfactory in the observation of tubal occlusion [13], while others have introduced a very large variance in the two procedures, especially in diagnosing the occlusion of a single or both of the tubes and peritoneal factors [14,15]. A meta-analysis by Swart *et al*. also showed that HSG has low diagnostic accuracy relative to laparoscopy, particularly when dealing with distal tubal disease or pelvic adhesions [16].

In Bangladesh, there is a paucity of literature regarding the relative diagnostic performance of HSG relative to laparoscopy, mainly due to limited studies with small sample sizes or methodological variability. Because there is no doubt that proper tubal evaluation is the key to the management of infertility, the necessity to conduct strong, local studies that could assess the effectiveness of these diagnostic tools in the local Bangladesh population and in the local health sector is also very urgent.

The objective of the study is to determine whether HSG and laparoscopy are equivalent methods for diagnosing tubal infertility in Bangladesh and provide a side-by-side comparison of the diagnostic accuracy of tube evaluation in Bangladeshi women, through reference to laparoscopy.

METHODOLOGY & MATERIALS

This study was a cross-sectional observational analysis conducted at the Department of Obstetrics and Gynaecology **(**Infertility**)**, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. The research was carried out over a one-year period from January to December 2009. A

total of 150 women with infertility were assessed to evaluate the diagnostic performance of Hysterosalpingography (HSG) compared to laparoscopy for detecting tubal pathologies.

Inclusion Criteria:

1. Women aged 20–40 years with infertility of at least one year duration.
2. Patients willing to undergo both HSG and laparoscopy.
3. Normal hormonal profile and ovulatory cycles.
4. No male factor infertility confirmed by semen analysis.

Exclusion Criteria:

1. Known pelvic malignancies.
2. Patients with active pelvic inflammatory disease.
3. Women who had previously undergone tubal corrective surgery.
4. Contraindications to radiological contrast or anaesthesia.

All participants underwent a standardized diagnostic protocol. Hysterosalpingography (HSG) was performed during the proliferative phase of the menstrual cycle using water-soluble contrast media, under aseptic conditions. Laparoscopy with photoperturbation was scheduled for the following cycle under general anaesthesia. A gynaecological endoscopic surgeon performed all laparoscopies to minimize inter-observer variability. Data on tubal patency, pelvic pathology, and associated findings were recorded using structured forms. All participants provided informed consent, and confidentiality and ethical handling of data were strictly maintained throughout the study. Data were analyzed using SPSS version 25.0. Descriptive statistics, such as the mean, standard deviation, and percentage, were calculated. Diagnostic test evaluation included sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy. Statistical significance was set at $p \leq 0.05$.

RESULTS

Table 1: Demographic characteristics of the participants (n=150)

Demographic Variable		Frequency (n)	Percentage (%)
Age (years)	20–25	22	14.7
	26–30	60	40.0
	31–35	44	29.3
	>35	24	16.0
Mean ± SD		29.8 ± 5.1	
Type of Infertility	Primary	100	66.7
	Secondary	50	33.3
Duration of Infertility	<5 years	54	36.0
	5–10 years	78	52.0
	>10 years	18	12.0
Mean ± SD		5.8 ± 2.9	
Menstrual Cycle	Regular	113	75.3
	Irregular	37	24.7
Previous Abdominal Surgery	Yes	21	14.0
	No	129	86.0

Table 1 summarizes the demographic and clinical profiles of the study participants. The majority (40%) of women were aged 26–30 years, with a mean age of 29.8 ± 5.1 years. Primary infertility was more common (66.7%) than secondary infertility (33.3%). Most participants had infertility lasting between 5–10 years (52%). A majority had regular menstrual cycles (75.3%) and no history of abdominal surgery (86%).

Table 2: Tubal assessments via HSG vs laparoscopy

Findings	HSG (n = 150)	Laparoscopy (n = 150)
Normal	60 (40.0%)	96 (64.0%)
Unilateral block	47 (31.3%)	34 (22.7%)
Bilateral block	43 (28.7%)	20 (13.3%)

Table 2 compares the detection of tubal abnormalities by HSG and laparoscopy. HSG identified 60 normal cases (40%), 47 with unilateral block (31.3%), and 43 with bilateral block (28.7%). In contrast, laparoscopy found 96 normal tubes (64%), 34 with unilateral block (22.7%), and only 20 with bilateral block (13.3%), showing that HSG overestimated tubal blockage.

Table 3: Additional laparoscopic findings (n=150)

Finding	Frequency (n)	Percentage (%)
Peritubal/periovarian adhesions	28	18.67
Endometriosis	8	5.33
Genital tuberculosis	7	4.67
Bicornuate/unicornuate uterus	4	2.67
Fibroid uterus	3	2.00

Table 3 presents the additional laparoscopic findings. Laparoscopy detected additional pelvic pathologies not seen on HSG. Peritubal or periovarian adhesions were observed in 18.67% of patients, followed by endometriosis (5.33%), genital tuberculosis (4.67%), congenital uterine anomalies (2.67%), and fibroids (2.00%).

Table 4. Cross-tabulation of HSG and Laparoscopic Findings (n = 150)

HSG Finding	Laparoscopy Blocked	Laparoscopy Patent	Total
Blocked	38 (True Positive)	52 (False Positive)	90
Patent	12 (False Negative)	48 (True Negative)	60
Total	50	100	150

Table 4 presents a 2x2 comparison of HSG findings against laparoscopy as the reference standard. HSG correctly identified 38 true positives and 48 true negatives but had 52 false positives and 12 false negatives. This discrepancy highlights the moderate sensitivity and low specificity of HSG.

Table 5. Diagnostic performance of HSG (compared to laparoscopy)

Metric	Value (%)
Sensitivity	76.00%
Specificity	48.00%
Positive Predictive Value	42.20%
Negative Predictive Value	80.00%
Diagnostic Accuracy	57.30%

Table 5 provides key diagnostic performance metrics for HSG. Sensitivity was 76.0%, specificity was 48.0%, and diagnostic accuracy was 57.3%. The positive predictive value was 42.2%, and the negative predictive value was 80.0%, indicating that HSG is more reliable in ruling out tubal blockage than confirming it.

DISCUSSION

Correct diagnosis of tubal infertility is vital in the field of reproductive medicine, particularly in a resource-limited situation where cost-effectiveness and accessibility of the procedure are categorically of importance. This study compared hysterosalpingography (HSG) with laparoscopy, as the gold

standard, to compare their ability to diagnose tubal pathology in infertile women. The results indicated significant diagnostic differences between the two techniques; the laparoscopy procedure detected more normal tubes, as well as other pelvic abnormalities not seen in HSG.

This study identified that HSG had overestimated tubal obstruction in a considerable number of instances. In particular, 90 women had tubal blockages revealed with the help of HSG, which was proven with only 50 blockages found via laparoscopy. This generated 52 false-positive results, and this implied a specificity of 48 percent. These limitations were noted in a few previous studies. As an example, Ikechebelu *et al*. have stated that HSG often resulted in false positive results because of factors like cornual spasm, technical errors, or transient occlusion when there was blockage of the upper part of the tube [14]. Gokhan *et al*. have shown that HSG was not able to demonstrate peritubal adhesions nor minor peritoneal lesions that could be easily diagnosed by laparoscopy [17].

Our study resulted in the sensitivity of HSG of 76 percent, and it corresponds to the sensitivity of 65 percent to 85 percent reported by Swart *et al*. in their meta-analysis when the sensitivity depends on a patient population and a procedure [16]. Nonetheless, the sensitivity was rather high, but the specificity was low; hence, the limitation of HSG in giving a sure diagnosis of the presence of occlusion of the tubes.

In our study, positive prediction value (PPV) was 42.2 percent, and negative prediction value (NPV) was 80 percent. These values indicate that a negative HSG finding (i.e., patent tubes) is reasonably reliable and this is clinically useful in excluding tubal obstruction in non-high-risk patients. This agrees with the findings by Broeze *et al*., who concluded that HSG demonstrated high levels of NPV in women with no previous cases of diseases and surgery of the pelvis [8].

The fact that laparoscopy can identify other diseases that cause infertility is a great strength of this procedure, as HSG cannot be used to reveal them. Our study detected the presence of peritubal adhesions (18.7%), endometriosis (5.3%), and genital tuberculosis (4.7%), which is similar to what Nahar *et al*. and Tvarijonavičienė & Nadišauskienė reported and outlined that numerous pelvic pathologies remain unidentified using only HSG [5,18]. These pathologies are of great concern and would affect reproductive outcomes, and the issues ought to be considered in a full infertility assessment.

The differences between bilateral blockage detection with HSG and laparoscopy were quite notable as well. Also, as observed by HSG, it established bilateral blockage in 28.7 percent of the cases compared to just 13.3 percent by laparoscopy. This reflects the outcome of a study conducted by Ibinaiye *et al*., which indicated that HSG overdiagnosed bilateral blockages, and this is usually done by subjecting the patients to unnecessary procedures or recommending assisted reproductive technologies [19].

Remarkably, our HSG diagnostic precision (57.3 %) was less than regional studies had described previously. A 70 percent accuracy in the Iranian women was reported by Foroozanfard and Sadat, which implies that the difference in demography and method,s including the time of HSG, the type of contrast, and technical expertise, may affect the results [11]. This might be due to the reason that genital tuberculosis and pelvic inflammatory disease is very common amongst the population of Bangladesh, and this fact might lead to anatomical distortions that cannot be interpreted through radiographic imaging alone.

Considering its contraindications, HSG plays a significant role, especially as a primary-line investigation in settings with limited resources. It is not impulsive, cheap and readily accessible. Chalazonitis *et al*. and Capobianco *et al*. are two of the authors that suggest keeping HSG as an option in initial infertility investigations, particularly in cases where no laparoscopy is available, or patients refuse it [7,20].

Findings of the study also confirm the suggestions of global fertility guidelines, according to which laparoscopy can be used in case of abnormal HSG or a high clinical suspicion of pelvic pathology [21]. Tanahatoe *et al*. suggested a selective procedure in women with abnormal HSG or abnormal intrauterine insemination only, which would best optimize the resources and at the same time be diagnostic in detail [22].

The advantages and disadvantages of our study were that only a single surgeon did all laparoscopy procedures, which makes them consistent, but at the same time, may sometimes cause a certain amount of observer bias. There was also an inability to generalize because patients underwent a selection procedure which pre-screened patients with male factor infertility as well as abnormal hormone levels. Multicenter and inter-observer variation should also be assessed in future studies.

CONCLUSION

This study highlights that hysterosalpingography (HSG), while a useful initial screening tool, has moderate sensitivity and low specificity in diagnosing tubal pathology compared with laparoscopy. Laparoscopy demonstrated superior diagnostic accuracy and was able to identify additional pelvic pathologies, such as adhesions, endometriosis, and genital tuberculosis. Therefore, while HSG may be used to exclude tubal occlusion in selected cases, laparoscopy remains essential for comprehensive evaluation in women with suspected tubal infertility.

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