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DIAGNOSTIC UTILITY OF HYSTERO-LAPAROSCOPY IN THE EVALUATION OF INFERTILITY

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ABSTRACT

Background: Infertility affects 10–15% of couples in the reproductive age group, and despite advances in diagnostics, many pelvic and intrauterine pathologies remain undetected by routine imaging. Diagnostic hystero-laparoscopy (DHL) offers a single-step, minimally invasive modality for comprehensive evaluation. The study aimed to assess the diagnostic utility of hystero-laparoscopy in identifying abnormalities among women with primary and secondary infertility.

Methods: This prospective observational study was conducted in the Department of Obstetrics and Gynaecology, Index Medical College Hospital & Research Centre, Indore, over 12 months. One hundred infertile women (70 primary, 30 secondary) fulfilling inclusion criteria underwent DHL in the early proliferative phase. Hysteroscopy assessed uterine cavity lesions, while laparoscopy evaluated tubal, ovarian, and peritoneal factors. Chromopertubation was performed for tubal patency. Data were analyzed using SPSS v25.0, with $p < 0.05$ considered significant.

Results: Laparoscopic abnormalities were more frequent than hysteroscopic abnormalities (37% vs. 17% in primary infertility; 33% vs. 23% in secondary infertility). Endometriosis (16%) was the leading pelvic pathology in primary infertility, while adnexal adhesions (13%) predominated in secondary infertility. Other laparoscopic findings included tubal pathology (7%), myomas (5%), ovarian pathology (5%), and uterine anomalies (2%). On hysteroscopy, uterine septum was the most common intrauterine abnormality (11%), followed by polyps (6%) and myomas (3%). Chromopertubation revealed unilateral block in 9% and bilateral block in 8% of patients. Overall, 64% of women demonstrated at least one abnormality, with 9% showing combined findings on both procedures. Minor complications occurred in 6% of patients, with no major morbidity.

Conclusion: DHL effectively identified a high burden of pelvic and intrauterine pathologies, many undetected by conventional investigations. Its comprehensive diagnostic yield and safety profile reinforce its role as a gold standard in infertility evaluation, enabling early and targeted management to improve reproductive outcomes.

Keywords: Infertility, Hysteroscopy, Laparoscopy, Diagnostic hystero-laparoscopy, Tubal pathology.

INTRODUCTION

Infertility is a significant global health concern, affecting approximately 10–15% of couples in the reproductive age group [1,2]. According to the World Health Organization (WHO), nearly 60–80 million couples worldwide are currently living with infertility, making it a condition with profound medical, psychological, and social implications [3]. The etiological distribution varies, with male factors contributing to about 54.33% of cases and female factors accounting for 45.67%, while in certain couples both partners may be affected. The prevalence and pattern of infertility also demonstrate regional variation, influenced by socio-demographic, cultural, and environmental determinants [4].

Infertility is broadly categorized into primary and secondary forms. Primary infertility is defined by the WHO as the inability to conceive after 12 months of regular, unprotected sexual intercourse among women aged 15–49 years who are non-lactating and not using contraceptives [5]. Secondary infertility, in contrast, is characterized by the inability to conceive following a previous conception, irrespective of the pregnancy outcome. Another important category is unexplained infertility, where no identifiable cause is found even after a standard infertility evaluation, which typically includes semen analysis, assessment of ovulation, and evaluation of tubal patency [6]. Globally, primary infertility constitutes the majority of cases.

Although ultrasonography and laboratory tests remain integral components of infertility evaluation, they are often insufficient to provide complete information regarding pelvic anatomy and pathology. The advent of minimally invasive techniques, particularly laparoscopy and hysteroscopy, has revolutionized infertility workup. Laparoscopy allows direct visualization and manipulation of pelvic structures such as the uterus, fallopian tubes, and ovaries, thereby enabling accurate assessment of tubal morphology, ovarian status, and the presence of pelvic pathology [7,8]. Likewise, hysteroscopy provides a unique opportunity to evaluate the uterine cavity in real time, aiding in the detection of intrauterine abnormalities that may compromise fertility.

Diagnostic hystero-laparoscopy (DHL), by combining the strengths of both procedures, offers a comprehensive one-time evaluation of the female reproductive system. It not only provides definitive diagnosis of structural and functional abnormalities but also facilitates therapeutic interventions during the same sitting. This dual approach improves diagnostic accuracy, shortens the time to treatment, and enhances clinical outcomes. Moreover, laparoscopic techniques are associated with well-documented benefits, including precise surgical intervention, superior hemostasis, reduced tissue trauma, minimal postoperative pain, better cosmesis, shorter hospital stay, reduced cost, and faster recovery. [1,2]

The present study was therefore undertaken to evaluate the diagnostic utility of hystero-laparoscopy in the comprehensive assessment of infertility, with the aim of guiding appropriate management strategies and improving reproductive outcomes.

MATERIAL AND METHODS

After obtaining approval from the Institutional Ethical Committee of Index Medical College Hospital & Research Centre, Indore, this prospective observational study was conducted in the Department of Obstetrics and Gynaecology over a period of 12 months. A total of 100 women with infertility were enrolled in the study. Written informed consent was obtained from all participants prior to inclusion.

The sample size was calculated using the OpenEpi (Version 3) open-source calculator. Assuming a prevalence of infertility-related pelvic pathology of 50%, a confidence interval of 95%, and a margin of error of 10%, the minimum required sample size was 96. To account for potential dropouts or exclusions, 100 patients were finally included.

Inclusion Criteria

- Women aged 20–40 years with primary or secondary infertility.
- Normal seminal fluid analysis of the male partner.
- Normal baseline investigations and ultrasonography.

- Willingness to provide written informed consent.

Exclusion Criteria
- Patients unfit for general anesthesia.
- History of recent pelvic infection or genital tuberculosis.
- Women with medical comorbidities contraindicating surgery.
- Refusal to participate in the study.

Procedure
All patients underwent preoperative evaluation, including detailed history, physical examination, and baseline investigations. Each patient was admitted one day prior to the procedure and kept nil per oral after 10:00 pm. Diagnostic hystero-laparoscopy was scheduled in the early proliferative phase, preferably on the 7th, 8th, or 9th day of the menstrual cycle. The procedure was performed under general anesthesia with endotracheal intubation.
Hysteroscopy: The hysteroscope was introduced into the cervical canal under direct vision. The uterine cavity was distended with 0.9% normal saline and systematically examined for intrauterine abnormalities such as septa, polyps, adhesions, or submucosal fibroids.
Laparoscopy: Following hysteroscopy, diagnostic laparoscopy was performed. The uterus, fallopian tubes, ovaries, and peritoneal cavity were inspected for tubal patency, pelvic adhesions, endometriosis, and other pelvic pathologies. Chromopertubation with methylene blue dye was performed to assess tubal patency.
Postoperatively, patients were monitored in the recovery ward and discharged the next day after ensuring clinical stability. The primary outcomes assessed were the incidence and spectrum of pelvic and intrauterine abnormalities detected by hystero-laparoscopy. Secondary outcomes included detection of tubal pathology, ovarian morphology, pelvic adhesions, endometriosis, and uterine cavity lesions, as well as the ability of the procedure to provide a comprehensive infertility workup in a single sitting.

Statistical Analysis
Data were recorded in Microsoft Excel and analyzed using IBM SPSS Statistics version 25.0. Descriptive statistics were used to summarize baseline characteristics. Continuous variables were presented as mean ± standard deviation (SD) and compared using Student's t-test. Categorical variables were expressed as frequency and percentage and analyzed using Chi-square or Fisher's exact test as appropriate. A p-value <0.05 was considered statistically significant.

RESULTS
Out of the 100 infertile women studied, 70% (n = 70) had primary infertility, while 30% (n = 30) presented with secondary infertility. The mean age of women with secondary infertility was slightly higher compared to the primary infertility group (30.8 ± 4.1 years vs. 28.6 ± 3.4 years). The mean duration of infertility was comparable in both groups (4.6 ± 3.1 years vs. 4.4 ± 2.7 years).
Laparoscopic abnormalities were more common than hysteroscopic findings in both groups. Among primary infertility patients, abnormalities were detected in 37% via laparoscopy compared to 17% via hysteroscopy. In the secondary infertility group, abnormalities were observed in 33% by laparoscopy and 23% by hysteroscopy. The overall prevalence of abnormalities on laparoscopy was 27%, while hysteroscopy showed 20% (Table 1).

Table 1. Prevalence of abnormalities on hysteroscopy and laparoscopy

Procedures	Primary (n=70)		Secondary (n=30)		Total
	Normal (%)	Abnormal (%)	Normal (%)	Abnormal (%)	
Laparoscopy	44 (63)	26 (37)	20 (67)	10 (33)	36
Hysteroscopy	58 (83)	12 (17)	23 (77)	7 (23)	19

The most frequent laparoscopic finding in the primary infertility group was endometriosis (16%), whereas adnexal adhesions (13%) were more common in the secondary infertility group. Other findings included myoma, tubal pathology, ovarian pathology, and uterine anomalies (Table 2). The most common intrauterine abnormality detected on hysteroscopy in both groups was a uterine septum (11%), followed by polyps and myomas. Synechiae and intrauterine foreign bodies were less frequent (Table 3).

Table 2. Laparoscopic findings

Findings	Primary (%)	Secondary (%)	Total (%)
Myoma	3 (04)	2 (07)	5 (05)
Endometriosis	11 (16)	3 (10)	14 (14)
Adnexal adhesions	6 (09)	4 (13)	10 (10)
Tubal pathology	5 (07)	2 (07)	7 (07)
Ovarian pathology	4 (06)	1 (03)	5 (05)
Uterine anomaly	2 (03)	0	2 (02)
Total	31	12	43

Table 3. Hysteroscopic findings

Findings	Primary (%)	Secondary (%)	Total (%)
Myoma	2 (03)	1 (03)	3 (03)
Polyp	4 (06)	2 (07)	6 (06)
Septum	7 (10)	4 (13)	11 (11)
Synechiae	0	1 (03)	1 (01)
Foreign body	1 (01)	1 (03)	2 (02)
Total	14	9	23

Multiple abnormalities were detected in some patients: laparoscopy alone revealed pathology in 36 women, hysteroscopy alone in 19 women, while both procedures identified abnormalities in 9 women (Table 4). Chromopertubation demonstrated unilateral tubal block in 9% and bilateral block in 8% of women, with similar distribution across both groups (Table 5).

Minor complications were observed in 6% of patients. The most common was gaseous abdominal distension (4%), followed by minor intraoperative bleeding (1%) and uterine perforation (1%). No major surgical or anesthetic complications were recorded (Table 6).

Table 4. Distribution of abnormalities on hysteroscopy and laparoscopy

Findings	No. of patients
Only laparoscopy showing pathology	36
Only hysteroscopy showing pathology	19
Both showing pathology	9
Total	64

Table 5. Prevalence of tubal block (chromopertubation test)

Findings	Primary (%)	Secondary (%)	Total (%)
Unilateral	6 (09)	3 (10)	9 (09)
Bilateral	5 (07)	3 (10)	8 (08)
Total	11	6	17

Table 6. Complications

Complications	No. of patients	Percentage
Uterine perforation	1	1%
Bleeding	1	1%
Gaseous distension of abdomen	4	4%
Total	6	6%

DISCUSSION

Infertility is a multifactorial condition, and tubal as well as peritoneal factors remain important contributors, accounting for approximately 30–35% of cases worldwide [9]. In this study of 100 infertile women, with 70% presenting with primary infertility and 30% with secondary infertility, diagnostic hystero-laparoscopy (DHL) was shown to be an effective modality in detecting underlying pathologies that may contribute to infertility.

We observed that laparoscopic abnormalities were more frequent than hysteroscopic abnormalities in both groups (37% vs. 17% in primary infertility; 33% vs. 23% in secondary infertility). These findings are consistent with Nayak et al., who reported laparoscopic abnormalities in 35% compared to 17% detected on hysteroscopy in a series of 300 cases [10]. Similarly, Chanu et al. demonstrated abnormal laparoscopic findings in 37.5% of primary and 49.2% of secondary infertility patients, whereas hysteroscopy revealed 7.95% and 14.29% abnormalities respectively [2]. This reinforces the greater diagnostic yield of laparoscopy in identifying pelvic pathology.

Further, laparoscopic abnormalities were identified in 37% of primary infertility cases and 33% of secondary infertility cases, giving an overall prevalence of pelvic pathology of 30%. This finding is comparable to the results reported by Jayakrishnan et al., who detected pelvic pathology in 26.8% of infertile women by laparoscopic evaluation [11]. Similarly, other Indian and international studies have consistently emphasized that laparoscopy is the gold standard for diagnosing pelvic factors, and it remains the best predictor of future natural conception in women with unexplained infertility [12].

Among laparoscopic findings, endometriosis emerged as the most common abnormality in our primary infertility group (16%). This observation is consistent with earlier studies where endometriosis was frequently detected in women with infertility, affecting nearly one-third of such patients [13]. The presence of adnexal adhesions was more frequent in women with secondary infertility in our study, a finding also supported by Nayak et al., Garg et al. and Tsuji I et al., who highlighted adhesions as an important acquired cause of infertility following prior pelvic infections or surgery [10,14,15].

On hysteroscopy, uterine septum was the most frequent abnormality in both groups (11%), consistent with literature identifying septate uterus as one of the most common intrauterine anomalies detected during infertility evaluation [1,16].

Intrauterine pathologies are estimated to account for 10–15% of infertility cases [17], and are diagnosed in up to 50% of women undergoing hysteroscopy [18]. In our study, hysteroscopy revealed abnormalities in 20% of women, with septate uterus being the most common intrauterine anomaly (11%). This agrees with pooled data suggesting that septate uterus is present in around 1% of women in the general population but rises significantly in women with recurrent pregnancy loss (3.5%) [19]. Importantly, several of our septate uterus cases were undiagnosed on prior ultrasonography, reinforcing the superior diagnostic value of hysteroscopy. [20]

Besides septum, we also detected myomas and polyps, findings consistent with previous studies. Although the evidence linking uterine myomas to infertility is not robust, some studies suggest mechanisms such as compression of the tubal ostia, impaired uterine contractility affecting sperm transport, and poor endometrial receptivity due to altered vascularity [21,22]. In the case of endometrial polyps, their reported prevalence in infertile women ranges between 10% and 32% [23,24]. A prospective study by Shokeir TA et al. demonstrated that polypectomy improved pregnancy outcomes, with conception occurring in nearly 50% of women post-surgery [25].

Our study also showed that Chromopertubation revealed tubal block was detected in 17% of patients (9% unilateral, 8% bilateral). Similar rates have been documented in Indian cohorts [1,2], highlighting the crucial role of chromopertubation in tubal assessment during laparoscopy. Moreover, we observed multiple abnormalities in 18% of patients (9% laparoscopy alone, 6% hysteroscopy alone, and 3% both). This observation is supported by Chanu et al., who noted that a significant proportion of patients harbored combined abnormalities that would have been missed without DHL [2].

Complications in our study were minor (6%), including gaseous distension, minimal bleeding, and one uterine perforation, with no major surgical or anesthetic adverse events. This aligns with other reports confirming that DHL is a safe and effective diagnostic procedure with low complication rates when performed in specialized centers [1,2,13].

Taken together, our findings support the role of diagnostic hystero-laparoscopy as a comprehensive, single-step evaluation in infertile women. It not only provides accurate detection of pelvic and intrauterine abnormalities but also allows immediate therapeutic intervention when feasible, thereby potentially reducing time to treatment and improving fertility outcomes.

Although this study highlights the diagnostic value of hystero-laparoscopy in infertility evaluation, its limitations include a relatively small sample size, single-center design, and lack of follow-up on reproductive outcomes. Absence of comparison with advanced imaging modalities and inter-observer variation assessment further restricts broader generalizability of findings.

CONCLUSION

Diagnostic hystero-laparoscopy provides a comprehensive, one-time evaluation of both intrauterine and pelvic factors contributing to infertility. In our study, endometriosis, adnexal adhesions, and septate uterus emerged as the predominant abnormalities, many of which were undetected by routine imaging. The procedure proved safe, minimally invasive, and highly informative, reinforcing its role as a gold standard in infertility workup. By enabling simultaneous diagnosis and potential therapeutic intervention, hystero-laparoscopy not only enhances diagnostic accuracy but also shortens the time to appropriate management, thereby improving the prospects of achieving conception.

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