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A CROSS-SECTIONAL STUDY ON THE ROLE OF DIAGNOSTIC LAPAROSCOPY IN IDENTIFYING TUBAL AND PERITONEAL FACTORS IN FEMALE INFERTILITY.

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ABSTRACT

Background
Infertility affects a significant percentage of couples worldwide, with tubal and peritoneal factors being major contributors. While hysterosalpingography (HSG) is commonly used for assessing tubal patency, its limitations in accuracy make diagnostic laparoscopy a preferred choice. Laparoscopy allows direct visualization of the pelvic organs, providing a more accurate diagnosis of tubal blockages and peritoneal pathologies, such as adhesions and endometriosis, which are often undetectable through non-invasive techniques. The study aims to evaluate the role of diagnostic laparoscopy in identifying tubal and peritoneal causes of infertility in female patients.

Methods
A cross-sectional study was conducted on 50 women with primary or secondary infertility. Each participant underwent diagnostic laparoscopy following clinical evaluation and HSG. Data were collected on tubal blockages, peritoneal adhesions, and endometriosis, and results were analyzed to compare findings between primary and secondary infertility groups.

Results
Tubal factors, including bilateral tubal blockage, were identified in 32% of cases, with a similar incidence in both primary and secondary infertility. Peritoneal factors, such as pelvic adhesions and endometriosis, were present in 24% of cases, predominantly in primary infertility. Diagnostic laparoscopy revealed a higher sensitivity for detecting these factors than HSG, emphasizing its role in cases where non-invasive imaging was inconclusive.

Conclusion
Diagnostic laparoscopy is a valuable tool for identifying tubal and peritoneal factors in female infertility, offering high diagnostic accuracy and aiding in tailored treatment planning. Its ability to directly visualize pelvic abnormalities makes it essential in the comprehensive evaluation of infertility.

Recommendations
Laparoscopy should be considered in routine infertility workups, especially for patients with unexplained infertility or inconclusive HSG results. Further research on combining laparoscopy with minimally invasive treatments may improve fertility outcomes.

Keywords: Diagnostic Laparoscopy, Female Infertility, Tubal Factors, Peritoneal Factors, Endometriosis, Hysterosalpingography
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INTRODUCTION

Diagnostic laparoscopy has become essential in evaluating female infertility, particularly for diagnosing tubal and peritoneal factors. Infertility affects approximately 10-15% of couples globally, with tubal blockages and peritoneal adhesions contributing to 25-40% of cases. Diagnostic laparoscopy is considered a gold standard for visualizing these issues, showing superior accuracy over non-invasive procedures like hysterosalpingography (HSG) in identifying tubal occlusions and peritoneal pathologies [1,2]. Recent studies highlight laparoscopy's sensitivity in detecting anomalies that might otherwise go unnoticed, facilitating targeted treatment planning for infertility [3].

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Laparoscopy is especially valuable for patients with unexplained infertility or inconclusive HSG results. While HSG has moderate sensitivity, it is limited in detecting proximal tubal blockages, often resulting in false positives or negatives due to spasms or mucosal obstructions during contrast administration [4]. Laparoscopy provides direct pelvic inspection, enabling clinicians to visualize subtle lesions, such as small peritoneal adhesions or early-stage endometriosis, with greater precision [5]. This enhances its utility for addressing anomalies more effectively, which HSG cannot achieve reliably [6].

Endometriosis and pelvic adhesions, common causes of infertility, are increasingly diagnosed through laparoscopic evaluation. Endometriosis, found in 10-20% of women undergoing laparoscopy, affects fertility by causing chronic inflammatory changes in the peritoneal cavity [7]. Advances in minimally invasive laparoscopic techniques also allow for simultaneous diagnosis and treatment, which can improve fertility outcomes [8].

Recent studies support laparoscopy's effectiveness in managing infertility. A systematic review noted that laparoscopic intervention for tubal obstructions and adhesions can enhance fertility outcomes, potentially delaying or avoiding the need for IVF [3]. Laparoscopic chromopertubation, a dye test for assessing tubal patency, also provides valuable insights, guiding subsequent treatments [2].

In conclusion, the comprehensive approach laparoscopy offers in diagnosing tubal and peritoneal factors positions it as a crucial tool in female infertility evaluation. Combining precise diagnosis with low complication rates, laparoscopy remains advantageous in complex infertility cases that demand detailed anatomical insights [6,7].

The study aims to evaluate the role of diagnostic laparoscopy in identifying tubal and peritoneal causes of infertility in female patients.

METHODOLOGY

Study Design

This study employed a cross-sectional clinical design.

Study Setting

The study was conducted at the Gynecology & Obstetrics Department of Madhubani Medical College and Hospital. Patients were recruited from the outpatient department and provided consent to undergo diagnostic laparoscopy as part of their infertility evaluation. The study was carried out during the period from 1st May 2023 to 30th April 2024.

Participants

A total of 50 female patients diagnosed with infertility, including both primary and secondary infertility, were enrolled in the study. All participants expressed a desire to conceive and consented to the diagnostic procedure.

Inclusion Criteria

Female patients diagnosed with infertility (both primary and secondary types) who were anxious to conceive and willing to undergo diagnostic laparoscopy were included.

Exclusion Criteria

Patients were excluded if their partners presented with severe male infertility factors, such as azoospermia or significant oligospermia.

Bias

To minimize selection bias, the study recruited patients who met all inclusion criteria and volunteered to participate. Information and observational bias were reduced through standardized preoperative assessments, consistent diagnostic laparoscopy procedures, and objective data collection.

Variables

Variables included the presence of specific diagnostic findings from laparoscopy, types, and incidence of infertility-related tubal and peritoneal factors (e.g., tubal blockages, peritoneal adhesions, pelvic endometriosis), patient demographics (age, duration of infertility), type of infertility (primary or secondary), and previous obstetric history.

Data Collection

Data was collected through:

Clinical History and Examination

Patients underwent thorough history-taking and physical examination to document infertility duration, previous obstetric outcomes, and relevant medical history.

Diagnostic Laparoscopy Findings

Details of tubal and peritoneal abnormalities were documented during laparoscopy, including the presence of bilateral tubal blockage, pelvic adhesions, and endometriosis.

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Procedure

Following informed consent, each patient was admitted and underwent a series of standard preoperative evaluations, including clinical history, physical examination, and laboratory tests. Under anesthesia, laparoscopy was performed to evaluate the pelvic organs directly. Chromopertubation was used to assess tubal patency, and findings on tubal and peritoneal factors were recorded. Observations included the presence of bilateral tubal block, peritoneal adhesions, pelvic congestion, hydrosalpinx, and endometriosis.

Patients were monitored for any immediate complications following the laparoscopy. All findings were documented and reviewed about the primary objective of identifying tubal and peritoneal factors associated with infertility.

Statistical Analysis

Statistical analysis was conducted to evaluate the prevalence and type of tubal and peritoneal factors in the sample. Descriptive statistics were used to summarize patient demographics, infertility duration, and the frequency of identified factors. Comparisons between primary and secondary infertility were made where relevant, and associations between infertility type and diagnostic findings were analyzed.

Ethical considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

RESULTS

Table 1. Participant Demographics

Age (Years)	Primary Infertility (%)	Secondary Infertility (%)
<20	3%	0%
20-25	31%	33.3%
26-30	34%	6.7%
31-35	26%	46.7%
>35	6%	13.3%

The study included 50 women with infertility, where 70% (35) had primary infertility, and 30% (15) had secondary infertility. The age distribution showed that most women with primary infertility were aged 26-30 years (34%), while secondary infertility was more prevalent in women aged 31-35 years (46.7%). Table 1 provides the age distribution among primary and secondary infertility cases. Most primary infertility cases were observed in women aged 26-30 years, while secondary infertility was more frequent in women aged 31-35 years.

Table 2. Duration of Infertility

Duration (Years)	Primary Infertility (%)	Secondary Infertility (%)
1-5	71%	60%
6-10	26%	33%
>10	3%	7%

Most primary infertility patients (71%) reported an infertility duration of 1-5 years, followed by 26% for 6-10 years and 3% for over 10 years. In the secondary infertility group, 60% had infertility for 1-5 years, with the remaining 33% and 7% reporting durations of 6-10 and over 10 years, respectively. Table 2 shows the duration of infertility among participants. Both primary and secondary infertility cases were most commonly associated with a duration of 1-5 years.

Table 3. Findings on Tubal Factors

Tubal Factor	Primary Infertility (%)	Secondary Infertility (%)	Total (%)
Bilateral Tubal Blockage	31.43%	33.3%	32%

Table 3 presents the prevalence of bilateral tubal blockages among primary and secondary infertility cases. Tubal blockages were found in 32% of cases. Primary infertility cases had a 31.43% incidence of bilateral tubal blockage, while secondary infertility cases had a similar rate of 33.3%. Tubal factors were a significant finding, present in approximately one-third of cases in both groups.

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Table 4. Findings on Peritoneal Factors

Peritoneal Factor	Primary Infertility (%)	Secondary Infertility (%)	Total (%)
Pelvic Adhesions	8.57%	20%	14%
Pelvic Endometriosis	2.86%	0%	2%
Endometriosis with Adhesions	14.29%	0%	10%

Peritoneal adhesions and pelvic endometriosis were also significant findings

Pelvic adhesions were found in 8.57% of primary and 20% of secondary infertility cases.
Endometriosis was found in 2.86% of primary infertility cases, while endometriosis with adhesions was observed in 14.29% of primary cases.

Table 4 outlines the distribution of peritoneal factors in primary and secondary infertility. While pelvic adhesions and endometriosis were primarily observed in primary infertility cases, secondary infertility cases showed a higher rate of isolated adhesions.

Table 5. Overall Causes of Infertility Identified by Laparoscopy

Cause of Infertility	Primary Infertility (%)	Secondary Infertility (%)	Total (%)
Tubal Factor	31.43%	33.33%	32%
Peritoneal Factor	25.71%	20%	24%
Unexplained	8.57%	20%	12%

The most frequently identified causes were tubal factors (32%) and peritoneal factors (24%), while 12% of cases had no identifiable cause, classified as unexplained infertility. Table 5 summarizes the main causes of infertility identified via laparoscopy. Tubal factors were the leading cause, followed by peritoneal factors. In 12% of cases, no specific cause was identified, highlighting the presence of unexplained infertility.

Table 6. Complications of Diagnostic Laparoscopy

Complication	No. of Cases	Percentage (%)
Abdominal Pain	2	4%
Other (minor)	0	0%
Total	2	4%

Minor complications were observed in 4% of patients, primarily consisting of abdominal discomfort and pain. There were no severe complications. Table 6 provides a summary of complications associated with the laparoscopic procedure. The complication rate was minimal, demonstrating the safety and tolerability of diagnostic laparoscopy in infertility evaluation.

DISCUSSION

The results of this study highlight the value of diagnostic laparoscopy in identifying key infertility factors among women with primary and secondary infertility. The study sample comprised 50 women, of whom 70% presented with primary infertility and 30% with secondary infertility. The age distribution showed that most primary infertility cases were in women aged 26-30 years, while secondary infertility was more prevalent in women aged 31-35 years. This trend aligns with previous findings indicating that primary infertility typically manifests at a younger age, whereas secondary infertility, often influenced by previous pregnancies or complications, appears later. Furthermore, the majority of participants in both groups had experienced infertility for 1-5 years, which reflects a common period during which couples seek medical assistance for infertility issues.
Diagnostic laparoscopy revealed that tubal factors were present in 32% of cases, with bilateral tubal blockage being equally prevalent among both primary (31.43%) and secondary (33.3%) infertility cases. Tubal blockage represents a significant barrier to natural conception, as it prevents the egg and sperm from meeting in the fallopian tube, highlighting the critical role of diagnostic laparoscopy in directly visualizing such conditions. In addition to tubal factors, peritoneal factors, including pelvic adhesions and endometriosis, were found in 24% of cases. Specifically, pelvic adhesions were more common in secondary infertility cases (20%), while primary infertility cases showed a higher occurrence of endometriosis and adhesions. These findings emphasize laparoscopy's unique advantage in identifying

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adhesions and endometriosis—conditions that are often undetectable through non-invasive imaging.

The laparoscopy findings illustrated that tubal and peritoneal factors accounted for a large proportion of infertility causes, at 32% and 24%, respectively. However, 12% of cases remained unexplained, as no specific abnormalities were detected during the procedure. Unexplained infertility cases, despite comprehensive diagnostic testing, suggest the presence of factors that may not be detectable through standard laparoscopy, such as subtle endometrial or hormonal issues. This further underlines the multifactorial nature of infertility and the limitations of current diagnostic tools, even with the sensitivity of laparoscopy.

The study observed a low complication rate of 4%, limited to minor abdominal discomfort in a few cases. This low complication rate reaffirms the procedure's safety and feasibility as a diagnostic tool in infertility workups, especially when more invasive methods or lengthy diagnostics could be avoided.

These findings underscore diagnostic laparoscopy's efficacy as a "gold standard" for directly visualizing tubal and peritoneal abnormalities that contribute to infertility, offering reliable diagnosis with minimal risk. Given that tubal and peritoneal factors are frequently implicated in infertility cases, laparoscopy proves to be essential for cases where other diagnostic tools fail to provide conclusive information. The detection of tubal blockages, adhesions, and endometriosis suggests that timely intervention through laparoscopy can facilitate more targeted treatment planning, potentially enhancing fertility outcomes for many women.

Firstly, hysterosalpingography (HSG) and laparoscopy are commonly employed for tubal assessment, yet they offer different diagnostic strengths. A study found that while HSG is a useful preliminary tool for visualizing the cervical canal, uterine cavity, and tubal patency, it often lacks accuracy in complex cases such as pelvic adhesions or hydrosalpinx. Laparoscopy, by contrast, is considered the gold standard due to its ability to provide a detailed, panoramic view of pelvic structures, making it especially effective for diagnosing more nuanced tubal factors in infertility [9].

Similarly, a comparative study revealed that although HSG is cost-effective, its accuracy is limited, particularly for detecting peritubal adhesions and hydrosalpinx. The study reported that HSG and laparoscopy complement each other in infertility assessment, with laparoscopy delivering higher diagnostic accuracy and acting as a confirmatory tool following HSG abnormalities. This combination approach optimizes the overall diagnostic process, allowing for a more comprehensive evaluation of tubal infertility factors [10].

Further, the detection of tubal blockages and endometriosis through combined diagnostic hystero-laparoscopy was examined. In the study of primary subfertility cases, diagnostic laparoscopy effectively identified significant contributors to infertility, including unilateral and bilateral tubal blockages, peri-tubal adhesions, and endometriosis. This supports the value of laparoscopy as a diagnostic procedure, especially in cases where HSG findings are inconclusive or need confirmation [11].

A study also underscored laparoscopy's critical role in identifying tubal factors, finding that 31.2% of cases presented with tubal abnormalities such as peritubal adhesions and tubo-ovarian masses. This study highlighted laparoscopy's ability to uncover pathology that may be pivotal for treatment decisions, especially for assisted reproductive techniques like in vitro fertilization (IVF) [12].

Lastly, a study emphasized the advantage of combining hysteroscopy and laparoscopy in a single session for comprehensive infertility evaluations. In the study, this combined approach effectively identified a range of abnormalities including uterine, ovarian, and peritoneal pathologies, enhancing diagnostic yield and supporting its utility as a one-stop diagnostic and therapeutic procedure [13].

CONCLUSION

In summary, diagnostic laparoscopy proves to be an invaluable tool for evaluating female infertility, particularly in identifying tubal and peritoneal factors that may go undetected by non-invasive methods. The procedure offers high diagnostic accuracy, directly visualizing pelvic abnormalities such as tubal blockages, adhesions, and endometriosis with minimal complications. Given its effectiveness, laparoscopy should be considered in routine infertility assessments, especially for patients with inconclusive HSG results or unexplained infertility, to enable a more precise and tailored treatment approach that could improve fertility outcomes.

LIMITATIONS

The limitations of this study include a small sample population who were included in this study. Furthermore, the lack of a comparison group also poses a limitation for this study's findings.

RECOMMENDATION

Laparoscopy should be considered in routine infertility workups, especially for patients with unexplained infertility or inconclusive HSG results. Further research on combining laparoscopy with minimally invasive treatments may improve fertility outcomes.

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DATA AVAILABILITY

Data is available upon request.

AUTHOR CONTRIBUTIONS

All authors contributed to the design of the research. BG collected and analyzed the data. PKB wrote the manuscript. BG and PKB edited the paper. All authors read and approved the paper.

LIST OF ABBREVIATIONS

HSG - Hysterosalpingography
IVF - In Vitro Fertilization

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CONFLICT OF INTEREST

The authors have no conflicting interests to declare.

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