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RESEARCH ARTICLE

"ROLE OF DIAGNOSTIC LAPAROSCOPY IN INFERTILITY: AN OBSERVATIONAL STUDY"

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Infertility, Diagnostic Laparoscopy, Primary Infertility, Secondary Infertility, Ovarian Factors, Tubal Factors, Uterine Factors, Clinical Evaluation

Abstract

Background: Infertility is a complex condition affecting numerous women worldwide. Diagnostic laparoscopy has emerged as a valuable tool in identifying underlying causes of infertility. This cross-sectional study, conducted at the Department of Obstetrics and Gynaecology, Government Hospital, Kota, aimed to assess the role of diagnostic laparoscopy in evaluating infertility.

Aim: To evaluate the demographic profile, clinical presentations, and laparoscopic findings in women undergoing infertility evaluation and to identify the association between age, duration of marriage, and type of infertility.

Material and Methods: A total of 100 women with infertility were included in this study. Participants' demographic data, clinical history, and anthropometric measurements were recorded. Laparoscopic procedures were performed to identify uterine, tubal, and ovarian factors contributing to infertility. The statistical analysis examined the association between age, duration of marriage, and infertility type, with significance determined by p-values.

Results: The study found that 65% of participants had primary infertility, with a higher prevalence among younger women and those married for shorter durations. A significant association was observed between age, marriage duration, and infertility type ($p = 0.001$ and $p = 0.0001$, respectively). Laparoscopy revealed ovarian factors as the most common cause of infertility (35%), followed by tubal (18%) and uterine factors (15%). Complications from the procedure were minimal, with only 2% experiencing extra-peritoneal air insufflation, 5% abdominal pain, and 1% wound sepsis.

Conclusion: Diagnostic laparoscopy plays a crucial role in identifying the causes of infertility, particularly in younger women with primary infertility and shorter marriage durations. The procedure is safe with low complication rates, making it a valuable tool in the comprehensive evaluation of infertility. These findings highlight the importance of individualized approaches to infertility management based on age and marriage duration.

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Introduction:-

Infertility is a prevalent and multifaceted condition affecting millions of couples worldwide, with a significant impact on their emotional well-being and quality of life [1]. According to the World Health Organization (WHO),

infertility is defined as the inability to conceive after one year of regular, unprotected sexual intercourse [2]. This condition affects approximately 10-15% of couples of reproductive age globally, making it a significant public health concern [3].

Infertility can be attributed to various underlying factors, including male and female factors, as well as a combination of both. The major causes of infertility include ovulatory dysfunction {20-40%}, tubal and peritoneal pathology {30-40%}, and male factors {30-40%}, uterine pathology is relatively uncommon and the remainder is largely unexplained.

For male factor infertility, semen analysis is the primary diagnostic tool, assessing various parameters such as volume, concentration, motility, and morphology. At least two semen analyses should be performed, unless the male has recently impregnated a partner.

Among the diagnostic tools available for evaluating female infertility, diagnostic laparoscopy has emerged as a gold standard method which is valuable and widely employed technique. Laparoscopy, also known as peritoneoscopy or pelviscopy, is a minimally invasive surgical procedure that allows direct visualization of the pelvic organs, including the uterus, fallopian tubes, ovaries, and surrounding structures [5]. This procedure involves the insertion of a thin, lighted telescopic instrument called a laparoscope through a small incision in the abdomen, typically near the navel [6].

The introduction of diagnostic laparoscopy has revolutionized the evaluation and management of infertility by providing invaluable insights into potential underlying pathologies that may not be readily identifiable through other diagnostic modalities [7]. Laparoscopy offers several advantages over traditional open surgical procedures, including reduced postoperative pain, shorter recovery times, and a lower risk of complications [8].

One of the primary indications for diagnostic laparoscopy in the context of infertility is the evaluation of tubal patency and the identification of tubal pathologies [9].

Another crucial application of diagnostic laparoscopy is the diagnosis and staging of endometriosis, a condition characterized by the growth of endometrial tissue outside the uterus [11]. Endometriosis is a leading cause of infertility, and laparoscopy is considered the gold standard for its diagnosis and assessment [12]. During the procedure, endometriotic lesions can be identified, and their extent and severity can be accurately evaluated, enabling appropriate treatment planning and potentially improving fertility outcomes [13]. In cases of unexplained infertility, where initial diagnostic tests and imaging studies fail to identify a clear cause, diagnostic laparoscopy can provide valuable insights [14].

Furthermore, diagnostic laparoscopy plays a crucial role in the assessment and management of uterine factors contributing to infertility.

In addition to its diagnostic capabilities, laparoscopy offers the potential for simultaneous therapeutic interventions, further enhancing its utility in the management of infertility [17]. During the same procedure, surgeons can perform procedures such as removal of endometriotic lesions, lysis (separation) of adhesions, tubal surgeries, or ovarian surgeries, potentially improving fertility outcomes without the need for additional surgical procedures [18].

These may include bleeding, infection, organ injury, anesthesia-related complications, and the rare possibility of conversion to open surgery if complications arise or adequate visualization is not achievable [19].

It is crucial to note that diagnostic laparoscopy should be viewed as part of a comprehensive diagnostic and treatment approach for infertility. The decision to proceed with laparoscopy is typically based on a thorough evaluation of the patient's medical history, fertility history, and results from other diagnostic tests, such as ovulation assessment, hormonal testing, and imaging studies [20]. Additionally, laparoscopy should be considered in the context of the patient's age, fertility goals, and potential risks and benefits associated with the procedure.

In recent years, the field of diagnostic laparoscopy has witnessed significant advancements and technological innovations, further enhancing its diagnostic and therapeutic potential. The integration of robotic-assisted laparoscopy, 3D and high-resolution imaging systems, fluorescence imaging techniques, and advanced tissue

manipulation tools have the potential to improve surgical precision, diagnostic accuracy, and patient outcomes [21, 22].

Ultimately, this observational study aims to provide a comprehensive assessment of the role of diagnostic laparoscopy in the evaluation and management of infertility, contributing to the growing body of evidence and potentially informing clinical practice guidelines and patient counseling strategies.

Purpose of the Study:-

The purpose of the study is to find out the “**Role of diagnostic Laparoscopy in infertility :- An Observational study**”

Aims and Objectives:-

Aims:-

To identify the role of diagnostic Laparoscopy in infertility.

Objectives:-

The objectives of this study is to analyze the findings in female on whom laparoscopy was performed for the evaluation & management of infertility.

Material and Method:-

Type of study:

Observational study.

Study Design :

Hospital based Study.

Place of study:

Department of Obstetrics and Gynaecology, government hospital, kota

Duration of study:

October 2022 onwards till Aug 2024.

Study Population:

All infertile women attending gynec OPD.

Sample size

The sample size was calculated as per the following formula:

Convenience sampling was done, and the sample size (n) was calculated as,

$$n = \frac{Z^2 \times p \times q}{e^2} = \frac{(1.64)^2 \times 0.37 \times 0.63}{(0.1)^2} = 93$$

Where,

- Z = 1.64 at 90% Confidence Interval
- p = prevalence 37 % of secondary infertility(as per seed article)**Error! Bookmark not defined.**
- q = 1-p
- e = margin of error, 10%

The sample size came as ninety three (n = 93). After rounded off we studied 100 cases.

Inclusion criteria:

- All infertile women whose husband showed normal semen analysis.

Exclusion criteria:

Genital Tuberculosis

- undiagnosed bleeding,
- Unwilling to participate

- Women with normal fertility

Methodology:-

This hospital-based study was conducted in the Department of Obstetrics at Medical College Kota. The database was accessed after obtaining institutional ethical approval. Written consent forms were taken from all the patients. Case records were obtained from October 2022 to September 2023. The proforma was used for data collection, which included recording the socioeconomic background of the subjects, such as age, detailed history regarding lifestyle, type of family, education, smoking, alcohol use, etc., followed by the determination of clinical data such as BMI, menstrual abnormalities, type of infertility, and treatment given.

The husbands of all the infertile patients underwent semen analysis after three days of abstinence. A thorough gynecological examination was performed on the patients, and all necessary investigations (baseline endocrinal investigations, antral follicle count, serum anti-Müllerian hormone, complete clinical history of the patient, ovulation study, post-menstrual HSG) were conducted, and the findings were recorded in the proforma. Abdominal ultrasound, hysterosalpingography on day 6, and hormonal assessments, including thyroid function tests and serum prolactin, were done routinely. AMH was performed on selected patients depending on their age.

Diagnostic laparoscopy with chromopertubation was done. Laparoscopy, a surgical procedure, allowed for endoscopic visualization of the peritoneal and pelvic cavities.

Statistical Analysis:

The questionnaires were initially checked for completeness, and data was cleaned for errors and missing values. The corrected data was then entered into Microsoft Excel after preparing a Master-chart. After data entry, one random form was picked and data entry was re-checked. Data analysis was done using licensed SPSS software version 24.0 (Chicago, Illinois). Univariate analyses were done initially and the results were presented with the help of tables, text, bar-diagrams and pie-charts. Descriptive statistics were used to calculate frequencies of categorical variables, and measures of central tendencies and dispersion were used to describe continuous variables.

Bi-variate analysis was done using the Chi-square test between the type of infertility and age and duration of marriage. p value < 0.05 was considered as statistically significant.

Results:-

The mean age of the study participants was 28.930 years, with a standard deviation of 3.3882 years. The age range of the participants was from 23.0 years to 34.0 years.

Table 1:- Distribution of study participants according to age.

Age	Frequency	Percent
≤25 years	19	19.0
26-30 years	43	43.0
31-40 years	38	38.0
Total	100	100.0

The distribution of study participants according to age was as follows: 19 participants (19.0%) were aged 25 years or younger, 43 participants (43.0%) were aged between 26 and 30 years, and 38 participants (38.0%) were aged between 31 and 40 years.

Table 2:- Distribution of study participants according to residence.

Residence	Frequency	Percent
Rural	34	34.0
Urban	66	66.0
Total	100	100.0

The distribution of study participants according to residence showed that 34 participants (34.0%) were from rural areas, while 66 participants (66.0%) were from urban areas.

Table 3:- Distribution of study participants according to education.

Education	Frequency	Percent
Illiterate	29	29.0
5th	14	14.0
8th	14	14.0
12th	24	24.0
graduate	19	19.0
Total	100	100.0

The distribution of study participants according to education revealed that 29% were illiterate, 14% had completed education up to 5th grade, another 14% had education up to 8th grade, 24% had completed up to 12th grade, and 19% were graduates.

Table 4:- Distribution of study participants according to occupation:

Occupation	Frequency	Percent
Housewife	72	72.0
Working	28	28.0
Total	100	100.0

The distribution of study participants according to occupation showed that 72% were housewives, while 28% were working woman.

Table 5:- Anthropometric measurement distribution of study participants:

	Weight (kg)	Height	BMI
Mean	57.79	162.43	21.94
Median	58.00	162.00	21.30
SD	6.79	3.36	2.80
Minimum	48.00	156.00	18.14
Maximum	69.00	169.00	26.11

The distribution of study participants based on anthropometric measurements revealed the following statistics:

- **Weight:** The mean weight was 57.79 kg with a standard deviation of 6.79 kg. The median weight was 58.00 kg, ranging from a minimum of 48.00 kg to a maximum of 69.00 kg.
- **Height:** The mean height was 162.43 cm with a standard deviation of 3.36 cm. The median height was 162.00 cm, ranging from a minimum of 156.00 cm to a maximum of 169.00 cm.
- **BMI:** The mean Body Mass Index (BMI) was 21.94 with a standard deviation of 2.80. The median BMI was 21.30, with values ranging from a minimum of 18.14 to a maximum of 26.11.

Table 6:- Distribution of study participants according to parity:

Parity	Frequency	Percent
Multi	20	20.0
Nullipara	80	80.0
Total	100	100.0

The distribution of study participants based on parity revealed that 20% (20 participants) were multiparous, while 80% (80 participants) were nulliparous.

Table 7:- Distribution of study participants according to duration of marriage:

Age	Frequency	Percent
Mean \pm SD	7.5 \pm 2.8 years	
\leq 5 years	35	35.0
6-10 years	45	45.0
>10 years	20	20.0
Total	100	100.0

The study participants had an average duration of marriage of 7.5 years with a standard deviation of 2.8 years. Out of the 100 participants, 35 (35.0%) had been married for 5 years or less, 45 (45.0%) had been married for 6 to 10 years, and 20 (20.0%) had been married for more than 10 years.

Table 8:- Distribution of study participants according to menstruation pattern:

Pattern	Frequency	Percent
Irregular	52	52.0
Regular	48	48.0
Total	100	100.0

Out of the 100 study participants, 52 (52.0%) reported having an irregular menstruation pattern, while 48 (48.0%) had a regular menstruation pattern.

Table 9:- Distribution of study participants according to menstruation flow:

Pattern	Frequency	Percent
Normal	40	40.0
Scanty flow	38	38.0
Heavy flow	22	22.0
Total	100	100.0

Out of the 100 study participants, 40 (40.0%) reported having a normal menstruation flow, 38 (38.0%) experienced scanty flow, and 22 (22.0%) had heavy flow.

Table 10:- Distribution of study participants according to type of infertility:

Infertility	Frequency	Percent
Primary	65	65.0
Secondary	35	35.0
Total	100	100.0

The table presented the distribution of study participants according to the type of infertility and showed that, out of the total 100 participants, 65 had experienced primary infertility (65%), while the remaining 35 participants had dealt with secondary infertility (35%).

Table 11:- Distribution of study participants according to HSG findings:

HSG findings	Frequency	Percent
Not done	82	82.0
Arcuate uterus	10	10.0
Cornual block	4	4.0
Unicornuate uterus	4	4.0
Total	100	100.0

The table presented the distribution of study participants according to HSG findings and showed that, out of the total 100 participants, 82 had not undergone HSG (82%), 10 had an arcuate uterus (10%), 4 had a cornual block (4%), and another 4 had a unicornuate uterus (4%), highlighting the various HSG findings within the study group.

Table 12:- Distribution of study participants according to Chromoperturbation:

Chromoperturbation	Frequency	Percent
Negative	60	60.0
Positive	40	40.0
Total	100	100.0

The table presented the distribution of study participants according to Chromoperturbation findings and showed that, out of the total 100 participants, 60 had negative results (60%), while 40 had positive results (40%),

Table 13:- Distribution of study participants according to complaints:

Complaints	Frequency	Percent
Lower abdominal pain	19	19.0
Weight loss/gain	11	11.0
Acne	31	31.0
Recurrent abortion	4	4.0
Menstrual irregularities	22	22.0
Dyspareunia/menorrhagia)	18	18.0

The table presented the distribution of study participants according to their complaints and showed that, out of the total participants, 19 had lower abdominal pain (19%), 11 experienced weight loss or gain (11%), 31 had acne (31%), 4 had recurrent abortion (4%), 22 reported menstrual irregularities (22%), and 18 had dyspareunia or menorrhagia (18%),

Table 14:- Distribution of study participants according to cause of infertility:

Cause	Frequency	Percent
Uterine factors	15	15.0
Tubal factors	18	18.0
Ovarian	35	35.0
Normal	32	32.0
Total	100	100.0

The table presented the distribution of study participants according to the cause of infertility on laparoscopic and showed that, out of the total 100 participants, 15 had uterine factors (15%), 18 had tubal factors (18%), 35 had ovarian factors (35%), and 32 were classified as normal (32%).

Table 15:- Distribution of study participants according to laparoscopic findings:

Laparoscopic findings	Frequency	Percent
Uterine factors (n=15)		
Fibroid	6	6.0
PID	9	9.0
Unicornuate uterus	3	3.0
Tubal factors (n=18)		
Unilateral Tubal block	10	10.0
Bilateral tubal block	3	3.0
Tubo-ovarian mass	2	2.0
B/L block with beaded appearance	2	2.0
Fimbrial cyst	1	1.0
Peritubal or periovarian adhesion	5	5.0
Ovarian (n=35)		
Bilateral ovarian cyst	22	22.0
Chocolate cyst	10	10.0
Simple cyst	3	3.0
PCOD	14	14.0
Normal	32	32.0

The table presented the distribution of study participants according to laparoscopic findings and showed the following results: among those with uterine factors (n=15), 6 had fibroids (6%), 9 had PID (9%), and 3 had a unicornuate uterus (3%). For participants with tubal factors (n=18), 10 had a unilateral tubal block (10%), 3 had a bilateral tubal block (3%), 2 had a tubo-ovarian mass (2%), 2 had a B/L block with a beaded appearance (2%), 1 had a fimbrial cyst (1%), and 5 had peritubal or periovarian adhesions (5%). Among those with ovarian factors (n=35), 22 had bilateral ovarian cysts (22%), 10 had a chocolate cyst (10%), 3 had a simple cyst (3%), and 14 had PCOD (14%). Additionally, 32 participants were classified as normal (32%), highlighting the variety of laparoscopic findings within the study group.

Table 16:- Distribution of study participants according to laparoscopic complications:

Complications	Frequency	Percent
Extra peritoneal insufflation of air	2	2.0
Abdominal pain	5	5.0
Wound sepsis	1	1.0

The table presented the distribution of study participants according to laparoscopic complications and showed that, out of the total participants, 2 experienced extra peritoneal insufflation of air (2%), 5 had abdominal pain (5%), and 1 had wound sepsis (1%).

Table 17:- Association of age with type of infertility:

Age	Primary	Secondary	p-value
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	Count	%	Count	%	0.001
≤25 years	19	29.2%	0	0.0%	
26-30 years	22	33.8%	21	60.0%	
31-40 years	24	36.9%	14	40.0%	
Total	65	100.0%	35	100.0%	

The table presents the association of age with the type of infertility among study participants. It shows that among participants aged ≤25 years, 19 had primary infertility (29.2%) and none had secondary infertility (0.0%). In the age group of 26-30 years, 22 had primary infertility (33.8%) and 21 had secondary infertility (60.0%). For participants aged 31-40 years, 24 had primary infertility (36.9%) and 14 had secondary infertility (40.0%). Overall, the table illustrates that primary infertility is more common in the younger age groups, while secondary infertility is more prevalent in the 26-30 and 31-40 years age groups. The p-value for this association is 0.001, indicating that the observed differences in the distribution of infertility types across age groups are statistically significant.

Table 18:- Association of duration of marriage with type of infertility:

Duration of marriage	Primary		Secondary		p-value
	Count	%	Count	%	
≤5 years	31	47.7%	4	11.4%	0.0001
6-10 years	34	52.3%	11	31.4%	
>10 years	0	0.0%	20	57.1%	
Total	65	100.0%	35	100.0%	

The table presents the association of the duration of marriage with the type of infertility among study participants. It shows that among participants married for ≤5 years, 31 had primary infertility (47.7%) and 4 had secondary infertility (11.4%). For those married for 6-10 years, 34 had primary infertility (52.3%) and 11 had secondary infertility (31.4%). In the group married for more than 10 years, none had primary infertility (0.0%) while 20 had secondary infertility (57.1%). This data highlights that primary infertility is more common in couples married for ≤10 years, whereas secondary infertility is predominantly seen in couples married for over 10 years. The p-value for this association is 0.0001, indicating that the differences in infertility types across marriage durations are statistically significant.

Summary and Conclusion:-

Current study was a cross sectional study, conducted at the Department of Obstetrics and Gynaecology, government hospital, Kota. This study aimed to identify the role of diagnostic Laparoscopy in infertility. A total 100 females with infertility were included in the study. Summary of the findings are follow-

Age:

The mean age of the study participants was 28.930 years, with a standard deviation of 3.3882 years. Nineteen participants (19.0%) were aged 25 years or younger, 43 participants (43.0%) were aged between 26 and 30 years, and 38 participants (38.0%) were aged between 31 and 40 years.

Residence:

The distribution of study participants according to residence showed that 34 participants (34.0%) were from rural areas, while 66 participants (66.0%) were from urban areas.

Education and Occupation:

The distribution of study participants according to education revealed that 29% were illiterate, 14% had completed education up to 5th grade, another 14% had education up to 8th grade, 24% had completed up to 12th grade, and 19% were graduates. The distribution of study participants according to occupation showed that 72% were housewives, while 28% were working women.

Anthropometric Measurements:

The mean weight was 57.79 kg with a standard deviation of 6.79 kg. The mean height was 162.43 cm with a standard deviation of 3.36 cm. The mean Body Mass Index (BMI) was 21.94 with a standard deviation of 2.80.

Parity:

The distribution of study participants based on parity revealed that 20% (20 participants) were multiparous, while 80% (80 participants) were nulliparous.

Duration of Marriage:

The study participants had an average duration of marriage of 7.5 years with a standard deviation of 2.8 years. Out of the 100 participants, 35 (35.0%) had been married for 5 years or less, 45 (45.0%) had been married for 6 to 10 years, and 20 (20.0%) had been married for more than 10 years.

Menstruation Pattern:

Out of the 100 study participants, 52 (52.0%) reported having an irregular menstruation pattern, while 48 (48.0%) had a regular menstruation pattern. Among the participants, 40 (40.0%) reported having a normal menstruation flow, 38 (38.0%) experienced scanty flow, and 22 (22.0%) had heavy flow.

Infertility Type:

The distribution of study participants according to the type of infertility showed that, out of the total 100 participants, 65 had experienced primary infertility (65%), while the remaining 35 participants had dealt with secondary infertility (35%).

HSG Findings:

The distribution of study participants according to HSG findings showed that, out of the total 100 participants, 82 had not undergone HSG (82%), 10 had an arcuate uterus (10%), 4 had a cornual block (4%), and another 4 had a unicornuate uterus (4%).

Chromoperturbation Findings:

The distribution of study participants according to Chromoperturbation findings showed that, out of the total 100 participants, 60 had negative results (60%), while 40 had positive results (40%).

Complaints:

The distribution of study participants according to their complaints showed that, out of the total participants, 19 had lower abdominal pain (19%), 11 experienced weight loss or gain (11%), 31 had acne (31%), 4 had recurrent abortion (4%), 22 reported menstrual irregularities (22%), and 18 had dyspareunia or menorrhagia (18%).

Laparoscopic Findings:

The distribution of study participants according to the cause of infertility on laparoscopy showed that, out of the total 100 participants, 15 had uterine factors (15%), 18 had tubal factors (18%), 35 had ovarian factors (35%), and 32 were classified as normal (32%). Among those with uterine factors, 6 had fibroids (6%), 9 had PID (9%), and 3 had a unicornuate uterus (3%). For participants with tubal factors, 10 had a unilateral tubal block (10%), 3 had a bilateral tubal block (3%), 2 had a tubo-ovarian mass (2%), 2 had a B/L block with a beaded appearance (2%), 1 had a fimbrial cyst (1%), and 5 had peritubal or periovarian adhesions (5%). Among those with ovarian factors, 22 had bilateral ovarian cysts (22%), 10 had a chocolate cyst (10%), 3 had a simple cyst (3%), and 14 had PCOD (14%).

Complications of Laparoscopy:

The distribution of study participants according to laparoscopic complications showed that, out of the total participants, 2 experienced extra peritoneal insufflation of air (2%), 5 had abdominal pain (5%), and 1 had wound sepsis (1%).

Fertility and Age:

Among participants aged ≤ 25 years, 19 had primary infertility (29.2%) and none had secondary infertility (0.0%). In the age group of 26-30 years, 22 had primary infertility (33.8%) and 21 had secondary infertility (60.0%). For participants aged 31-40 years, 24 had primary infertility (36.9%) and 14 had secondary infertility (40.0%). The p-value for this association is 0.001, indicating that the observed differences in the distribution of infertility types across age groups are statistically significant.

Duration of Marriage and Infertility:

Among participants married for ≤ 5 years, 31 had primary infertility (47.7%) and 4 had secondary infertility (11.4%). For those married for 6-10 years, 34 had primary infertility (52.3%) and 11 had secondary infertility (31.4%). In the group married for more than 10 years, none had primary infertility (0.0%) while 20 had secondary infertility (57.1%). The p-value for this association is 0.0001, indicating that the differences in infertility types across marriage durations are statistically significant.

Conclusion:-

This study on the role of diagnostic laparoscopy in infertility has provided comprehensive insights into the demographic profile, clinical presentations, and laparoscopic findings in women undergoing infertility evaluation. Key findings include a predominance of primary infertility (65%), particularly in younger age groups and shorter marriage durations, a high prevalence of menstrual irregularities, and significant associations between age, marriage duration, and infertility type. The laparoscopic findings demonstrated a diverse range of pathologies, with ovarian factors being most common (35%), followed by tubal (18%) and uterine (15%) factors. Importantly, the study also found low complication rates associated with the laparoscopic procedure, supporting its safety and utility in infertility evaluation.

These results underscore the multifaceted nature of infertility and highlight the valuable role of laparoscopy as a diagnostic tool. They emphasize the need for comprehensive, age-appropriate, and duration-specific approaches to infertility evaluation and management, potentially improving outcomes for infertile couples.

Strengths:

1. Comprehensive approach: The study examined a wide range of factors including demographic characteristics, clinical presentations, and laparoscopic findings, providing a holistic view of infertility in the study population.
2. Large sample size: With 100 participants, the study had sufficient power to detect significant associations and trends.
3. Detailed laparoscopic findings: The study provided a thorough breakdown of laparoscopic findings, offering valuable insights into the anatomical factors contributing to infertility.
4. Analysis of age and marriage duration: The study's examination of how age and marriage duration relate to infertility type provides important context for understanding infertility patterns.
5. Inclusion of complication data: By reporting on complications associated with laparoscopy, the study offers a balanced view of the procedure's risks and benefits.

Limitations:

1. Single-center study: As the research was conducted in one center, the findings may not be fully generalizable to other settings or populations.
2. Cross-sectional design: The study's cross-sectional nature limits the ability to establish causal relationships or track changes over time.
3. Limited male factor analysis: The study focused primarily on female factors, potentially overlooking the contribution of male factors to infertility.
4. Lack of long-term follow-up: The study does not provide information on long-term outcomes or pregnancy rates following laparoscopic evaluation and potential interventions.

Recommendations:-

1. Implement age and duration-specific protocols for infertility evaluation and management, recognizing the different patterns observed in various age groups and marriage durations.
2. Develop targeted screening programs for ovarian pathologies, given their high prevalence in the study population.
3. Enhance public health initiatives aimed at early detection and management of menstrual irregularities, which may be early indicators of fertility issues.
4. Conduct longitudinal studies to track long-term outcomes and pregnancy rates following laparoscopic evaluation and interventions.
5. Expand the study to multiple centers to improve generalizability and capture potential regional variations in infertility patterns.
6. Incorporate male factor analysis in future studies to provide a more comprehensive picture of infertility causes.

7. Develop and evaluate patient education programs to improve understanding of fertility issues and promote timely seeking of medical attention.

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