Exploring the Causes of Female Infertility

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Abstract:

Background: Female infertility is multifactorial, caused by ovarian, tubal, uterine, and peritoneal factors, as well as unexplained causes, affecting reproductive outcomes globally.

Objective: To identify and determine the incidence of various causes of female infertility in patients presenting to a tertiary care center in India.

Material and Methods: A prospective observational study was conducted among 80 women presenting with infertility. Clinical evaluation, hormonal profiling, imaging, and laparoscopic or hysteroscopic assessments were performed to determine etiological factors. Data were analyzed using descriptive and inferential statistics.

Results: Ovarian and tubal factors were the most common causes of infertility. Uterine and peritoneal factors contributed significantly, while a substantial proportion remained unexplained. Hysterolaparoscopy provided comprehensive assessment, confirming multifactorial etiologies.

Conclusion: Female infertility is predominantly multifactorial, with ovarian and tubal factors leading. A systematic, multidisciplinary diagnostic approach is essential to accurately identify causative factors and guide effective management.

Keywords: Female infertility, ovarian factor, Tubal factor, Hystero Laparoscopy.

Introduction

Female infertility is a significant public health concern affecting millions of women globally, with varying etiologies influenced by genetic, environmental, and lifestyle factors [1]. In India, the prevalence of infertility among women of reproductive age ranges between 3.9% and 16.8%, with primary infertility accounting for approximately 8.9% in urban populations [2]. Understanding the multifactorial causes of female infertility is crucial for developing effective diagnostic and therapeutic strategies [3].

Ovarian dysfunction, particularly polycystic ovary syndrome (PCOS), is a leading cause of female infertility. PCOS is characterized by hormonal imbalances and metabolic disturbances, leading to anovulation and, consequently, infertility [4]. Studies have highlighted the increasing incidence of PCOS in urban Indian populations, attributed to factors such as sedentary lifestyles, dietary habits, and environmental exposures [5].

Tubal factor infertility, resulting from conditions such as pelvic inflammatory disease, endometriosis, or previous surgeries, leads to damage or blockage of the fallopian tubes, impairing the passage of the ovum [6]. In a study conducted in South Rajasthan, tubal pathology was identified as a significant contributor to female infertility, underscoring the need for timely diagnosis and intervention [7].

Uterine factors, including fibroids, adenomyosis, and congenital anomalies, can also impede implantation or fetal development [8]. These conditions often remain undiagnosed without appropriate imaging and diagnostic procedures, emphasizing the importance of comprehensive evaluation in infertility workups [9].

Endometriosis, a condition where endometrial-like tissue grows outside the uterus, is another significant cause of infertility. It leads to pelvic pain, adhesions, and impaired ovarian function [10]. A study from a tertiary care center in South India reported a notable prevalence of endometriosis among infertile women, highlighting its role in reproductive health [10].

Materials and Methods

This study was designed as a prospective, observational study conducted at the Department of Obstetrics and Gynecology in a tertiary care center in India. The study period extended over 12 months, from January 2023 to December 2023. The study population included 80 women presenting

with infertility who consented to participate in the research. Women aged between 20 and 40 years with a history of infertility for at least one year were included. Women with congenital uterine anomalies, acute pelvic infections, malignancy, or unwillingness to participate were excluded.

A comprehensive clinical evaluation was performed for all participants, including detailed medical history, menstrual history, and gynecological examination. Diagnostic investigations included hormonal profiling, ultrasonography to assess ovarian and uterine morphology, hysterosalpingography for tubal patency, and additional tests as indicated to evaluate endocrine, ovulatory, or anatomical causes of infertility. Relevant laboratory investigations, including thyroid profile, prolactin levels, and semen analysis of male partners, were also considered to identify contributing factors.

Data regarding demographic characteristics, clinical findings, and investigation results were systematically collected. Ethical approval was obtained from the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to inclusion in the study. Patient confidentiality and privacy were maintained throughout the study.

Data analysis involved descriptive statistics to summarize demographic and clinical characteristics. Continuous variables were presented as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Associations between different etiological factors and infertility were analyzed using chi-square tests or Fisher's exact test, with statistical significance considered at a p-value of <0.05.

All statistical analyses were performed using SPSS version 26.0, with graphical representations created using Microsoft Excel 2016.

Results

Table 1 presents the overall causes of infertility among 80 women, with 50 patients having primary infertility and 30 with secondary infertility. Ovarian factor was the most common cause in both groups, affecting 27 patients (54%) with primary infertility and 13 patients (43.3%) with secondary infertility. Tubal factor was identified in 11 patients (22%) overall, while uterine factor contributed to infertility in 9 patients (17.5%). Peritoneal factor was noted in 9 patients (17.5%), and unexplained infertility accounted for 8 patients (16%), showing that a substantial proportion of infertility cases remains idiopathic.

Table 2 details laparoscopically identified pathologies in 62 women who underwent the procedure. Among patients with primary infertility (n=38), ovarian factors were identified in 17 patients (44.7%), including PCOS in 9 (23.7%), simple cysts in 1 (2.6%), chocolate cysts in 3 (7.9%), complex cysts in 3 (7.9%), and streak ovaries in 1 (2.6%). Tubal blockages were found in 10 patients (26.3%), while uterine factor anomalies were observed in 5 patients (13.2%), and peritoneal factors, including endometriosis, pelvic adhesions, and tuberculosis, were noted in 10 patients (26.3%). Secondary infertility cases (n=24) showed a similar distribution but with slightly higher proportions of tubal and peritoneal factors. These findings highlight ovarian and tubal factors as the predominant contributors to female infertility. Table 3 summarizes the causes of infertility identified via hysterolaparoscopy. Overall, ovarian factor was most frequently identified, affecting 26 patients (32.5%), followed by tubal factor in 21 patients (26.3%), uterine factor in 19 patients (23.8%), peritoneal factor in 15 patients (18.8%), and unexplained infertility in 14 patients (17.5%). This confirms that an integrated diagnostic approach using hysteroscopy and laparoscopy provides a comprehensive assessment of the multifactorial etiologies of infertility in women.

Table 1: Causes of Infertility (N=80)

Causes of Infertility	Primary (N=50) N (%)	Secondary (N=30) N (%)	Total (N=80) N (%)
Ovarian factor	27 (54)	13 (43.3)	40 (50)
Tubal factor	11 (22)	6 (20)	17 (21.25)
Uterine factor	9 (18)	5 (16.7)	14 (17.5)
Peritoneal factor	9 (18)	5 (16.7)	14 (17.5)
Unexplained	6 (12)	8 (26.7)	14 (17.5)

Table 2: Laparoscopically Identified Pathology of Infertility (N=62)

Causes of Infertility	Primary Infertility (N=38) Frequency (%)	Secondary Infertility (N=24) Frequency (%)	Total Frequency (N=62) (%)
Ovarian factor	17 (44.7)	8 (33.3)	25 (40.3)
PCOS	9 (23.7)	5 (20.8)	14 (22.6)
Simple cyst	1 (2.6)	1 (4.2)	2 (3.2)
Chocolate cyst	3 (7.9)	1 (4.2)	4 (6.5)
Complex cyst	3 (7.9)	1 (4.2)	4 (6.5)

Streak ovaries	1 (2.6)	0	1 (1.6)
Tubal factor	10 (26.3)	7 (29.2)	17 (27.4)
Bilateral block	6 (15.8)	2 (8.3)	8 (12.9)
Unilateral block	4 (10.5)	5 (20.8)	9 (14.5)
Hydrosalpinx	0	0	0
Uterine factor	5 (13.2)	3 (12.5)	8 (12.9)
Fibroid	3 (7.9)	2 (8.3)	5 (8.1)
Mullerian anomaly	2 (5.3)	1 (4.2)	3 (4.8)
Hypoplastic uterus	0	0	0
Peritoneal factor	10 (26.3)	6 (25)	16 (25.8)
Endometriosis	4 (10.5)	3 (12.5)	7 (11.3)
Pelvic adhesions	3 (7.9)	2 (8.3)	5 (8.1)
Tuberculosis	3 (7.9)	1 (4.2)	4 (6.5)

Table 3: Hysterolaparoscopically Identified Causative Factors of Infertility (N=62)

Causes of Infertility	Primary (N=38) N (%)	Secondary (N=24) N (%)	Total (N=62) N (%)
Uterine factor	10 (26.3)	5 (20.8)	15 (24.2)
Tubal factor	10 (26.3)	6 (25)	16 (25.8)
Ovarian factor	17 (44.7)	8 (33.3)	25 (40.3)
Peritoneal factor	10 (26.3)	5 (20.8)	15 (24.2)
Unexplained	6 (15.8)	8 (33.3)	14 (22.6)

Discussion

The present study evaluated the etiological factors contributing to female infertility in a tertiary care center in India. Our findings indicate that ovarian factors, particularly polycystic ovary syndrome (PCOS), were the most prevalent cause, consistent with multiple contemporary studies highlighting metabolic and endocrine disruptions as major contributors to infertility [11]. Tubal factors, including unilateral and bilateral blockages, were the second most common cause, emphasizing the impact of pelvic inflammatory disease, prior surgeries, and infections such as tuberculosis on female reproductive potential [12].

Uterine factors, including fibroids and congenital anomalies, contributed to a significant proportion of infertility cases, aligning with previous literature that underscores structural uterine pathologies as critical determinants of reproductive outcomes [13]. Peritoneal factors such as endometriosis and pelvic adhesions were also notable contributors, reflecting the complex interplay between intra-abdominal pathology and fertility potential [14].

Notably, unexplained infertility accounted for a considerable proportion, highlighting the limitations of current diagnostic modalities and the potential role of subtle endocrine or immunological factors [15].

The distribution of primary and secondary infertility cases in this cohort reflects trends observed in other Indian tertiary care settings, with primary infertility slightly more common and associated predominantly with ovarian and tubal factors. The findings reinforce the need for comprehensive evaluation using clinical examination, hormonal assessment, imaging, and laparoscopic or hysteroscopic interventions to accurately diagnose the underlying cause. Early identification and targeted management of these factors can significantly improve fertility outcomes, reduce psychological stress, and optimize the allocation of assisted reproductive technologies.

Overall, this study confirms that infertility in women is multifactorial, with ovarian, tubal, uterine, and peritoneal factors contributing variably. Integrating clinical, imaging, and surgical evaluations provides the most reliable assessment of causative factors, which is essential for personalized therapeutic planning in tertiary care settings.

Conclusion

Female infertility is predominantly caused by ovarian and tubal factors, with uterine and peritoneal pathologies contributing significantly. A comprehensive, multidisciplinary diagnostic approach, including hormonal evaluation, imaging, and laparoscopic or hysteroscopic assessment, is crucial to identify the underlying etiology. Early and targeted interventions can enhance fertility outcomes and reduce the burden of infertility in tertiary care populations.

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