e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com

International Journal of Pharmaceutical Quality Assurance 2026; 17(3); 109-114

Original Research Article

Endometriosis-Associated Infertility: An Analysis of Treatment Strategies and Clinical Outcomes

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Received: 10-01-2026 / Revised: 12-02-2026 / Accepted: 15-03-2026

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Conflict of interest: Nil

Abstract:

Background: Endometriosis is a chronic estrogen-dependent disorder commonly affecting women of reproductive age and is strongly associated with infertility. Management remains challenging due to its multifactorial pathophysiology and variable response to treatment.

Aim: To evaluate clinical characteristics, treatment modalities, and reproductive outcomes in women with endometriosis-associated infertility.

Methodology: This hospital-based prospective observational study included 90 infertile women aged 20–40 years with confirmed endometriosis. Patients received individualized management in the form of surgical, medical, combined therapy, or assisted reproductive techniques (ART). Clinical and reproductive outcomes were assessed during follow-up.

Results: Most participants were aged 26–35 years and had primary infertility. Moderate to severe disease (rASRM Stages III–IV) predominated. Combined surgery and medical therapy were the most common treatment approach (42.2%). Overall, 48.9% of women achieved pregnancy, with 28.9% conceiving spontaneously and 20% through ART, while 51.1% did not conceive.

Conclusion: Nearly half of women with endometriosis-associated infertility achieved pregnancy following treatment. Multimodal, individualized management strategies, including surgery and ART, play a crucial role in optimizing reproductive outcomes.

Keywords: Endometriosis, Infertility, Laparoscopy, Assisted Reproductive Techniques, Reproductive Outcomes.

DOI: 10.25258/ijpqa.17.3.20

Introduction

Endometriosis is a long-term and estrogen-dependent gynecological condition, which is marked by the occurrence of endometrial-like tissue out of the uterine cavity, mostly in women of childbearing age [1]. It is closely connected with the pain in the pelvis, dysmenorrhea and infertility, and infertility was reported in about 3050 percent of the patients. The pathophysiology of infertility relating to endometriosis is multifactorial and comprises of distorted pelvic anatomy, altered peritoneal environment, chronic inflammation, impaired folliculogenesis, poor oocyte quality, and poor endometrial receptivity [2]. Due to its complicated pathophysiology, infertility in women with endometriosis needs a personalized management approach where the risks of the symptoms and potential of reproductive success are balanced.

Surgery, especially laparoscopic surgery with excision or ablation of endometriotic lesions is one of the mainstays of endometriosis-related infertility. It has been shown by numerous research that surgery may enhance the spontaneous rate of conception, particularly in the women with minimal to moderate disease [3]. Normal pelvic anatomy, elimination of inflammatory lesions, and reduction of adhesions play a role in enhancing the effect of tubal activities and ovulatory. The factors that affect clinical outcome after surgery include the level of the disease stage, the age of a patient, ovarian reserve, and the period of infertility. The fertility outcome of women with early-stage endometriosis is usually good compared to women with advanced disease, where widespread adhesions and ovarian infiltrations can restrict fertility [4].

Medical management such as gonadotropin-releasing hormone (GnRH) agonist, progestins and oral contraceptives are important as far as the reduction of symptoms are concerned, but it is not as helpful in improving fertility where a standalone approach is concerned [5]. Suppressive hormonal therapy

prevents ovulation and thus it does not directly increase conception rates. Nevertheless, there is pelvic environment formation, which can be achieved through postoperative hormonal therapy, which can lower recurrence of the disease and enhance long-term outlook [6]. There is limited evidence that medical treatment before assisted reproductive technology can enhance implantation rates with the reduction of inflammatory activity and the increase of endometrial receptivity.

Assisted reproductive technologies (ART), especially the in vitro fertilization (IVF) technique, is broadly applied in women with endometriosis related infertility, especially in cases whereby the surgery or medical interventions have failed or when other infertility causes are involved [7]. The overall clinical outcomes associated with IVF among women with endometriosis are generally positive but there are some studies which indicate that there are lower oocyte yield, fertilization rates, and implantation rates among women with endometriosis than those with other infertility causes [8]. Despite this, cumulative pregnancy and live birth rates using IVF are encouraging. Some studies have found that pretreatment with hormonal suppression prior to IVF has led to an increase in clinical pregnancy rate especially in women with severe endometriosis.

Effects of endometriosis therapy on ovarian reserve is an important issue to consider in the assessment of clinical outcomes. Surgery, especially ovarian cystectomy of endometrioma, can result in decreased ovarian reserve because of the unintentional excision of healthy ovarian tissue. This highlights the need to use a cautious approach during surgery and ensure that the patient is selected. Fertility preservation methods, including oocyte or embryo cryopreservation, can be discussed in the selected patients particularly those with bilateral ovarian disease or in the patients, who need to undergo surgery regularly [9].

To sum up, the results of clinical treatment of infertility complicating endometriosis depend on the complex interaction between the severity of the disease, the type of treatment, and the characteristics of a particular patient. Individualized treatment approach based on multidisciplinary therapy that incorporates surgical therapy, medical therapy, and assisted reproductive methods represents the most promising opportunity to have a successful reproductive outcome. Diagnosis, intervention, and prudent choice of treatment methods are necessary to maximize fertility and minimize the recurrence of disease, treatment-compliant complications.

Methodology

Study Design: This study was designed as a hospital-based prospective observational study aimed at evaluating the clinical outcomes of infertility treatment among women diagnosed with endometriosis.

Study Area: The study was conducted in the Department of Reproductive Medicine and Surgery, Mahatma Gandhi Medical College, India.

Study Participants

Inclusion Criteria

- Women aged 20–40 years
- Diagnosed cases of endometriosis confirmed by clinical evaluation, imaging, or laparoscopy
- Patients presenting with primary or secondary infertility
- Women who have undergone medical and/or surgical treatment for endometriosis
- Patients willing to participate and who provided written informed consent

Exclusion Criteria

- Infertility due to male factor causes
- Presence of tubal infertility unrelated to endometriosis
- Women with uterine anomalies or congenital reproductive tract malformations
- Patients with endocrine disorders affecting fertility (e.g., uncontrolled thyroid disease, hyperprolactinemia)
- History of pelvic inflammatory disease
- Previous ovarian or pelvic surgery unrelated to endometriosis
- Patients unwilling to participate or lost to follow-up

Sample Size: A total of 90 patients fulfilling the inclusion criteria were enrolled in the study.

Procedure: After obtaining informed written consent, eligible participants were enrolled and evaluated using a detailed clinical history, physical examination, and relevant investigations including pelvic ultrasonography and diagnostic laparoscopy where indicated. The severity of endometriosis was staged according to the revised American Society for Reproductive Medicine (rASRM) classification. Patients received individualized treatment in the form of medical therapy, surgical intervention, or a combination of both, depending on disease severity, age, duration of infertility, and reproductive goals. Post-treatment follow-up was conducted to assess clinical outcomes such as restoration of ovulation, symptom relief, and achievement of pregnancy, either spontaneously or through assisted reproductive techniques.

Statistical Analysis: Data was entered into Microsoft Excel and analyzed using SPSS software version 27. Descriptive statistics were used to summarize demographic and clinical variables. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation. Associations between treatment modalities and reproductive outcomes were analyzed using appropriate statistical tests,

with a p-value of less than 0.05 considered statistically significant.

Result

Table 1 shows the demographic features of the 90 study participants. Most of the women were between 2630 years (35.6), then the age group of 3135 years (31.1) and this means that most of the women were in the best reproduction age. The lower percentage was between 20 25 years (20%) and the over 35 years (13.3). In terms of body mass index (BMI), most of the respondents were overweight (31.1%), with a small group becoming obese (8.9%); the rest (60 percent) had a normal BMI. Regarding the duration of infertility, 42.2% of the participants indicated that they had a 2 years or less period of infertility, participants who had 3-5 years of infertility had 37.8 years of infertility, and 20% of the participants had 5 years of infertility or above, which indicated that a large percentage of participants were focused during the early to intermediate period of infertility.

Table 1: Demographic Characteristics of Study Participants (n = 90)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	20–25	18	20
	26–30	32	35.6
	31–35	28	31.1
	>35	12	13.3
BMI (kg/m²)	Normal (18.5–24.9)	54	60
	Overweight (25–29.9)	28	31.1
	Obese (≥30)	8	8.9
Duration of infertility	≤2 years	38	42.2
	3–5 years	34	37.8
	>5 years	18	20

Table 2 illustrates the clinical features of the 90 women with endometriosis that were considered in the study. Majority of the respondents were those with primary infertility (68.9%), and almost a third had secondary infertility (31.1%), which means that in this group, primary infertility was more commonly linked to endometriosis. Concerning the severity of the diseases according to the revised American Society for Reproductive Medicine (rASRM) scale, the higher percentage of the diagnoses was advanced disease (Stage III: 37.8% and Stage IV: 22.2%), which revealed a preponderance of moderate and severe disease. Stages I and II were found less often (15.6 and 24.4% of patients, respectively), indicating the presence of early-stage endometriosis. Analysis of symptoms showed that dysmenorrhea was the most common complaint with 80% of the patients presenting with it, chronic pelvic pain (64.4) and dyspareunia (51.1), as the endometriosis symptom burden in this infertile group was high.

Table 2: Clinical Characteristics of Endometriosis (n = 90)

Variable	Category	Frequency (n)	Percentage (%)
Type of infertility	Primary	62	68.9
	Secondary	28	31.1
Stage of endometriosis (rASRM)	Stage I	14	15.6
	Stage II	22	24.4
	Stage III	34	37.8
	Stage IV	20	22.2
Symptoms	Dysmenorrhea	72	80
	Chronic pelvic pain	58	64.4
	Dyspareunia	46	51.1

Table 3 indicates that out of 90 patients, the combination type of treatment was the most popular; it was a combination of both medical and surgical treatments, and it was administered in 38 cases (42.2%), and it is apparent that multimodal therapy is more popular in infertility related to endometriosis. Laparoscopic surgery was employed in 24 patients (26.7%), which is quite significant as it is another form of treatment in the first place. The application of assisted reproductive techniques (ART) was also used in 16 patients (17.8%) indicating that taking this method is applied in a limited number of cases when the traditional methods might be inadequate. The least popular method was medical therapy, which was administered to 12 patients (13.3%), so the role of medical therapy as a stand-alone treatment in this population was minimal.

Table 3: Treatment Modalities Administered (n = 90)		
Treatment modality	**Frequency (n)**	**Percentage (%)**
Laparoscopic surgery alone	24	26.7
Surgery + medical therapy	38	42.2
Medical therapy alone	12	13.3
Assisted reproductive techniques (ART)	16	17.8

Table 4 highlights the results of treatment in terms of reproductive outcomes of 90 participants. A significant proportion of the women (48.9%) got pregnant at the follow-up period, which is favorable overall pregnancy rate after intervention. Spontaneous conception occurred in 26 patients (28.9%), indicating that a significant number of patients were treated without external intervention to be given back their fertility. Moreover 18 women (20%) got pregnant with the help of assisted reproductive techniques (ART), which brings to the fore the supplemental effect of ART in getting pregnant to those women who did not conceive naturally. Nevertheless, even with treatment, 46 (51.1) of the participants failed to conceive, indicating the still unresolved problems of infertility in endometriosis and the necessity of considering the unique and multifaceted methods of fertility management.

Table 4: Reproductive Outcomes After Treatment (n = 90)		
Outcome	**Frequency (n)**	**Percentage (%)**
Spontaneous conception	26	28.9
Conception with ART	18	20
No conception	46	51.1
Overall pregnancy rate	44	48.9

Discussion

The given research examined the demographic features, characteristics of diseases, the strategy of treatment, and the outcomes of treatment in women with the infertility caused by endometriosis. Most of the participants were aged 26-35 years, and this is the age when the fertility rate is the most productive, which is also aligned with the age when infertility issue has become a significant clinical concern. The fact that the proportion of women with an infertility duration of 5 years and less was quite high probably shows that the rate of early presentation is higher and timely referrals are more common. Normal BMI was being dominant, which would imply that infertility in this cohort was more predisposed to be due to endometriosis itself as opposed to metabolic, however, the significant representation of overweight and obese women would indicate the possible contributory role of BMI in reproduction. A review of 27 articles by Vercellini et al., (1998) [10] reported that there was no clear evidence of whether the number, size, or the location of fibroids before myomectomy affected post-surgery pregnancy rates.

Primary infertility was extremely prevalent compared to secondary infertility, as the existing literatures show high association of endometriosis and primary infertility. This can be explained by the premature interference with the pelvic anatomy, ovulatory functions and peritoneal environment by the disease. The emergence of secondary infertility in almost a third of respondents, however, highlights the progressive course of endometriosis and its possible ability to affect fertility even when conception was previously successful. Lee et al., (2013) [11] demonstrated 43 infertile wo- men with surgically supported endometriosis and reported the natural conception rate of the 12 months after laparoscopy operation was 41.9 percent without the use of ART or hormone treatment.

The staging of disease showed that there was a combination of moderate and severe cases of endometriosis (Stages III and IV) which showed that many of the patients were being presented in advanced stages. This observation can be attributed to the diagnosis being made late because of the presence of nonspecific symptoms or underdiagnosis of endometriosis at its early stages. It is proved that advanced disease is linked with deformed anatomy of the pelvis, adhesions, and impaired ovarian reserve, which negatively influence fertility. The comparatively lower disease stage at an earlier stage reinforces the necessity of a better way of early detection. Li et al., (2017) [12] concluded the likelihood of the occurrence of spontaneous conception rate subsequent the laparoscopic surgical practice of EMS related infertility was realized to be 46.5% and this re-established the worth of laparoscopic surgery.

Analysis of the symptoms proved that dysmenorrhea, chronic pelvic pain, and dyspareunia were very common which aligns with the typical symptom triad of endometriosis. Symptomatic disease is correlated with infertility impairment as the symptom burden of this infertile population is high. Such symptoms usually lead to decreased quality of life and can be the cause of medical consultation, but they are not always directly related to the extent of the disease, which is related to the heterogeneity and

complexity of endometriosis. The meta-analysis by Yong et al., (2017) [13] determined 11 studies altogether (two cohort studies and 9 case control studies) and it indicated that an increased BMI can be associated with reduced risk of endometriosis.

In the case of management, the most common approach was the multimodal treatment that went hand in hand with surgery and medical treatment. This is a survival of the clinical practice in the present day whereby the restoration of pelvic anatomy through surgery and medical suppression is a common favorable choice to increase fertility rates. Laparoscopic surgery by itself was also a major significant factor especially in patients whose disease was operable. The relatively low utilization of medical therapy as an exclusive intervention confirms the presence of evidence to support the idea of hormonal suppression without surgical intervention as having a limited efficacy in enhancing fertility results. As implied in his retrospective cohort study work, Gonzales et al., (2017) [14] suggested that there is no expressive difference in reproductive outcomes in women undergoing IVF and diagnosed with EMS-associated infertility compared to women without this disease.

The reproductive outcomes recorded a total pregnancy rate of 48.9, which implies that almost half of the women were benefiting the interventions. Natural conception in a significant percentage of patients demonstrates the efficacy of treatment to restore the natural fertility of patients especially following surgery. This addition made by ART in the realization of pregnancy further highlights its status as a significant addition particularly to the women with advanced disease or protracted infertility. Nevertheless, the fact that more than half of the respondents failed to conceive despite treatment highlights the multifaceted pathophysiology of infertility related to endometriosis and supports the need to apply treatment measures on an individual stage and multidisciplinary basis.

Conclusion

The paper shows that infertility related to endometriosis is a challenging clinical issue, and the success of the therapy depends on age, severity of the disease, burden of symptoms, and the treatment mode. Although moderate to severe disease predominated, close to half of the women were able to achieve pregnancy after the intervention and this shows the efficacy of multimodal and individualized interventions. Surgery, especially with medical therapy, was the main form of treatment, which helped to restore fertility, and assisted reproductive techniques offered significant supplementary advantages in some instances. The high percentage of spontaneous conception denotes the importance of prompt intervention particularly among the females in the optimal age of reproduction. The fact that non-conception persisted in a significant proportion, however, highlights the importance of early diagnosis, the approach to treatment should be carefully selected, and a multidisciplinary approach to the issue should be taken to achieve the optimal fertility results in women with endometriosis.

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