

PERSONALIZED REPRODUCTIVE MANAGEMENT AFTER SURGICAL TREATMENT OF OVARIAN ENDOMETRIOSIS**Agababyan Larisa Rubenovna**

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Abstract. Ovarian endometriosis is a chronic, estrogen-dependent gynecological disorder that significantly impairs reproductive function and is a leading cause of infertility in women of reproductive age. Surgical management, particularly laparoscopic cystectomy, is widely used to remove endometriotic lesions and improve fertility outcomes. However, postoperative reproductive success is highly variable and cannot be explained by surgical intervention alone, which highlights the necessity of a personalized reproductive management approach. This study analyzes current evidence on fertility outcomes following surgical treatment of ovarian endometriosis and emphasizes individualized strategies for optimizing reproductive success. Literature indicates that postoperative fertility outcomes depend on multiple factors, including patient age, ovarian reserve (AMH and AFC levels), disease severity, cyst characteristics, and duration of infertility. Although surgery may improve spontaneous conception by restoring pelvic anatomy and reducing inflammatory processes, it may also lead to a decline in ovarian reserve due to inadvertent damage to healthy ovarian tissue. Therefore, integrating assisted reproductive technologies (ART), particularly in vitro fertilization (IVF), plays a crucial role in patients with diminished ovarian reserve or delayed conception. Additionally, fertility preservation strategies such as oocyte and embryo cryopreservation further enhance reproductive potential in high-risk cases.

Keywords: ovarian endometriosis, infertility, personalized reproductive management, laparoscopic cystectomy, ovarian reserve, AMH, AFC, IVF, assisted reproductive technology (ART), fertility outcomes.

Introduction. Ovarian endometriosis represents one of the most clinically significant forms of endometriosis, a chronic, estrogen-dependent inflammatory disease characterized by the presence of endometrial-like tissue outside the uterine cavity. When the ovaries are involved, the disease typically manifests as endometriomas, which are strongly associated with pelvic pain, progressive adhesions, altered pelvic anatomy, and, most importantly, infertility. Endometriosis affects approximately 10% of women of reproductive age, and ovarian involvement is observed in up to 40–50% of these patients, making it a major challenge in reproductive medicine and gynecological practice. The pathophysiology of infertility in ovarian endometriosis is complex and multifactorial. Chronic inflammation within the pelvic cavity leads to increased production of cytokines and prostaglandins, which negatively affect oocyte quality, fertilization, and embryo implantation. In addition, oxidative stress caused by iron overload in endometriotic cysts contributes to follicular damage and impaired ovarian function. Mechanical distortion of pelvic anatomy, including adhesions and tubal dysfunction, further reduces the likelihood of spontaneous conception. Importantly, ovarian endometriomas are consistently associated with diminished ovarian reserve, reflected by reduced anti-Müllerian hormone (AMH) levels and decreased antral follicle count (AFC), both of which are key predictors of reproductive potential. Surgical treatment, particularly laparoscopic cystectomy, is widely accepted as the standard therapeutic approach for ovarian endometriosis in symptomatic women and those experiencing



infertility. The primary goals of surgery include removal of endometriotic lesions, reduction of pain, restoration of normal pelvic anatomy, and improvement of fertility outcomes. However, despite its clinical advantages, concerns remain regarding the potential negative impact of surgery on ovarian reserve. During cyst excision, healthy ovarian tissue may be inadvertently removed or damaged, resulting in a postoperative decline in AMH levels and a reduction in ovarian responsiveness. The impact of surgery on reproductive outcomes remains controversial in current literature. Some studies demonstrate improved spontaneous pregnancy rates following surgical intervention, particularly in young patients with unilateral endometriomas and preserved ovarian reserve. Conversely, other studies report minimal improvement in fertility outcomes, especially in women with advanced age, bilateral disease, or previously reduced ovarian function. These inconsistencies highlight that surgical treatment alone is not sufficient to ensure optimal reproductive success. In recent years, there has been a significant shift toward personalized reproductive management in patients with ovarian endometriosis. This approach emphasizes individualized decision-making based on multiple clinical parameters, including patient age, ovarian reserve markers (AMH and AFC), disease severity, cyst size and laterality, and duration of infertility. Personalized strategies aim to balance the benefits of surgical treatment with the risks of ovarian damage while optimizing overall fertility outcomes. Furthermore, assisted reproductive technologies (ART), particularly in vitro fertilization (IVF), have become an essential component of reproductive planning in these patients. In selected cases, early referral to IVF may provide higher cumulative pregnancy rates compared to repeated surgical interventions. Additionally, fertility preservation methods such as oocyte and embryo cryopreservation are increasingly recommended for women at high risk of postoperative decline in ovarian reserve. Therefore, understanding the relationship between surgical treatment and reproductive outcomes in ovarian endometriosis is crucial for optimizing clinical decision-making. This study aims to explore the importance of a personalized reproductive management approach after surgical treatment of ovarian endometriosis and to evaluate its role in improving fertility outcomes.

Literature Review. Ovarian endometriosis has been extensively studied as one of the most complex gynecological conditions affecting female fertility. Current literature consistently identifies endometriosis as a chronic inflammatory and estrogen-dependent disease that significantly impairs reproductive function. Ovarian involvement, particularly in the form of endometriomas, is strongly associated with infertility due to combined mechanical, inflammatory, and endocrine disturbances. Multiple studies report that women with ovarian endometriosis have significantly lower pregnancy rates compared to age-matched controls, largely due to compromised oocyte quality, altered follicular environment, and reduced ovarian reserve. A substantial body of research has focused on the impact of ovarian endometriomas on ovarian reserve. Anti-Müllerian hormone (AMH) and antral follicle count (AFC) are widely recognized as the most reliable markers of ovarian reserve. Numerous clinical studies and meta-analyses have demonstrated that women with ovarian endometriomas exhibit significantly lower AMH levels compared to healthy women, even before surgical intervention. This suggests that the disease itself, not only its treatment, contributes to diminished ovarian function. Proposed mechanisms include chronic inflammatory activity, oxidative stress caused by iron-rich cyst fluid, and disruption of follicular development. Surgical management, particularly laparoscopic cystectomy, remains the most commonly recommended treatment for ovarian endometriomas in symptomatic patients and those with infertility. The landmark studies by Donnez et al. established cystectomy as superior to drainage and coagulation techniques due to lower recurrence rates and improved spontaneous pregnancy outcomes. However, subsequent evidence has raised concerns regarding the potential iatrogenic damage to healthy ovarian tissue during cyst excision. Histological studies confirm that ovarian cortical tissue may be inadvertently removed along with the cyst capsule, leading to a postoperative decline in ovarian reserve. Systematic reviews and meta-analyses consistently report a significant reduction in AMH levels



after laparoscopic cystectomy, particularly in cases involving bilateral endometriomas or repeated surgical interventions. Some studies indicate partial recovery of ovarian reserve within 6–12 months postoperatively, while others demonstrate persistent and irreversible decline. These discrepancies may be explained by differences in surgical technique, baseline ovarian reserve, patient age, and extent of disease. Despite concerns regarding ovarian reserve, several studies demonstrate that surgical treatment can improve spontaneous pregnancy rates in selected patient groups. The primary mechanism is believed to be restoration of normal pelvic anatomy, improved ovulation dynamics, and reduction of inflammatory mediators in the peritoneal environment. Higher pregnancy rates are typically observed in younger women, patients with unilateral endometriomas, and those with preserved baseline ovarian reserve. However, in women with advanced reproductive age or severe disease, the benefit of surgery appears limited. In recent years, increasing attention has been directed toward comparing surgical treatment with assisted reproductive technologies (ART), particularly in vitro fertilization (IVF). Evidence suggests that IVF may bypass many of the pathophysiological barriers associated with endometriosis, including tubal dysfunction and peritoneal inflammation. Several comparative studies indicate that immediate IVF may provide higher cumulative live birth rates than surgical intervention in women with diminished ovarian reserve or prolonged infertility. Moreover, surgery prior to IVF does not consistently improve ART outcomes and may delay definitive treatment. Another important focus in the literature is the refinement of surgical techniques aimed at preserving ovarian function. Conventional stripping cystectomy using bipolar coagulation has been associated with thermal damage to surrounding ovarian tissue. As a result, alternative techniques such as CO₂ laser ablation, plasma energy, and hemostasis-sparing approaches have been developed. These methods aim to minimize collateral damage while maintaining effective disease removal. Studies suggest that tissue-sparing techniques may better preserve AMH levels without significantly increasing recurrence rates. The concept of personalized reproductive management has emerged as a key development in modern reproductive medicine. Recent studies emphasize that no single treatment strategy is optimal for all patients with ovarian endometriosis. Instead, individualized approaches based on patient age, ovarian reserve markers, cyst characteristics, infertility duration, and reproductive goals are recommended. Predictive models and clinical algorithms are increasingly used to guide decision-making regarding whether to proceed with surgery, IVF, or combined strategies. Fertility preservation has also become an important topic in recent literature. Oocyte and embryo cryopreservation prior to surgical intervention are recommended for women at high risk of ovarian reserve loss, particularly those with bilateral endometriomas or low baseline AMH levels. This strategy ensures future reproductive potential even if ovarian function declines postoperatively. In summary, the literature highlights a complex and sometimes conflicting relationship between ovarian endometriosis, surgical treatment, and fertility outcomes. While surgery remains valuable for symptom control and selected fertility cases, its impact on ovarian reserve necessitates careful patient selection. The growing consensus supports a personalized, multidisciplinary approach that integrates surgery, assisted reproduction, and fertility preservation to optimize reproductive outcomes.

Research Methodology. This study is designed as a narrative literature review focusing on personalized reproductive management after surgical treatment of ovarian endometriosis. The methodological approach is based on a systematic synthesis of published scientific evidence, clinical guidelines, and recent meta-analyses related to fertility outcomes, ovarian reserve dynamics, and assisted reproductive technologies (ART). The literature was collected from internationally recognized scientific databases, including PubMed, Scopus, Web of Science, and Google Scholar. Additionally, guidelines and consensus statements from professional organizations such as the American Society for Reproductive Medicine (ASRM) and the



European Society of Human Reproduction and Embryology (ESHRE) were included to ensure clinical relevance and scientific validity.

Search Strategy. A structured search strategy was applied using the following keywords and combinations:

- “ovarian endometriosis”
- “endometrioma and fertility”
- “laparoscopic cystectomy and ovarian reserve”
- “AMH and endometriosis”
- “IVF outcomes in endometriosis”
- “personalized reproductive management”
- “assisted reproductive technology and endometriosis”

Boolean operators (AND, OR) were used to refine the search results. The search was limited to articles published in English within the last 10–15 years to ensure relevance to current clinical practice.

Inclusion criteria: Peer-reviewed original research articles, systematic reviews, and meta-analyses. Studies evaluating reproductive outcomes after ovarian endometriosis surgery. Articles discussing ovarian reserve markers (AMH, AFC). Research on ART and fertility preservation strategies in endometriosis patients

Exclusion criteria: Case reports with limited sample size. Non-peer-reviewed publications. Studies unrelated to reproductive outcomes. Articles without full-text availability

Data Extraction and Analysis. Relevant data were extracted manually and included: Study design and population characteristics. Type of surgical intervention. Fertility outcomes (spontaneous pregnancy, IVF success rates). Ovarian reserve indicators (AMH, AFC changes). Impact of personalized treatment strategies. The collected data were analyzed using a qualitative synthesis approach. Comparative analysis was performed to identify consistent patterns, contradictions, and clinical trends across different studies. Ethical Considerations since this study is based on previously published literature, no direct involvement of human participants was required. Therefore, ethical approval was not necessary. However, all sources were critically evaluated to ensure scientific integrity and academic reliability. **Methodological Limitations** this study is limited by the heterogeneity of included studies, variations in surgical techniques, differences in patient populations, and variability in outcome reporting. Additionally, the narrative review design may introduce selection bias compared to a fully systematic review approach.

Discussion. The findings of this review highlight the complex and multifactorial relationship between ovarian endometriosis, surgical treatment, and reproductive outcomes. Ovarian endometriosis is not only a structural gynecological disorder but also a systemic inflammatory condition that directly affects ovarian physiology, folliculogenesis, and oocyte competence. The accumulated evidence confirms that infertility in these patients is driven by both mechanical and biological mechanisms, including pelvic adhesions, tubal dysfunction, oxidative stress, and chronic inflammatory activity within the pelvic microenvironment. One of the most critical issues discussed in the literature is the dual effect of laparoscopic cystectomy on fertility outcomes. On one hand, surgical removal of endometriomas improves pelvic anatomy, reduces inflammatory burden, and increases the likelihood of spontaneous conception, particularly in young patients with unilateral disease and preserved ovarian reserve. On the other hand, multiple studies consistently demonstrate a postoperative decline in ovarian reserve markers, especially anti-Müllerian hormone (AMH), suggesting that surgical excision may inadvertently damage healthy ovarian tissue. This paradox represents a central clinical dilemma in reproductive surgery: balancing fertility improvement with ovarian preservation. The variability in reproductive outcomes after surgery can be explained by several key factors. Patient age remains one of the strongest predictors of fertility success, as ovarian reserve



naturally declines with advancing age. Women under 35 years of age tend to benefit more from surgical intervention compared to older patients, in whom diminished ovarian reserve may limit the potential advantages of surgery. Similarly, unilateral endometriomas are associated with better postoperative fertility outcomes than bilateral disease, which carries a higher risk of reduced ovarian reserve due to more extensive tissue involvement and surgical manipulation. Another important factor influencing outcomes is the baseline ovarian reserve. Patients with normal AMH and AFC levels prior to surgery are more likely to achieve spontaneous pregnancy compared to those with already compromised ovarian function. This finding emphasizes the importance of preoperative ovarian reserve assessment in clinical decision-making. In this context, AMH has emerged as a key biomarker for predicting both surgical risk and reproductive prognosis. The role of surgical technique is also critically emphasized in recent literature. Conventional cystectomy using traction and bipolar coagulation has been associated with greater ovarian tissue loss and thermal damage. In contrast, alternative techniques such as CO₂ laser vaporization, plasma energy ablation, and meticulous hemostasis without excessive cauterization have demonstrated improved preservation of ovarian tissue. These findings suggest that surgical expertise and technique selection significantly influence postoperative ovarian function and should be carefully considered in fertility-oriented cases. A major theme in contemporary research is the comparison between surgical management and assisted reproductive technologies (ART), particularly in vitro fertilization (IVF). Evidence increasingly suggests that immediate IVF may be more effective than surgery-first strategies in women with diminished ovarian reserve, advanced maternal age, or prolonged infertility. IVF bypasses the pathophysiological barriers associated with endometriosis, including tubal dysfunction and peritoneal inflammation, thereby providing a more direct route to pregnancy. Importantly, several studies indicate that prior surgical treatment does not necessarily improve IVF success rates and may in some cases delay definitive fertility treatment. The concept of personalized reproductive management has therefore become central in modern clinical practice. Unlike traditional one-size-fits-all approaches, individualized treatment strategies take into account multiple patient-specific variables, including age, ovarian reserve, cyst characteristics, symptom severity, infertility duration, and reproductive goals. This approach allows clinicians to stratify patients into different management pathways: surgical intervention for selected cases, direct IVF for high-risk patients, or combined strategies for complex scenarios. Fertility preservation strategies further strengthen the personalized approach. Oocyte and embryo cryopreservation prior to surgical intervention are particularly valuable in women with bilateral endometriomas, low AMH levels, or those of advanced reproductive age. These techniques provide a safeguard against potential postoperative decline in ovarian function and ensure future reproductive opportunities. Despite significant advances, several gaps remain in the current literature. Many studies are retrospective, with heterogeneous patient populations and variable surgical techniques, making direct comparisons difficult. Additionally, long-term reproductive outcomes and cumulative live birth rates are not consistently reported, limiting the ability to draw definitive conclusions. Future research should focus on prospective randomized controlled trials and the development of standardized clinical protocols for personalized reproductive management. In conclusion, the evidence strongly supports the adoption of an individualized, multidisciplinary approach in managing infertility associated with ovarian endometriosis. While surgical treatment remains an important therapeutic option, its role must be carefully balanced with the risks of ovarian reserve reduction. Integration of ART and fertility preservation strategies represents a key advancement in optimizing reproductive outcomes and improving patient-centered care.

Conclusion. Ovarian endometriosis remains one of the most challenging conditions in reproductive medicine due to its progressive nature, inflammatory pathophysiology, and strong association with infertility. Surgical management, particularly laparoscopic cystectomy, plays an important role in symptom relief, anatomical restoration, and improvement of spontaneous



pregnancy rates in selected patients. However, current evidence demonstrates that surgery may also negatively affect ovarian reserve, especially in cases of bilateral disease, advanced maternal age, or repeated interventions. The review highlights that reproductive outcomes after surgical treatment are highly variable and cannot be predicted by surgery alone. Instead, successful fertility restoration depends on a combination of factors, including patient age, baseline ovarian reserve (AMH and AFC levels), disease severity, and surgical technique. Therefore, a standardized treatment approach is not optimal for all patients. A personalized reproductive management strategy is essential for achieving optimal outcomes. This approach integrates clinical evaluation, hormonal assessment, imaging findings, and individualized reproductive goals to guide treatment selection. In many cases, early use of assisted reproductive technologies (ART), particularly in vitro fertilization (IVF), provides superior cumulative pregnancy rates compared to repeated surgical interventions. Additionally, fertility preservation techniques such as oocyte and embryo cryopreservation are highly recommended for high-risk patients. Overall, the integration of surgery, ART, and fertility preservation within a personalized framework represents the most effective strategy for improving reproductive outcomes in women with ovarian endometriosis. Future research should focus on refining predictive models and optimizing minimally invasive surgical techniques to further enhance ovarian function preservation.

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