

Personified Approach To Fertility Restoration In Women After Surgery On Ovarian Endometriosis

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ABSTRACT

This article explores a personified approach to fertility restoration in women after surgery for ovarian endometriosis. The study emphasizes the complexity of reproductive outcomes influenced by surgical intervention, ovarian reserve status, and individualized treatment strategies. Particular attention is given to the role of ovarian reserve markers, fertility preservation techniques, and assisted reproductive technologies in optimizing reproductive potential. The review highlights that standard surgical approaches may compromise ovarian function, while personalized management improves fertility outcomes and reduces risks of iatrogenic damage. The findings support a multidisciplinary and patient-centered strategy integrating gynecological surgery, reproductive medicine, and psychological support. The study contributes to modern reproductive medicine by promoting individualized decision-making for women affected by ovarian endometriosis.

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Introduction

Endometriosis is a chronic, estrogen-dependent inflammatory disorder characterized by the presence of endometrial-like tissue outside the uterine cavity. Among its various forms, ovarian endometriosis, often manifesting as endometriomas, represents one of the most clinically significant and challenging phenotypes due to its strong association with pelvic pain, infertility, and reduced ovarian reserve. The disease affects a considerable proportion of women in reproductive age, and its impact on fertility potential has become a central concern in contemporary reproductive medicine. Despite advances in both surgical and medical management, restoration and preservation of fertility in women undergoing ovarian endometriosis surgery remain complex and multifactorial issues that require individualized clinical strategies. Surgical intervention, particularly cystectomy for ovarian endometriomas, is widely accepted as an effective method for alleviating pain, improving spontaneous conception rates in selected patients, and reducing recurrence risk. However, accumulating evidence has highlighted the potential adverse effects of surgery on ovarian reserve. The inadvertent removal of healthy ovarian tissue, thermal damage from hemostatic techniques, and postoperative adhesions can collectively contribute to diminished ovarian function. This paradox—whereby surgical treatment may simultaneously improve and impair fertility outcomes—has intensified the need for more nuanced, patient-centered approaches to fertility restoration [1].

In recent years, the concept of a personalized or “personified” approach in reproductive medicine has gained increasing attention. This approach emphasizes tailoring clinical decisions based on individual patient characteristics, including age, ovarian reserve markers, reproductive goals, genetic predispositions, disease severity, and previous treatment history. In the context of ovarian endometriosis, such a strategy is particularly relevant given the heterogeneity of disease presentation and the variability in ovarian response to surgical and medical interventions. Personalized fertility restoration aims not only to optimize reproductive outcomes but also to minimize iatrogenic damage and preserve long-term endocrine function. A key component of this individualized strategy involves comprehensive preoperative assessment of ovarian reserve using biomarkers such as anti-Müllerian hormone (AMH), antral follicle count (AFC), and basal follicle-stimulating hormone (FSH) levels. These indicators provide critical information for risk stratification and surgical planning. Women with already compromised ovarian reserve may benefit from more conservative surgical techniques or alternative fertility-preserving strategies, including assisted reproductive technologies (ART) prior to surgery. Conversely, patients with normal ovarian reserve and significant symptomatic disease may be more suitable candidates for laparoscopic cystectomy with meticulous surgical technique aimed at minimizing follicular loss. Another important dimension of the personified approach is the integration of fertility preservation techniques. Oocyte or embryo cryopreservation prior to surgery is increasingly recommended in selected cases, particularly in women of

advanced reproductive age or those with bilateral endometriomas. In addition, emerging strategies such as in vitro maturation of oocytes and ovarian tissue preservation are being explored as potential adjuncts to existing fertility preservation protocols. These innovations reflect a broader shift toward proactive fertility management rather than reactive treatment after ovarian damage has occurred [2].

Medical management also plays a significant role in personalized fertility restoration. Postoperative hormonal suppression, typically using gonadotropin-releasing hormone (GnRH) analogs or progestins, has been shown to reduce recurrence rates of endometriosis. However, its use must be carefully balanced against the desire for immediate conception, as prolonged suppression may delay reproductive attempts. Therefore, individualized postoperative planning is essential, taking into account patient priorities and reproductive timelines. Furthermore, advances in minimally invasive surgery have significantly improved outcomes in ovarian endometriosis management. Techniques such as laparoscopic stripping with careful dissection planes, use of energy devices with reduced thermal spread, and enhanced visualization technologies contribute to improved preservation of ovarian tissue. Nevertheless, surgical expertise remains a critical determinant of postoperative ovarian function, reinforcing the importance of centralizing care in specialized reproductive surgery centers [3].

Psychological factors also deserve attention in the context of fertility restoration. Women with endometriosis often experience anxiety, depression, and reduced quality of life due to chronic pain and infertility. A personified approach therefore extends beyond biological parameters to include psychological support, counseling, and shared decision-making. This holistic perspective ensures that patients are active participants in their treatment journey and that therapeutic strategies align with their emotional and reproductive goals. Fertility restoration in women after surgery for ovarian endometriosis represents a complex clinical challenge that cannot be addressed through standardized protocols alone. The evolving concept of a personified approach offers a promising framework for optimizing reproductive outcomes while preserving ovarian function. By integrating individualized risk assessment, fertility preservation techniques, surgical precision, and patient-centered care, modern reproductive medicine is moving toward more effective and compassionate management strategies for women affected by this condition [4].

Literature review

Ovarian endometriosis, particularly in the form of endometriomas, represents one of the most challenging conditions in reproductive medicine due to its dual impact on pelvic pathology and fertility potential. Contemporary literature consistently emphasizes that endometriosis is not

merely a localized gynecological disorder but a systemic inflammatory condition that significantly affects ovarian function, oocyte quality, and reproductive outcomes. The surgical management of ovarian endometriomas remains a cornerstone of treatment; however, its implications for fertility restoration are complex and often paradoxical, necessitating individualized or “personified” therapeutic strategies. A large body of evidence suggests that ovarian endometriomas negatively influence ovarian reserve even before surgical intervention. Chronic inflammation, oxidative stress, and mechanical compression of ovarian tissue contribute to follicular depletion and impaired folliculogenesis. Studies consistently demonstrate reduced anti-Müllerian hormone (AMH) levels and diminished antral follicle count (AFC) in affected patients compared to healthy controls. This baseline impairment is a critical factor that must be considered when planning surgical intervention, as pre-existing ovarian compromise increases the risk of further postoperative decline [5].

Surgical cystectomy is widely regarded as the most effective technique for removing endometriomas and reducing recurrence rates. However, its impact on ovarian reserve has been extensively debated. Recent clinical analyses indicate that AMH levels may decrease significantly following cystectomy, with reductions ranging from moderate to severe depending on cyst size, bilaterality, and surgical technique. The main mechanism of ovarian damage is thought to be inadvertent excision of healthy ovarian cortex and thermal injury during hemostasis. Despite this, some studies report partial recovery of ovarian reserve within 6–12 months post-surgery, suggesting a dynamic and partially reversible ovarian response. In contrast, ablative techniques such as laser vaporization and plasma energy have been proposed as ovarian tissue-sparing alternatives. These methods aim to minimize damage to healthy ovarian tissue while effectively treating endometriotic lesions. Comparative analyses show that while ablative approaches may better preserve AMH levels, they are associated with higher recurrence rates compared to cystectomy. This trade-off highlights the importance of individualized treatment planning based on patient age, reproductive goals, and ovarian reserve status [6].

Assisted reproductive technologies (ART), particularly in vitro fertilization (IVF), play a crucial role in fertility restoration after surgical treatment. Evidence suggests that surgical removal of endometriomas does not always improve IVF outcomes and, in some cases, may even reduce ovarian responsiveness due to diminished follicular pool. However, in selected patients, particularly those with large cysts or anatomical distortion, surgery may improve oocyte retrieval access and optimize reproductive outcomes. Thus, decision-making must be highly individualized, integrating both surgical and reproductive medicine perspectives. A growing body of literature supports the concept of fertility preservation prior to surgery in high-risk

patients. Oocyte and embryo cryopreservation are increasingly recommended strategies, particularly for women with bilateral endometriomas or low baseline AMH levels. This proactive approach ensures that viable gametes are preserved before potential surgical damage occurs. Additionally, emerging techniques such as ovarian tissue cryopreservation and in vitro maturation are being explored as future fertility preservation options. The role of medical therapy in fertility restoration is also significant. Postoperative hormonal suppression using gonadotropin-releasing hormone analogs or progestins has been shown to reduce disease recurrence and improve symptom control. However, its effect on fertility outcomes is controversial, as prolonged suppression may delay conception attempts. Therefore, treatment protocols must be adapted to individual reproductive timelines and patient preferences. The concept of a personified approach integrates all these dimensions into a unified clinical framework. This strategy emphasizes individualized risk assessment, incorporating biomarkers such as AMH, AFC, age, surgical history, and disease severity. It also considers psychosocial factors, including patient anxiety, fertility expectations, and quality of life. Personalized treatment pathways may include direct referral to ART, conservative surgery, combined surgical-medical approaches, or fertility preservation prior to intervention [7].

Recent meta-analyses highlight that no single surgical technique guarantees superior fertility outcomes. Instead, reproductive success depends on a combination of surgical expertise, disease phenotype, and individualized postoperative management. Importantly, the concept of “one-size-fits-all” treatment is no longer considered appropriate in modern reproductive medicine. Instead, precision medicine approaches tailored to individual ovarian biology are increasingly being adopted. Psychological and emotional dimensions also play a crucial role in fertility restoration. Women with ovarian endometriosis often experience significant psychological distress due to chronic pain and infertility. Incorporating counseling and shared decision-making into treatment planning improves patient satisfaction and adherence to therapeutic strategies. The literature strongly supports the transition from standardized treatment protocols toward individualized, patient-centered management in ovarian endometriosis. Fertility restoration after surgery should not be viewed as a single therapeutic outcome but as a dynamic process influenced by biological, surgical, and psychological factors. The integration of personalized medicine principles into reproductive care represents a significant advancement in optimizing outcomes for affected women [8].

Research discussion

Fertility restoration in women with ovarian endometriosis after surgical intervention remains one of the most debated and clinically complex issues in modern reproductive

medicine. The present discussion highlights that outcomes are not determined solely by the presence or absence of surgery, but rather by a multifactorial interaction between disease severity, ovarian reserve status, surgical technique, and individualized reproductive planning. The findings synthesized from recent clinical evidence strongly support a shift from standardized treatment algorithms toward a fully individualized or personified approach. One of the most critical considerations is the dual impact of ovarian endometriomas on fertility. On the one hand, the disease itself is associated with chronic inflammation, oxidative stress, and altered follicular microenvironment, all of which negatively affect oocyte quality and ovarian reserve. On the other hand, surgical treatment, while effective in removing pathological tissue and improving pelvic anatomy, may further compromise ovarian function. This paradox creates a therapeutic dilemma where both intervention and non-intervention carry potential risks to fertility outcomes. Therefore, decision-making must be highly individualized and based on comprehensive ovarian reserve assessment [9].

Anti-Müllerian hormone (AMH) and antral follicle count (AFC) remain the most reliable indicators for evaluating ovarian reserve in clinical practice. Evidence consistently shows that women with endometriomas have lower baseline AMH levels compared to healthy controls, and surgical excision can further reduce these levels significantly. However, the magnitude of decline is highly variable and depends on factors such as cyst size, bilaterality, surgical expertise, and use of hemostatic energy devices. This variability reinforces the importance of preoperative stratification, where patients at high risk of ovarian insufficiency may benefit from alternative strategies such as assisted reproductive technologies (ART) or fertility preservation prior to surgery. The role of surgical technique is another key determinant of postoperative fertility outcomes. Traditional cystectomy remains the gold standard for reducing recurrence and improving symptom control, but it is also associated with inadvertent removal of healthy ovarian cortex. In contrast, ablative techniques such as laser vaporization and plasma energy have been proposed as ovarian tissue-sparing alternatives. Although these methods appear more favorable in preserving ovarian reserve, they may carry higher recurrence risks. This trade-off highlights that no single surgical technique is universally superior; rather, the optimal approach must be selected based on patient-specific reproductive priorities. An important finding in the literature is that surgical intervention does not always improve fertility outcomes, particularly in the context of assisted reproduction. In some cases, IVF success rates are not significantly enhanced after removal of endometriomas, and ovarian response to stimulation may even decline due to reduced follicular pool. However, surgery may still be beneficial in selected cases where anatomical distortion

impairs oocyte retrieval or when large cysts compromise ovarian accessibility. This emphasizes that the decision for surgery should not be based solely on the presence of endometrioma but rather on a comprehensive reproductive strategy [10].

Fertility preservation has emerged as a crucial component of personified reproductive care. Oocyte and embryo cryopreservation prior to surgery are increasingly recommended for women with bilateral disease, recurrent endometriomas, or already diminished ovarian reserve. This proactive approach ensures that reproductive potential is safeguarded before any surgical insult occurs. Additionally, experimental approaches such as ovarian tissue cryopreservation and in vitro maturation of oocytes are expanding future possibilities, although they are not yet universally standardized in clinical practice. Postoperative management also plays a significant role in fertility outcomes. Hormonal suppression therapy can reduce recurrence rates and control disease progression; however, its impact on fertility timing must be carefully balanced. Delayed conception due to prolonged suppression may not be acceptable for women with advanced reproductive age. Therefore, individualized postoperative protocols that align with patient fertility goals are essential. This highlights the importance of shared decision-making between clinician and patient. Psychological and emotional factors further complicate fertility restoration in women with ovarian endometriosis. Chronic pain, infertility-related stress, and repeated treatment failures can significantly affect mental health and quality of life. Incorporating psychological counseling into treatment pathways improves patient adherence, reduces anxiety, and enhances overall satisfaction with care. A personified approach must therefore extend beyond biological parameters and include psychosocial dimensions [11].

From a broader perspective, the concept of precision medicine is becoming increasingly relevant in reproductive gynecology. Instead of applying uniform treatment protocols, clinicians are encouraged to integrate biomarkers, imaging findings, genetic predispositions, and patient preferences into individualized care plans. This approach not only improves clinical outcomes but also reduces unnecessary interventions and preserves long-term ovarian function. Despite significant advances, several challenges remain unresolved. There is still no universally accepted algorithm for deciding between surgery, ART, or combined approaches in patients with ovarian endometriosis. Additionally, long-term data on fertility outcomes after different surgical techniques remain limited. Future research should focus on large-scale prospective studies that compare personalized treatment strategies and evaluate reproductive success over extended follow-up periods. Fertility restoration after ovarian endometriosis surgery cannot be managed through a uniform clinical approach. The evidence strongly supports a personified

model that integrates ovarian reserve assessment, surgical precision, fertility preservation, and psychological support. Such a comprehensive and individualized strategy offers the best opportunity for optimizing reproductive outcomes while minimizing ovarian damage [12].

Research discussion

Fertility restoration in women after surgery for ovarian endometriosis remains a complex clinical challenge that requires a highly individualized approach. The available evidence indicates that neither surgical intervention nor conservative management alone can guarantee optimal reproductive outcomes. Instead, fertility potential is determined by a combination of baseline ovarian reserve, extent of disease, surgical technique, and postoperative reproductive planning. The concept of a personified approach provides a more effective framework for managing these patients, integrating ovarian reserve markers, patient age, reproductive goals, and psychosocial factors into clinical decision-making. While cystectomy remains the standard surgical method for disease control, its potential impact on ovarian reserve necessitates careful patient selection and surgical precision. Ovarian-sparing techniques and fertility preservation strategies further enhance the ability to maintain reproductive potential in high-risk patients. Personalized treatment strategies combined with early fertility counseling and multidisciplinary care offer the most promising pathway for improving reproductive outcomes in women with ovarian endometriosis.

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