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Current Approaches to the Treatment of Endometriosis: A Narrative Review

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ABSTRACT

Endometriosis is a complex, systemic clinical syndrome affecting over 10% of women and significantly impairing reproductive function and quality of life. Common symptoms include pelvic pain, dysmenorrhea, dyspareunia, and abnormal menstrual bleeding, often resulting in surgical interventions and, historically, hysterectomy [1]. The pathogenesis of endometriosis is multifactorial,

involving hormonal imbalance, chronic inflammation, and genetic and epigenetic factors. While retrograde menstruation remains the most accepted mechanism, other processes, such as coelomic metaplasia, stem cell involvement, and immune dysregulation, contribute to ectopic endometrial tissue implantation and persistence [2]. Epigenetic modifications further affect gene expression and hormonal responsiveness, promoting disease progression.

Diagnosis combines clinical evaluation and imaging, with laparoscopy and histological confirmation as the gold standard. Less invasive techniques, such as transvaginal ultrasound and MRI, are increasingly used due to their sensitivity for detecting deep lesions [4]. Treatment is tailored to symptom severity, disease extent, and fertility goals, integrating pharmacological, surgical, and supportive methods. Hormonal therapies such as combined oral contraceptives, progestins, and GnRH analogues, are first-line treatments, while surgery is reserved for refractory cases or anatomical complications. [3] Complementary interventions—such as physical activity, physiotherapy, dietary modifications, and psychological support—can enhance symptom control and quality of life.[4]

Comprehensive, multidisciplinary care is essential to optimize emphasizing early diagnosis, individualized therapy, and supportive care.

Keywords: endometriosis, pharmacotherapy, hormonal treatment, surgery, supportive therapy, pain management, quality of life

1. Introduction

Endometriosis is a chronic, inflammatory, and estrogen-dependent disease characterized by the presence of endometrial-like tissue outside the uterine cavity. It most commonly affects the pelvic organs, including the ovaries, fallopian tubes, and peritoneum, but can also involve distant sites such as the gastrointestinal tract, urinary system, lungs, or even the brain. The global prevalence of endometriosis is estimated at 10–15% of women of reproductive age, corresponding to approximately 176 million affected individuals worldwide. Notably, nearly half of women struggling with infertility are diagnosed with this condition.[5]

The etiology of endometriosis remains multifactorial and incompletely understood, involving complex interactions between hormonal, immune, genetic, and inflammatory factors. Despite its frequency, diagnosis is often delayed for many years due to non-specific or variable symptoms. The clinical presentation is heterogeneous, with pelvic pain, dysmenorrhea, dyspareunia, dysuria,

dyschezia, chronic fatigue, and infertility being the most commonly reported manifestations.[6] In some cases, symptoms may be mild or absent, further complicating early recognition.

Endometriosis significantly impairs women's physical, emotional, and social well-being. Pain, both cyclic and chronic, is a key contributor to reduced productivity, absenteeism, and decreased quality of life. Patients often experience anxiety, depressive symptoms, and sexual dysfunction, which may deteriorate intimate relationships and social functioning.[7] Studies have shown that the negative impact of endometriosis on quality of life is comparable to that of other chronic diseases such as rheumatoid arthritis or diabetes.[8]

Reproductive health is one of the most severely affected aspects. Endometriosis can disrupt ovulatory function, alter follicular fluid composition, and impair implantation through inflammatory and immunological mechanisms. Anatomical distortion of pelvic organs, adhesions, and ovarian endometriomas further reduce fertility potential. Moreover, the emotional burden associated with infertility and chronic pain amplifies psychological distress, leading to frustration and decreased self-esteem.[9] Consequently, endometriosis not only represents a major gynecological condition but also a substantial social and public health problem, necessitating comprehensive and individualized therapeutic strategies.

Endometriosis is a multifactorial disease with complex and not yet fully understood pathogenesis. The most widely accepted explanation is Sampson's theory of retrograde menstruation, which proposes that during menstruation, endometrial cells flow backward through the fallopian tubes into the pelvic cavity, where they implant and proliferate on peritoneal surfaces. However, this mechanism alone cannot explain all cases, as retrograde menstruation occurs in most women. Therefore, other hypotheses have been proposed, including coelomic metaplasia (transformation of peritoneal cells into endometrial-like cells), stem cell theory (involvement of bone marrow or progenitor stem cells), and immune dysfunction, which impairs the clearance of ectopic endometrial cells.[10]

Recent research highlights the role of genetic and epigenetic factors, hormonal imbalance, and chronic inflammation in promoting cell proliferation, angiogenesis, and resistance to apoptosis. Locally produced estrogens and inflammatory mediators such as prostaglandins, cytokines, and growth factors further enhance the survival and invasiveness of endometrial implants, perpetuating pain and infertility.[11]

Diagnosis of endometriosis remains difficult due to its nonspecific symptoms—such as chronic pelvic pain, dysmenorrhea, or infertility—that overlap with other gynecological or gastrointestinal conditions. The gold standard for definitive diagnosis is laparoscopy with histological confirmation of lesions. However, this method is invasive and costly. Non-invasive tools like transvaginal ultrasound (TVUS) and magnetic resonance imaging (MRI) have become valuable alternatives,

offering high sensitivity and specificity for deep infiltrating endometriosis and ovarian endometriomas, though they are less effective for small peritoneal lesions. [12],[13]

Currently, there are no reliable biomarkers for routine clinical use. Serum markers such as CA-125, as well as experimental candidates like cytokines, microRNAs, and endometrial proteins, show potential but lack sufficient specificity.[14] Therefore, diagnosis often relies on a comprehensive clinical assessment that integrates patient history, symptom evaluation, imaging results, and, when necessary, surgical confirmation.

Endometriosis remains a significant diagnostic and therapeutic challenge due to its complex pathophysiology, heterogeneous clinical presentation, and lack of reliable biomarkers. Despite the availability of multiple therapeutic options, no single approach provides a definitive cure, and treatment must be individualized according to symptom severity, disease extent, and fertility goals. Moreover, the chronic nature of the disease necessitates long-term management strategies that address both physical and psychological aspects. Therefore, understanding the current therapeutic options and their limitations is essential for optimizing patient outcomes and improving quality of life.

2. Objectives of the Review

The primary objective of this narrative review is to present and critically discuss current therapeutic approaches to endometriosis, with particular emphasis on pharmacological management. The review also aims to highlight the role of surgical and supportive therapies and to outline novel treatment strategies currently under investigation. Special attention is given to the impact of these therapeutic modalities on symptom control, fertility outcomes, and overall quality of life in affected women.

3. Methodology

This narrative review was conducted through a comprehensive search of PubMed, Google Scholar, ScienceDirect, and DOAJ databases, focusing primarily on studies published between 2020 and 2025. The search was limited to articles written in English to ensure consistency and accessibility of data. The main keywords included “endometriosis,” “quality of life,” “infertility,” “pain management,” “pharmacotherapy,” “surgery,” and “supportive therapy.” Although the review mainly considered recent literature, a small number of earlier studies published before 2020 were included when they provided essential background information or significant historical insights relevant to the topic.

4. Pharmacological Treatment of Endometriosis

4.1. Hormonal Therapy

Hormonal therapy represents a cornerstone in the management of endometriosis-associated pain, particularly in patients who do not wish to conceive immediately. First-line treatments typically include progestins and combined oral contraceptives (COCP), which act by suppressing ovarian function, inhibiting endometrial proliferation, and promoting atrophy of ectopic endometrial tissue [15,16].

Progestins are widely recommended across international guidelines as the initial pharmacological option for endometriosis-related pain. Dienogest (DNG), a 19-nortestosterone derivative with high progesterone receptor specificity, is administered orally at 2 mg per day and causes minimal reduction of estrogen levels, avoiding hypoestrogenic side effects [15,16]. Clinical studies demonstrate that dienogest effectively reduces non-menstrual pelvic pain (NMPP), dysmenorrhea, and dyspareunia, with comparable efficacy to GnRH agonists and better tolerability [15,16,18]. Other progestins, such as medroxyprogesterone acetate (MPA), can be administered intramuscularly or subcutaneously every three months and are effective, economical options for pain control with lower risk of bone loss than GnRH agonists [15,20]. The levonorgestrel-releasing intrauterine system (LNG-IUS) provides localized hormonal suppression by inducing endometrial atrophy, inhibiting proliferation, and promoting apoptosis, showing efficacy in reducing pain and recurrence after surgery [15,16].

Combined oral contraceptives remain a widely used first-line option for endometriosis-associated pain. COCPs, usually containing ethinyl estradiol and a progestin such as drospirenone or levonorgestrel, suppress ovulation and reduce endometrial proliferation. Evidence from meta-analyses and prospective studies shows significant improvements in dysmenorrhea, dyspareunia, dyschezia, and quality of life, including in women with deep infiltrating endometriosis or coexisting adenomyosis [16]. The choice between COCPs and progestins can be guided by patient preferences, contraindications to estrogen, or desired ovulatory suppression.

GnRH agonists (e.g., leuprolide, triptorelin) are reserved for patients who fail first-line therapies. By suppressing pituitary gonadotropins, they induce hypoestrogenism, which effectively reduces endometriosis-associated pain. However, adverse effects such as hot flushes, vaginal dryness, and accelerated bone loss limit their long-term use, and add-back therapy is recommended when treatment exceeds a few months [15,16]

GnRH antagonists (e.g., elagolix, relugolix, linzagolix) represent a newer oral therapeutic option. They provide dose-dependent ovarian suppression with rapid onset and partial hypoestrogenism, minimizing the side effects associated with GnRH agonists. Randomized controlled trials (SPIRIT 1 and 2) demonstrated that elagolix significantly reduces dysmenorrhea and non-menstrual pelvic pain, with better tolerability compared to traditional agonists [16,17]. Relugolix and linzagolix show similar efficacy in reducing pelvic pain, although data on dyspareunia are more limited, and dose-dependent adverse effects, including hot flushes and headache, have been reported [17].

Aromatase inhibitors (AIs) such as letrozole and anastrozole inhibit estrogen synthesis in both ovarian and peripheral tissues and are considered second-line therapy for persistent pain, particularly in patients with previous surgical or hormonal treatment failure [15]. Long-term use is associated with hypoestrogenic side effects, including hot flushes, arthralgia, and increased risk of osteoporosis, and they are not FDA-approved as definitive therapy.

Other experimental hormonal agents include selective progesterone receptor modulators (SPRM), e.g., mifepristone, and selective estrogen receptor modulators (SERM), e.g., SR-16234. SPRMs have shown efficacy in improving dysmenorrhea, but long-term safety and efficacy data are limited [15,16]. SERMs are mostly studied in research settings, with limited evidence of pain reduction [16].

Overall, hormonal therapies are effective in reducing pain, preventing recurrence, and improving quality of life, but limitations remain. First-line agents such as progestins, COCPs, and LNG-IUS are generally well tolerated and cost-effective, while second-line treatments (GnRH agonists/antagonists, AIs, SPRMs) may be reserved for resistant cases or specific clinical scenarios [15,16,18,19,20]. Future research is focused on identifying novel hormonal and non-hormonal pathways, optimizing routes of administration, and minimizing side effects while preserving fertility potential [19,20].

4.2. Non-hormonal pharmacotherapy

4.2.1 NSAIDs and Analgesics

Nonsteroidal anti-inflammatory drugs (NSAIDs) and paracetamol are commonly used as first-line symptomatic treatments for endometriosis-related pain, including dysmenorrhea, chronic pelvic pain, and acyclic pelvic pain [15,23,25]. NSAIDs act by inhibiting cyclooxygenase enzymes (COX-1 and COX-2), reducing prostaglandin synthesis, inflammation, and pain [15,21]. Despite widespread clinical use, high-quality evidence for their efficacy is limited. Some studies suggest no significant

difference in pain relief compared to placebo, and long-term use is discouraged due to potential side effects such as gastrointestinal ulcers or impaired ovulation, which is particularly relevant for women seeking pregnancy [15,23,25].

A short trial of NSAIDs or paracetamol is generally recommended; if inadequate, alternative therapies or referral to a pain or endometriosis specialist should be considered [23,25]. Neuromodulators, such as tricyclic antidepressants (e.g., amitriptyline), selective serotonin reuptake inhibitors (e.g., duloxetine), or anticonvulsants (e.g., gabapentin), may be used in chronic pain management when standard analgesics are insufficient. These drugs primarily act on central pain pathways rather than peripheral inflammation, but evidence in endometriosis-specific pain is limited and sometimes associated with significant side effects [23,25]

4.2.2 Antioxidants and Nutraceuticals

Recent research has explored non-hormonal pharmacological approaches targeting oxidative stress and inflammation, key contributors to endometriosis pathophysiology [24]

- N-Acetylcysteine (NAC): NAC replenishes intracellular glutathione, reducing oxidative stress and modulating inflammatory gene expression. Clinical studies in patients with ovarian endometriomas have shown that NAC reduces cyst size and inhibits abnormal cell proliferation without significant adverse effects [24].
- Melatonin: This pineal hormone has antioxidant and anti-inflammatory properties. It scavenges free radicals, stimulates antioxidant enzymes, inhibits lipid peroxidation, and downregulates MMPs. Clinical evidence demonstrates melatonin reduces chronic pelvic pain and analgesic consumption, while potentially modulating estradiol-sensitive endometrial cell proliferation [24].
- Curcumin: A bioactive compound from turmeric, curcumin inhibits NF-κB signaling, COX-2, and pro-inflammatory cytokine production, and may promote apoptosis in endometriotic cells. Clinical and in vitro studies indicate curcumin can reduce lesion growth, inflammation, and pain, suggesting a potential role as an adjuvant therapy [24].

4.2.3 Summary and Clinical Considerations

Non-hormonal therapy for endometriosis focuses primarily on pain relief and modulation of inflammation and oxidative stress. NSAIDs remain the cornerstone for symptomatic treatment, while nutraceuticals and antioxidants like NAC, melatonin, and curcumin offer promising adjunctive options, particularly in patients who cannot use hormonal therapy or wish to conceive [15,21,22,23,24,25].

Overall, non-hormonal therapy is generally safe and can reduce pain and inflammatory markers, but its efficacy may be variable, and further high-quality randomized controlled trials are needed to establish standardized protocols [15,21,22,23,24,25].

4.3. Surgical Management

Surgical treatment plays a key role in managing endometriosis, particularly in patients who do not respond to pharmacological therapy or who wish to improve their fertility. The main goals of surgery are to remove visible endometriotic lesions, restore normal pelvic anatomy, relieve pain, and enhance quality of life [26–29].

Surgical procedures are usually performed through laparoscopy, a minimally invasive technique in which small incisions are made in the abdomen, and a camera and surgical instruments are inserted to visualize and remove lesions. The surgeon may excise or ablate endometriotic implants, release adhesions, and drain or remove ovarian cysts (endometriomas). In severe cases with extensive disease or when other treatments fail, more radical procedures such as hysterectomy with or without oophorectomy may be considered, although these are reserved for women who have completed childbearing [26, 27].

One of the major challenges of surgical treatment is disease recurrence, which can reach about 27% within two years after surgery for endometriomas [28]. Recurrence often results from incomplete removal of lesions, as small or hidden foci may be difficult to detect during the operation. To improve precision, new intraoperative imaging techniques—such as fluorescence-guided surgery (FGS)—have been developed. These methods use fluorescent tracers that highlight endometriotic tissue, helping the surgeon identify and remove even microscopic lesions [26].

Minimally invasive techniques remain the standard approach. While conventional laparoscopy is the gold standard, robotic-assisted surgery (RAS) is increasingly used for deep infiltrating endometriosis (DIE). Robotic systems like Da Vinci® and Hugo™ RAS provide improved visualization, greater precision, and better ergonomics for the surgeon. Although these procedures may take longer, studies show similar safety profiles and recovery times compared to standard laparoscopy [27, 29]. RAS may be particularly useful in complex cases involving the bowel, bladder, or ureters, where precision is essential.

Because endometriosis surgery, especially for deep lesions, is technically demanding, it should be performed in specialized centers by experienced multidisciplinary teams that include gynecologists, general surgeons, and urologists. Preoperative imaging, such as ultrasound and MRI, is essential for accurate mapping of lesions and surgical planning [29].

Although surgery is often effective in reducing pain and improving fertility, it carries risks such as bleeding, infection, or decreased ovarian reserve after removal of ovarian cysts. For this reason, individualized treatment planning is crucial, especially for women who wish to conceive [27, 29]. Combining surgery with hormonal therapy—before or after the procedure—can lower the risk of recurrence and improve long-term outcomes [27, 28].

Surgical treatment can also improve sexual function and quality of life. Many patients experience significant pain relief and increased sexual satisfaction after surgery, although recurrence of symptoms can diminish these benefits over time [30]. Therefore, it is important to combine surgery with supportive and psychological care to address both physical and emotional aspects of the disease.

In summary, surgical treatment remains an essential component in the management of endometriosis, particularly for patients with severe or treatment-resistant disease. Advances in minimally invasive, robotic, and fluorescence-guided techniques have improved surgical accuracy and patient safety. However, the best results are achieved when surgery is performed by experienced teams as part of a comprehensive, multidisciplinary treatment plan that also includes medical and supportive therapies [26–30].

4.4. Supportive and Complementary Treatments

Recent research emphasizes the potential role of diet and nutritional supplementation in managing endometriosis symptoms by influencing inflammation, hormonal balance, oxidative stress, and immune responses [31]. Although most evidence remains preliminary, diet-based interventions and specific nutrient supplementation have been associated with symptom improvement and enhanced quality of life among affected women [36].

Certain dietary patterns appear to modulate disease progression. Diets rich in anti-inflammatory and antioxidant nutrients, such as the Mediterranean diet, characterized by high intake of olive oil, vegetables, fruits, whole grains, and fish, have been linked to reduced pain and better overall well-being [31]. Conversely, consumption of red meat, trans fats, and refined sugars may exacerbate

inflammation and increase disease risk [31]. Other approaches, including low FODMAP, gluten-free, and high-fiber diets, may alleviate gastrointestinal and pelvic symptoms, while a low-nickel diet can be beneficial for nickel-sensitive patients [31].

Among specific supplements, antioxidant vitamins such as vitamin C and vitamin E have shown promise in reducing oxidative stress and inflammation. A meta-analysis of clinical trials revealed that supplementation with these vitamins significantly decreased markers of oxidative stress, including malondialdehyde (MDA), and reduced inflammatory mediators such as interleukin-6 and monocyte chemotactic protein-1 [34]. Furthermore, combined vitamin C and E therapy has been associated with alleviation of chronic pelvic pain, dysmenorrhea, and dyspareunia. [34] These effects are likely related to inhibition of prostaglandin E2 synthesis and modulation of cytokine production.

Vitamin D, a fat-soluble compound involved in immune regulation and cellular differentiation, has also been extensively studied. Vitamin D receptors are expressed in the endometrium and ovaries, suggesting local immunomodulatory activity [33]. Deficiency in vitamin D correlates with increased severity of endometriosis, possibly due to elevated pro-inflammatory cytokines such as TNF-α and IL-6. Although some studies demonstrated decreased inflammatory markers after supplementation, human trials have produced inconsistent results, with limited evidence for improvement in pain or fertility outcomes [33,37]. Nonetheless, vitamin D supplementation may still be advisable in deficient women to prevent secondary conditions such as osteoporosis [37].

Zinc plays an essential role in antioxidant defence and immune modulation. Lower zinc levels have been observed in women with endometriosis, particularly in the follicular fluid of infertile patients [33]. Although there is insufficient evidence from supplementation trials, adequate zinc intake may be beneficial in reducing oxidative stress and inflammatory cytokine release [33]. Similarly, magnesium, known for its muscle-relaxing and anti-inflammatory properties, could potentially alleviate endometriosis-related pain by reducing smooth muscle spasms and angiogenesis; however, clinical data are scarce and warrant further investigation [33].

Natural compounds such as propolis and polyphenols (e.g., resveratrol, quercetin, chrysin) are gaining attention for their anti-inflammatory, antioxidant, and anti-proliferative actions [32,33,35]. Polyphenols may regulate estrogen pathways and inhibit angiogenesis without the adverse effects associated with hormonal therapy, making them promising candidates for long-term, supportive treatment [35]. Omega-3 fatty acids and resveratrol have also demonstrated potential in modulating inflammatory signaling and suppressing lesion growth, though results across studies remain inconsistent [32].

Probiotics may offer additional benefits by improving gut microbiota balance, enhancing immune function, and supporting vitamin B synthesis — important for patients with typically lower B-vitamin levels [33]. Similarly, selenium, due to its antioxidant and anti-inflammatory properties, has been associated with reduced disease severity when combined with vitamins C, E, and zinc [33].

Overall, dietary and supplementation strategies represent a promising adjunct to pharmacological and surgical management of endometriosis. Adopting an anti-inflammatory dietary pattern combined with targeted micronutrient support may help alleviate chronic pain and improve quality of life [31,34,36]. However, the current evidence is limited by small sample sizes, heterogeneity among studies, and lack of standardized dosing regimens. Therefore, larger randomized clinical trials are necessary to validate the clinical efficacy, safety, and optimal use of these nutritional interventions in endometriosis management [36,37].

Building on the concept of lifestyle-based management, another nonpharmacological strategy that has gained growing attention in recent years involves physical activity and physiotherapy, which may complement medical treatment by reducing pain intensity, improving pelvic floor function, and enhancing overall quality of life in women with endometriosis.

Physiotherapy plays an increasingly important role in the comprehensive management of endometriosis, complementing both pharmacological and surgical treatment. It aims not only to alleviate pain but also to improve mobility, restore pelvic floor function, and enhance overall quality of life. Physiotherapeutic management encompasses pre- and postoperative rehabilitation, scar therapy, pelvic floor training, manual techniques, and spa-based interventions such as hydrotherapy and balneology [38].

Physiotherapy for endometriosis includes both active and passive modalities. Active techniques such as kinesiotherapy focus on mobilizing the musculoskeletal system, particularly the lumbo-pelvic region, through individually tailored exercise programs, stretching, and breathing exercises. These interventions are crucial both before and after surgery to prevent complications such as circulatory disorders or venous stasis, to support scar healing, and to help restore normal physical activity [38]. Passive physiotherapeutic methods include electrotherapy, magnetotherapy, laser therapy, and light therapy, which aim to relieve pain, improve microcirculation, and accelerate tissue regeneration after surgical procedures. For example, low-level laser therapy (LLLT) enhances microcirculation, increases ATP production, and stimulates fibroblast activity, leading to improved tissue repair and pain relief [38].

Manual therapy is another important component of physiotherapy for women with endometriosis. Techniques such as joint and soft tissue mobilization, stretching, and acupressure are used to reduce muscle tone, alleviate pelvic pain, and restore mobility in tissues affected by adhesions [39]. Osteopathic and visceral manual therapies target the dynamic interactions between musculoskeletal structures, fascia, and internal organs to restore postural balance, enhance organ motility, and relieve tension in the pelvic region [38,39]. Studies have shown that such manual techniques can significantly reduce pain intensity (by up to 30%), improve dyspareunia, and enhance both physical and emotional well-being [39].

The use of electrophysical agents (EPAs)—including neuromuscular electrical stimulation (NMES), transcutaneous electrical nerve stimulation (TENS), and pulsed high-intensity laser therapy (HILT)—has also proven beneficial in reducing pelvic pain and improving quality of life. When used as adjuncts to hormonal therapy, EPAs significantly lowered pain and symptom severity in women with deep endometriosis [39]. Additionally, virtual reality and thermal biofeedback therapies that integrate relaxation and breathing exercises have been explored as novel approaches to pain management, demonstrating encouraging preliminary results [39].

Beyond targeted physiotherapy, regular physical activity (PA) represents a key nonpharmacological approach in managing endometriosis symptoms. Exercise - including yoga, pilates, stretching, and aerobic training, has been shown to reduce pain, stress, and the adverse effects of pharmacotherapy while improving well-being and self-image [39,40]. Mechanistically, exercise induces the release of anti-inflammatory myokines from contracting skeletal muscles, increases leukocyte production, and triggers acute anti-inflammatory responses through cortisol and adrenaline secretion [40]. Moreover, regular physical activity may lower estrogen levels, regulate menstrual flow, and help reduce the risk of endometrial cyst formation [38].

Yoga, in particular, has received growing attention due to its integration of movement, breathing, and meditation. Clinical studies indicate that yoga can reduce pain intensity, decrease reliance on painkillers, improve sleep quality, and foster self-awareness and emotional resilience among women with endometriosis [39,41]. Similarly, progressive muscle relaxation, as part of structured exercise programs, has been associated with reduced stress hormone levels and improved overall quality of life [39].

Despite these promising findings, the current evidence base remains limited by methodological heterogeneity, small sample sizes, and the absence of standardized outcome measures. Systematic reviews emphasize that while physical activity and physiotherapy show potential benefits, further large-scale randomized controlled trials (RCTs) are needed to determine optimal exercise intensity, duration, and modality for women with endometriosis [40,41]. Nonetheless, integrating physiotherapy and structured physical activity into multidisciplinary care offers a safe and effective means of supporting both physical and psychological well-being in affected women.

5. Discussion

Endometriosis remains a multifaceted and challenging condition to manage due to its chronic nature, complex pathophysiology, and variable clinical manifestations. Current therapeutic strategies, spanning pharmacological, surgical, and supportive approaches, aim primarily to alleviate pain, control disease progression, and improve quality of life rather than achieve a definitive cure. Hormonal therapy continues to serve as the cornerstone of medical management, effectively suppressing ectopic endometrial growth through ovarian function inhibition. Among these, progestins and combined oral contraceptives demonstrate high efficacy and tolerability, whereas GnRH agonists and antagonists provide valuable options for resistant cases. However, long-term hormonal suppression is often limited by side effects and recurrence after treatment discontinuation.

Non-hormonal therapies, including NSAIDs, antioxidants, and nutraceuticals such as N-acetylcysteine, melatonin, and curcumin, offer promising adjunctive benefits, particularly for patients contraindicated for hormonal therapy or seeking pregnancy. Nevertheless, most studies supporting their use are small and heterogeneous, underscoring the need for further randomized clinical trials to establish efficacy and safety profiles.

Surgery remains indispensable for patients with severe or refractory disease. Laparoscopic excision or ablation of lesions continues to be the gold standard, aiming to restore pelvic anatomy and fertility potential. The growing application of robotic and fluorescence-guided techniques has enhanced precision and visualization, yet recurrence remains a significant challenge. Optimal outcomes are achieved when surgical management is integrated into multidisciplinary care and combined with postoperative hormonal suppression.

Supportive and complementary treatments - particularly physiotherapy, regular physical activity, and dietary modification - represent valuable adjuncts that address both somatic and psychosocial dimensions of the disease. Evidence suggests that structured exercise, yoga, and manual therapies

may reduce pain intensity, improve pelvic floor function, and enhance emotional well-being. Despite promising findings, methodological limitations and lack of standardized exercise protocols prevent definitive conclusions about their long-term benefits.

Overall, current approaches emphasize a multimodal and individualized treatment paradigm combining pharmacological, surgical, and supportive strategies. Such integrative management can substantially improve symptom control and life quality but still falls short of addressing the disease's multifactorial pathogenesis and high recurrence rates.

6. Limitations

This review has several limitations. Firstly, as a narrative review, it does not employ systematic search and selection criteria, which increases the risk of selection bias and limits reproducibility. Although multiple databases were searched comprehensively, inclusion of studies was based on relevance and quality assessment by the author rather than predefined systematic protocols.

Secondly, most of the evidence discussed derives from heterogeneous studies varying in design, sample size, and outcome measures, which complicates direct comparison and limits the generalizability of findings.

Language restrictions also pose a limitation: only English-language publications were reviewed, which may have excluded relevant findings reported in other languages. Additionally, due to the narrative nature of this work, it was not possible to include all emerging therapeutic approaches or explore in detail the underlying molecular mechanisms of novel treatments.

7. Future Directions

Future research should focus on high-quality, large-scale randomized controlled trials that directly compare the effectiveness and long-term outcomes of different pharmacological and non-pharmacological interventions. Particular attention should be given to identifying reliable biomarkers for early diagnosis, predicting treatment response, and monitoring disease recurrence.

Further investigation into personalized medicine - including genetic, epigenetic, and immunological profiling - may pave the way toward targeted, mechanism-based therapies with fewer side effects. Additionally, integrative approaches combining hormonal, surgical, and lifestyle interventions should be standardized to provide evidence-based guidelines for multidisciplinary care.

Finally, more rigorous studies are needed to define optimal exercise regimens, physiotherapeutic modalities, and nutritional protocols that can complement conventional therapy and improve quality of life in women with endometriosis.

8. Conclusions

Endometriosis is a chronic, estrogen-dependent condition that profoundly impacts women's reproductive health and overall quality of life. Despite significant progress, no single therapy provides a definitive cure, and management must therefore remain individualized and multidisciplinary. Hormonal and surgical treatments continue to form the therapeutic foundation, while emerging evidence supports the value of physiotherapy, physical activity, and dietary interventions as effective supportive measures.

An integrated approach - encompassing medical, surgical, and lifestyle strategies, offers the greatest potential to reduce pain, limit recurrence, and enhance physical and psychological well-being. Continued research into novel molecular targets and personalized management strategies remains essential to achieving more effective and sustainable outcomes for women affected by endometriosis.

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