

THE ROLE OF OXIDATIVE STRESS IN THE DEVELOPMENT OF ENDOMETRIOSIS

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Abstract

Endometriosis is a complex gynecological disorder that affects female reproductive health, with hormonal, immunological, and inflammatory components involved in its pathogenesis. In recent years, increasing attention has been given to the role of oxidative stress in the progression of this disease. Oxidative stress results from an imbalance between reactive oxygen species (ROS) and the body's antioxidant defenses, leading to damage at the cellular level including lipids, proteins, mitochondria, and DNA. These alterations contribute to chronic inflammation, angiogenesis, immune dysfunction, and abnormal tissue proliferation seen in endometriosis.

This article examines the clinical and molecular aspects of oxidative stress in the development of endometriosis, focusing particularly on markers such as interleukin-6 (IL-6) and phospholipase A2 (PLA2). The results of our study indicate that the addition of phytotherapeutic agents to standard hormonal therapy improves both clinical symptoms and biochemical markers.

Notably, antioxidant-based integrative treatment significantly reduced pain (VAS scores), lesion size, and inflammatory markers (IL-6, PLA2), demonstrating higher effectiveness compared to hormonal monotherapy. These findings suggest that targeting oxidative stress may be a promising strategy to enhance conservative management of endometriosis.

Keywords: Endometriosis, oxidative stress, antioxidants, reactive oxygen species, IL-6, PLA2, phytotherapy, pathogenesis.

Introduction

Endometriosis is a chronic gynecological condition affecting approximately 10% of women of reproductive age. It is characterized by the presence of endometrial-like tissue outside the uterus, typically involving the ovaries, fallopian tubes, pelvic peritoneum, and, less frequently, distant organs such as the bowel or bladder. Clinically, endometriosis manifests as dysmenorrhea, chronic pelvic pain, dyspareunia, irregular menstruation, and infertility, all of which significantly impair a woman's quality of life. The pathogenesis of endometriosis is multifactorial and remains not fully understood. Current hypotheses include:

1. Retrograde menstruation
2. Hormonal imbalance
3. Genetic and epigenetic factors
4. Immune system dysfunction



Oxidative stress

Oxidative stress plays a pivotal role by promoting chronic inflammation and stimulating the proliferation of ectopic endometrial tissue. ROS and lipid peroxidation products enhance cytokine expression, reduce apoptosis, and promote angiogenesis in endometriotic lesions. Additionally, oxidative stress is linked to immune dysregulation, with elevated levels of IL-6 and PLA2 playing key roles in perpetuating inflammation and pain. Standard treatments for endometriosis include hormonal suppression, primarily with progestins or GnRH analogues. While these therapies reduce symptoms in many patients, recurrence is common, and long-term efficacy remains limited. Therefore, integrative treatment approaches that combine hormonal therapy with antioxidant-based metabolic interventions are being increasingly explored.

In this article, we investigate the role of oxidative stress in endometriosis and evaluate the clinical efficacy of combining hormonal therapy with phytotherapeutic agents. The aim is to determine whether this integrative strategy improves clinical and laboratory outcomes, thereby providing a more comprehensive and effective conservative management for patients with endometriosis.

Materials and Methods

A prospective, comparative clinical study was conducted on 60 women aged 18–40 diagnosed with stage I–II genital endometriosis. Participants were divided into two groups: Group 1 received dienogest 2 mg daily for 6 months. Group 2 received dienogest plus fitoterapy (1 suppository daily for 14 days, then weekly). Assessments included VAS pain scores, menstrual symptoms, ultrasound findings, IL-6 and PLA2 levels. Data were analyzed using SPSS 25.0, with $p < 0.05$ considered statistically significant.

Results

The table below presents the comparative outcomes between the two groups.

Parameter	Group 1 (Control)	Group 2 (Main)	p-value
VAS Pain Score (Before)	6.8±1.1	6.8±1.1	-
VAS Pain Score (After)	4.5±1.0	2.3±0.9	<0.01
Lesion Size (Before, cm ³)	3.3±0.5	3.3±0.5	-
Lesion Size (After, cm ³)	2.5±0.6	1.8±0.4	<0.01
IL-6 (Before, pg/ml)	16.7±2.5	16.7±2.5	-
IL-6 (After, pg/ml)	12.3±1.9	9.6±1.8	<0.01
PLA2 (Before, ng/ml)	11.5±2.0	11.5±2.0	-
PLA2 (After, ng/ml)	9.2±1.7	7.1±1.6	<0.01
Normalized Menstrual Cycle (%)	63%	83%	<0.05



Discussion

These findings support the hypothesis that combining hormonal therapy with metabolic and physiotherapeutic interventions is more effective in reducing symptoms and inflammatory markers in endometriosis. Prior studies (Ivanova et al., 2020; Khan et al., 2019) have similarly reported benefits of targeting systemic inflammation. Fitoterepy improves oxidative balance. IL-6 and PLA2 reductions reflect downregulation of inflammation. Such integrative approaches may become part of standard protocols.

Conclusion

Combining hormonal treatment with fitoterepy enhances clinical and biochemical outcomes in endometriosis. This multifaceted approach addresses both symptomatic and pathophysiological aspects, improving patient quality of life. Future randomized clinical trials are necessary to confirm these findings in larger populations.

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