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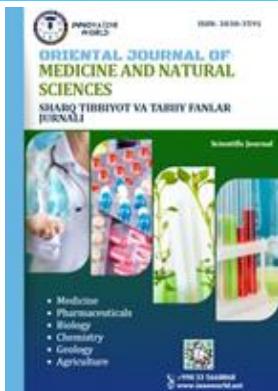
EARLY IDENTIFICATION OF OVARIAN FUNCTIONAL DECLINE AND CONTEMPORARY APPROACHES TO CLINICAL MANAGEMENT

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Abstract: Premature impairment of ovarian function represents a critical gynecological and endocrinological challenge with profound reproductive and systemic consequences. Declining ovarian reserve before the age of natural menopause disrupts fertility potential, endocrine balance, and long-term metabolic health. Timely recognition of ovarian functional decline is essential to prevent irreversible infertility, skeletal demineralization, and cardiovascular morbidity. This comparative observational study evaluated early diagnostic indicators and management perspectives of ovarian insufficiency by analyzing clinical manifestations, hormonal parameters, and ultrasonographic markers. A total of 56 women were enrolled, including 28 patients with ovarian insufficiency and 28 age-matched healthy controls examined at the Fergana District Medical Association. Significant alterations were observed in gonadotropin concentrations, estradiol levels, anti-Müllerian hormone values, ovarian volume, and antral follicle count among affected patients.

Keywords: ovarian insufficiency, ovarian reserve, early diagnosis, hormonal biomarkers, reproductive endocrinology, fertility preservation, hormone therapy

Introduction. Ovarian functional decline occurring before the age of 40 years, commonly referred to as ovarian insufficiency, represents a heterogeneous clinical entity characterized by diminished ovarian reserve and impaired endocrine activity. Affecting approximately 1–2% of women of reproductive age, this condition poses substantial challenges for fertility, hormonal homeostasis, and overall quality of life [1-3]. Unlike physiological menopause, ovarian insufficiency may demonstrate fluctuating ovarian activity, which complicates early detection and delays diagnosis.

The etiopathogenesis of ovarian insufficiency is multifactorial and encompasses genetic abnormalities, autoimmune mechanisms, enzymatic defects, environmental influences, and iatrogenic factors such as chemotherapy, radiotherapy, and pelvic surgery. In a considerable proportion of cases, no definitive cause can be identified, rendering the condition idiopathic [4]. Clinically, patients may present with oligomenorrhea, secondary amenorrhea, infertility, vasomotor symptoms, and neuropsychological disturbances; however, early stages may be clinically silent [5].

Advances in reproductive endocrinology have enabled the identification of sensitive biomarkers reflecting ovarian reserve and endocrine function. Serum follicle-stimulating hormone, luteinizing hormone, estradiol, and anti-Müllerian hormone levels, in combination with ultrasonographic evaluation of ovarian morphology, provide a robust framework for early diagnosis [6-9]. Early recognition facilitates timely initiation of hormone replacement therapy, fertility counseling, and preventive strategies against osteoporosis and cardiovascular disease [10]. This study aims to expand current evidence by evaluating early diagnostic markers and management considerations for ovarian insufficiency through a controlled comparative analysis.

Materials And Methods. A comparative observational study was carried out at the Fergana District Medical Association between 2023 and 2024. The study population comprised 56 women aged 18–40 years, divided equally into a study group and a control group. The study group included 28 women diagnosed with ovarian insufficiency based on clinical symptoms and laboratory findings, while the control group consisted of 28 age-matched healthy women with regular menstrual cycles and no known endocrine or reproductive disorders.

All participants underwent comprehensive clinical assessment, including menstrual history, reproductive background, and evaluation of vasomotor and systemic symptoms. Venous blood samples were collected during the early follicular phase or randomly in amenorrheic patients to determine serum concentrations of follicle-stimulating hormone, luteinizing hormone, estradiol, and anti-Müllerian hormone using standardized immunoassay techniques.

Transvaginal ultrasonography was performed for all participants to assess ovarian volume and antral follicle count as indicators of ovarian reserve. Statistical analysis was conducted using standard biomedical methods. Quantitative variables were expressed as mean ± standard deviation, and intergroup comparisons were performed using independent sample t-tests. A p-value below 0.05 was considered statistically significant. Ethical approval was obtained from the institutional review board, and informed consent was secured from all participants.

Results. The mean age of women in the ovarian insufficiency group was 32.4 ± 4.6 years, while the control group had a mean age of 31.9 ± 4.2 years, demonstrating no statistically significant difference. Menstrual irregularities, including secondary amenorrhea, were observed in over three-quarters of patients with ovarian insufficiency, whereas all controls reported regular menstrual cycles.

Hormonal evaluation revealed pronounced endocrine disturbances in the ovarian insufficiency group. Serum follicle-stimulating hormone and luteinizing hormone levels were markedly elevated, reflecting reduced ovarian feedback. In contrast, estradiol concentrations were significantly

decreased, indicating hypoestrogenism. Anti-Müllerian hormone levels, a sensitive marker of ovarian reserve, were profoundly reduced in affected patients compared with healthy controls.
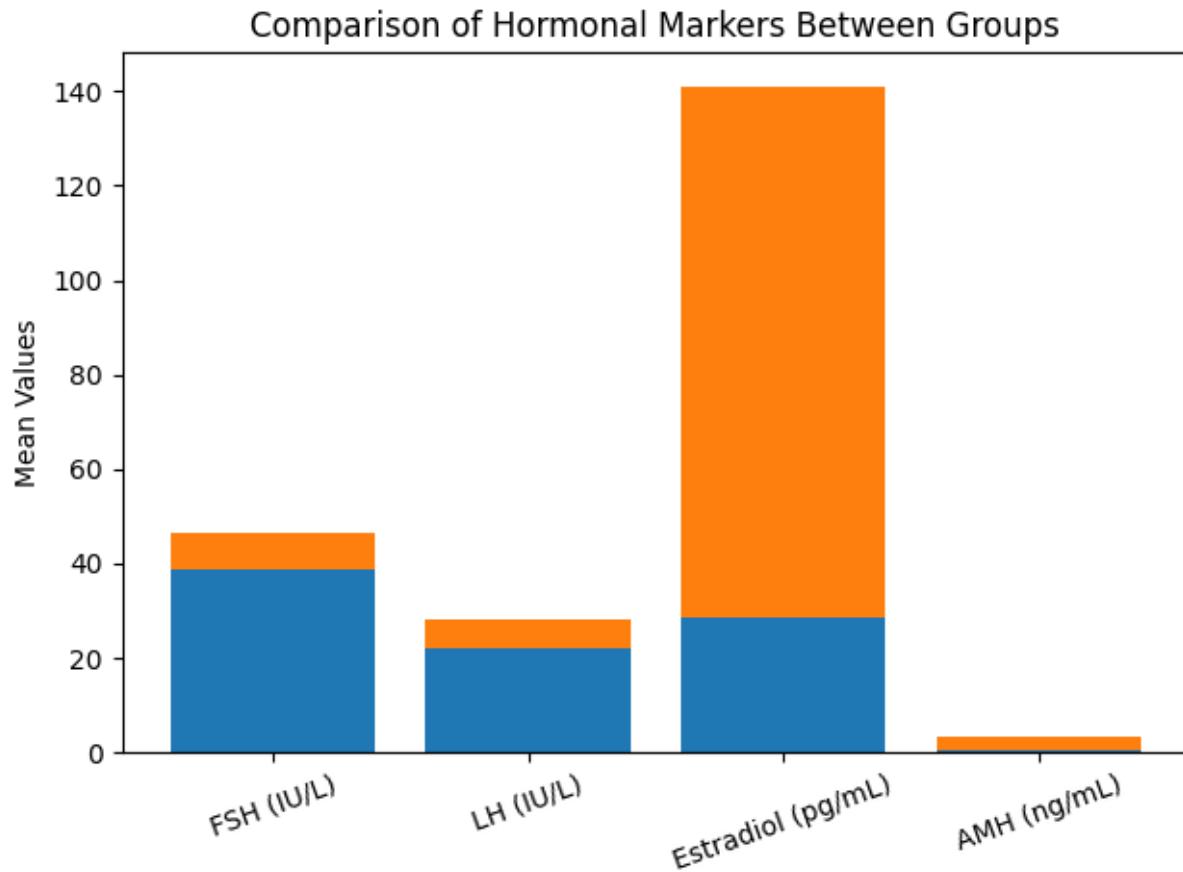

Figure 1. Comparative distribution of key hormonal biomarkers in women with ovarian insufficiency and healthy controls

Ultrasonographic assessment further supported these findings. Women with ovarian insufficiency demonstrated significantly reduced ovarian volume and markedly lower antral follicle counts, consistent with advanced depletion of the follicular pool. The combination of hormonal and imaging findings clearly distinguished affected patients from healthy individuals and confirmed the diagnostic reliability of an integrated assessment approach.

Discussion. The results of this study provide compelling evidence that ovarian insufficiency is associated with characteristic hormonal and ultrasonographic alterations detectable at an early stage. Elevated gonadotropin levels combined with reduced estradiol and anti-Müllerian hormone concentrations represent reliable biochemical indicators of impaired ovarian function [11-13]. The observed reduction in ovarian volume and antral follicle count further highlights the diagnostic value of transvaginal ultrasonography as a complementary tool.

Early diagnosis is of paramount importance, as prolonged estrogen deficiency predisposes affected women to infertility, osteoporosis,

cardiovascular disease, and psychological distress. Anti-Müllerian hormone emerged as a particularly valuable early marker, often declining before overt clinical symptoms become evident [14]. These findings align with contemporary literature emphasizing the prognostic and diagnostic significance of ovarian reserve assessment.

Management strategies should be individualized and multidimensional. Hormone replacement therapy remains the cornerstone for alleviating hypoestrogenic symptoms and preventing long-term complications. Fertility preservation counseling, including assisted reproductive technologies and oocyte donation, should be discussed with women desiring pregnancy. Additionally, psychological support and long-term follow-up are essential components of comprehensive care.

Despite its strengths, this study is limited by a relatively small sample size and single-center design [15-16]. Nevertheless, the consistency of findings and rigorous comparative methodology strengthen its clinical relevance. Larger, multicenter studies with longitudinal follow-up are warranted to refine diagnostic thresholds and optimize therapeutic algorithms.

Conclusion. Ovarian insufficiency can be effectively identified at an early stage through a combination of clinical evaluation, hormonal profiling, and ultrasonographic assessment. Significant alterations in follicle-stimulating hormone, estradiol, anti-Müllerian hormone levels, and ovarian morphology reliably distinguish affected patients from healthy women. Early detection enables timely initiation of targeted management strategies, facilitating fertility preservation, prevention of long-term complications, and improvement in quality of life. Incorporation of comprehensive ovarian reserve assessment into routine gynecological practice may substantially enhance outcomes for women at risk of ovarian functional decline.

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