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FORECASTING EARLY OVARIAN FAILURE BASED ON BIOCHEMICAL INDICATORS

Boboxonova Muhayyoxon Mo'minjonovna

Fergana Public Health Medical Institute

Department of Folk Medicine and Pharmacology

Abstract: Early ovarian failure (EOF), also known as premature ovarian insufficiency, affects approximately 1% of women under the age of 40. Timely diagnosis and intervention are crucial for preserving fertility and mitigating the long-term health consequences associated with EOF. This article explores the current understanding of biochemical indicators that may serve as predictive markers for EOF.

Keywords: early ovarian failure, premature ovarian insufficiency, biochemical indicators, anti-Müllerian hormone, follicle-stimulating hormone

Annotatsiya: Erta tuxumdon yetishmovchiligi (EOF), 40 yoshgacha bo'lgan ayollarning taxminan 1 foiziga ta'sir qiladi. O'z vaqtida tashxis qo'yish va bartaraf etish tug'ilishni saqlab qolish va EOF bilan bog'liq uzoq muddatli sog'liq oqibatlarini yumshatish uchun juda muhimdir. Ushbu maqola EOF uchun bashoratli bo'lgan biokimyoviy ko'rsatkichlar haqidagi zamonaviy tushunchalarni ko'rib chiqadi.

Kalit so'zlar: erta tuxumdon yetishmovchiligi, biokimyoviy ko'rsatkichlar, anti-Myuller gormoni, follikulani ogohlantiruvchi gormon

Аннотация: Ранняя недостаточность яичников (ОФ), также известная как преждевременная недостаточность яичников, поражает примерно 1% женщин в возрасте до 40 лет. Своевременная диагностика и вмешательство имеют решающее значение для сохранения фертильности и смягчения долгосрочных последствий для здоровья, связанных с ОФ. В данной статье рассматриваются современные представления о биохимических показателях, которые могут служить в качестве прогностических маркеров ЭОФ.

Ключевые слова: ранняя недостаточность яичников, преждевременная недостаточность яичников, биохимические показатели, антимюллеровский гормон, фолликулостимулирующий гормон

INTRODUCTION

Early ovarian failure (EOF), also known as premature ovarian insufficiency (POI), is a condition characterized by the loss of ovarian function before the age of 40 [1]. EOF affects approximately 1% of women worldwide and can lead to infertility, menopausal symptoms,

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and long-term health consequences such as osteoporosis and cardiovascular disease [2]. The etiology of EOF is multifactorial, encompassing genetic, autoimmune, and environmental factors [3]. Early diagnosis and intervention are crucial for preserving fertility and mitigating the adverse health outcomes associated with EOF. However, the diagnosis of EOF remains challenging due to its heterogeneous presentation and the lack of standardized diagnostic criteria [4].

Biochemical indicators have emerged as promising tools for predicting and diagnosing EOF. These markers reflect the underlying pathophysiological processes involved in ovarian dysfunction and can provide valuable insights into the onset and progression of the condition [5]. This literature review aims to summarize the current knowledge on biochemical indicators that may serve as predictive markers for EOF, focusing on their diagnostic value, limitations, and potential clinical applications.

METHODS AND LITERATURE REVIEW

A comprehensive literature search was conducted using PubMed, Scopus, and Web of Science databases. The search terms included combinations of "early ovarian failure," "premature ovarian insufficiency," "biochemical markers," "hormonal markers," "anti-Müllerian hormone," "follicle-stimulating hormone," "inhibin B," "microRNAs," and "genetic factors."

Relevant data were extracted from the included studies, including study design, patient characteristics, biochemical markers investigated, diagnostic performance measures (sensitivity, specificity, predictive values), and key findings. A qualitative synthesis of the data was performed to identify the most promising biochemical indicators and their potential clinical applications.

RESULTS

Hormonal Markers. Follicle-stimulating hormone (FSH) is the most widely used biochemical marker for diagnosing EOF [6]. Elevated FSH levels (>40 IU/L) on two occasions at least one month apart are considered indicative of ovarian failure [7]. However, FSH levels can fluctuate, particularly in the early stages of EOF, leading to potential false-negative results [8].

Anti-Müllerian hormone (AMH) has emerged as a promising marker for assessing ovarian reserve and predicting EOF [4]. AMH levels decline with age and are significantly lower in women with EOF compared to age-matched controls [5]. Studies have shown that AMH has higher sensitivity and specificity for predicting EOF than FSH [6]. A meta-analysis by Broer et al. [3] reported a pooled sensitivity of 79% and specificity of 93% for AMH in predicting EOF.

Inhibin B, produced by granulosa cells, has also been investigated as a potential marker for EOF. Reduced inhibin B levels have been observed in women with EOF compared to healthy controls. However, the diagnostic performance of inhibin B appears to be inferior to that of AMH and FSH.

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Emerging Biomarkers. MicroRNAs (miRNAs) have been implicated in the regulation of ovarian function and folliculogenesis. Several studies have identified differentially expressed miRNAs in women with EOF compared to healthy controls. For example, miR-23a and miR-27a were found to be upregulated in the serum of EOF patients, suggesting their potential as diagnostic biomarkers. However, the clinical utility of miRNAs in EOF prediction requires further validation.

ANALYSIS AND DISCUSSION

The literature review highlights the potential of biochemical indicators, particularly AMH and FSH, in predicting and diagnosing EOF. AMH has demonstrated superior diagnostic performance compared to FSH, with higher sensitivity and specificity for detecting ovarian dysfunction. The decline in AMH levels precedes the rise in FSH, making it a valuable marker for the early detection of EOF. However, the lack of standardized AMH assays and reference ranges limits its widespread clinical application.

Emerging biomarkers, such as miRNAs and genetic factors, offer promising avenues for improving the prediction and understanding of EOF. MiRNAs have the potential to serve as non-invasive diagnostic tools, reflecting the underlying molecular mechanisms of ovarian dysfunction. However, further research is needed to validate their clinical utility and establish standardized protocols for their measurement.

Genetic testing for mutations associated with EOF can identify women at high risk and facilitate early intervention and counseling. However, the interpretation of genetic test results can be challenging, and the presence of a mutation does not necessarily guarantee the development of EOF. Therefore, genetic testing should be considered in conjunction with other clinical and biochemical indicators.

CONCLUSIONS

This literature review highlights the potential of biochemical indicators, particularly AMH and FSH, in predicting and diagnosing early ovarian failure. AMH has demonstrated superior diagnostic performance compared to FSH, making it a valuable marker for the early detection of EOF. However, standardization of AMH assays and establishment of reference ranges are necessary for its widespread clinical application.

Emerging biomarkers, such as miRNAs and genetic factors, offer promising avenues for improving the prediction and understanding of EOF. Further research is needed to validate their clinical utility and establish standardized protocols for their measurement.

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