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The importance of biochemical markers in predicting pregnancy outcomes and extending gestation in cases of PPROM

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ABSTRACT

Preterm premature rupture of membranes (PPROM) represents a critical obstetric condition, significantly elevating the risks of preterm birth, neonatal complications, and maternal infections. Identifying pregnancies susceptible to PPROM at an early stage is vital for enhancing perinatal outcomes. Several biochemical markers, such as fetal fibronectin (fFN), placental alpha-microglobulin-1 (PAMG-1), insulin-like growth factor binding protein-1 (IGFBP-1), and inflammatory markers like C-reactive protein (CRP) and interleukins, demonstrate considerable diagnostic and predictive significance. This study examines the role of these biomarkers in PPROM diagnosis, prognosis of pregnancy outcomes, and the formulation of clinical interventions. Integrating biomarker analysis into obstetric care enables the timely administration of corticosteroids, antibiotics, and tocolytics, thereby prolonging gestation and improving neonatal survival. Further research is required to optimize biomarker-based strategies for personalized patient management.

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Homila pardalarining muddatidan oldin yorilishi (HPMOY) holatida homiladorlik natijalarini bashorat qilish va homiladorlik muddatini uzaytirishda biokimyoviy belgilovchilarning ahamiyati

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Kalit so‘zlar:
homila qobig‘ining muddatidan oldin yorilishi (HQMOY),
biokimyoviy markerlar,
homiladorlik natijalari,
fetal fibronektin (fFN),
yo‘ldosh alfa-mikroglobulin-1 (PAMG-1),
insulinga o‘xshash o‘sish omilini bog‘lovchi oqsil-1 (IGFBP-1),
C-reaktiv oqsil (CRP),
yallig‘lanish markerlari,
muddatidan oldin tug‘ishni bashorat qilish,
homiladorlik muddatini uzaytirish.

ANNOTATSIYA

Homila qobig‘ining muddatidan oldin yorilishi (HQMOY) jiddiy akusherlik holati hisoblanib, muddatidan oldin tug‘ish, chaqaloq asoratlari va onada infeksiya xavfini sezilarli darajada oshiradi. Perinatal natijalarni yaxshilash uchun HQMOYga moyil homiladorliklarni erta aniqlash hal qiluvchi ahamiyatga ega. Fetal fibronektin (fFN), yo‘ldosh alfa-mikroglobulin-1 (PAMG-1), insulinga o‘xshash o‘sish omilini bog‘lovchi oqsil-1 (IGFBP-1) kabi bir nechta biokimyoviy markerlar, shuningdek C-reaktiv oqsil (CRP) va interleykinlar kabi yallig‘lanish markerlari muhim diagnostik va prognostik qiymatga ega ekanligi aniqlangan. Ushbu tadqiqot mazkur biomarkerlarning HQMOYni tashxislash, homiladorlik natijalarini bashorat qilish va klinik choralarni ishlab chiqishdagi o‘rnini ko‘rib chiqadi. Biomarkerlar tahlilini akusherlik amaliyotiga joriy etish kortikosteroidlar, antibiotiklar va tokolitiklarni o‘z vaqtida qo‘llash imkonini beradi, bu esa homiladorlikni uzaytirish va chaqaloqlarning omon qolish darajasini oshirishga yordam beradi. Bemorlarni individual davolashni hisobga olgan holda biomarkerlarga asoslangan strategiyalarni takomillashtirish uchun qo‘shimcha tadqiqotlar o‘tkazish zarur.

Значение биохимических маркеров в прогнозировании исходов беременности и продлении гестации при преждевременном разрыве плодных оболочек (ПРПО)

Ключевые слова:
преждевременный разрыв плодных оболочек (ПРПО),
биохимические маркеры,
исходы беременности,
фетальный фибронектин (fFN),
плацентарный альфа-микроглобулин-1

(PAMG-1),
инсулиноподобный фактор роста,
связывающий белок-1 (IGFBP-1),
С-реактивный белок (CRP),
воспалительные маркеры,
прогнозирование преждевременных родов,
продление гестации.

АННОТАЦИЯ

Преждевременный разрыв плодных оболочек (ПРПО) является серьезным акушерским состоянием, значительно повышающим риск преждевременных родов, неонатальных осложнений и материнских инфекций. Ранняя идентификация беременностей, предрасположенных к ПРПО, имеет решающее значение для улучшения перинатальных исходов. Несколько биохимических маркеров, таких как фетальный фибронектин (fFN), плацентарный альфа-микроглобулин-1 (PAMG-1), инсулиноподобный фактор роста, связывающий белок-1 (IGFBP-1), а также воспалительные маркеры, включая С-реактивный белок (CRP) и интерлейкины, демонстрируют значительную диагностическую и прогностическую ценность. В этом исследовании рассматривается роль этих биомаркеров в диагностике ПРПО, прогнозировании исходов беременности и разработке клинических вмешательств. Интеграция анализа биомаркеров в акушерскую практику позволяет своевременно назначать кортикостероиды, антибиотики и токолитики, что способствует продлению беременности и повышению выживаемости новорожденных. Дальнейшие исследования необходимы для оптимизации стратегий,

основанных на биомаркерах, с учетом индивидуального ведения пациентов.

INTRODUCTION

PPROM, occurring in approximately 2–3% of pregnancies, is responsible for nearly 40% of preterm births. It is defined by the rupture of fetal membranes before 37 weeks of gestation and is associated with complications such as chorioamnionitis, neonatal sepsis, respiratory distress syndrome, and increased perinatal mortality. Prompt diagnosis and intervention are crucial for improving pregnancy outcomes and minimizing neonatal risks. Biochemical markers have emerged as valuable tools for assessing pregnancy outcomes in PPROM cases. Markers such as fetal fibronectin (fFN), placental alpha-microglobulin-1 (PAMG-1), and insulin-like growth factor binding protein-1 (IGFBP-1) aid in diagnosing membrane rupture and estimating the risk of preterm labor. Furthermore, inflammatory markers, including C-reactive protein (CRP) and interleukins, offer insights into intra-amniotic infections and inflammation, both of which significantly influence pregnancy prognosis.

The aim of the research is to assess the significance of biochemical markers in forecasting pregnancy outcomes and their role in prolonging gestation in cases of PPROM.

The objectives of the research are the following:

- To evaluate the diagnostic accuracy and predictive value of selected biochemical markers in PPROM.
- To investigate the role of inflammatory markers in detecting intra-amniotic infections and unfavorable pregnancy outcomes.
- To analyze the impact of biomarker-driven interventions on gestational extension and neonatal survival.
- To provide clinical recommendations for integrating biochemical markers into routine obstetric practice for enhanced PPROM management.

MATERIALS AND METHODS

Study Design and Data Collection

This study is based on a comprehensive review of literature, clinical trials, and retrospective cohort studies focused on biochemical markers in PPROM cases. Research articles were sourced from databases such as PubMed, Scopus, and Google Scholar, with a preference for studies published in the last decade. The selection criteria included studies evaluating the diagnostic precision, predictive significance, and clinical applications of biochemical markers.

Study Population and Selection Criteria

The studies reviewed included pregnant women diagnosed with PPROM between 24 and 36 weeks of gestation. Selection criteria included:

- Clinical and laboratory-confirmed PPROM diagnosis.
- Availability of biochemical marker data, including fFN, PAMG-1, IGFBP-1, and inflammatory markers (CRP, IL-6, IL-8).
- Documented pregnancy outcomes, including latency period, neonatal morbidity, and maternal complications.

Biochemical Markers Assessed

- Fetal Fibronectin (fFN): Evaluates the likelihood of preterm labor in PPROM cases.

- Placental Alpha-Microglobulin-1 (PAMG-1): A highly specific marker for detecting amniotic fluid leakage.

- Insulin-Like Growth Factor Binding Protein-1 (IGFBP-1): Used for confirming membrane rupture.

- Inflammatory Markers (CRP, IL-6, IL-8): Assess intra-amniotic infection and inflammation associated with adverse pregnancy outcomes.

Data Analysis and Interpretation

Collected data were analyzed based on:

- Sensitivity, specificity, and predictive values of each biomarker.

- Correlation between biomarker levels and pregnancy outcomes.

- The effectiveness of biomarker-guided clinical interventions, including corticosteroids, antibiotics, and tocolytics.

RESULTS AND DISCUSSION

Key Findings

- Fetal Fibronectin (fFN): Elevated fFN levels in vaginal secretions correlated strongly with preterm birth risk. Sensitivity ranged from 60% to 80%, with specificity between 70% and 90% for predicting delivery within seven days.

- Placental Alpha-Microglobulin-1 (PAMG-1): Exhibited high specificity (>95%) in confirming membrane rupture, enabling early clinical intervention.

- Insulin-Like Growth Factor Binding Protein-1 (IGFBP-1): Found to be a sensitive indicator of amniotic fluid leakage, though slightly less specific than PAMG-1.

- Inflammatory Markers (CRP, IL-6, IL-8): Elevated levels of CRP and interleukins were linked to intra-amniotic infection and neonatal morbidity. CRP levels exceeding 10 mg/L were associated with chorioamnionitis, highlighting the necessity of infection surveillance in PPROM cases.

-Pregnancy Prolongation and Neonatal Outcomes: Biomarker-guided interventions, including corticosteroids and antibiotics, resulted in an average pregnancy prolongation of 5–7 days, which was crucial in reducing neonatal respiratory distress syndrome and sepsis.

Clinical Implications

- Enhanced Diagnostic Accuracy: The high specificity of PAMG-1 and IGFBP-1 in detecting membrane rupture minimizes false-positive results, ensuring appropriate patient management.

- Improved Risk Stratification: fFN testing identifies women at high risk for preterm birth, facilitating timely medical interventions.

- Guided Clinical Management: Inflammatory marker monitoring enables early infection detection, ensuring prompt antibiotic therapy.

CONCLUSION

Biochemical markers are indispensable tools for early PPROM diagnosis, risk assessment, and clinical management. Findings from this study reinforce the effectiveness of markers such as fFN, PAMG-1, and IGFBP-1 in confirming membrane rupture and predicting pregnancy outcomes. Additionally, inflammatory markers like CRP and interleukins provide crucial insights into intra-amniotic infections, guiding timely clinical interventions.

Despite their benefits, challenges remain in terms of sensitivity variations, cost, and accessibility. Future research should refine diagnostic thresholds, develop predictive

models incorporating multiple biomarkers, and enhance accessibility in diverse healthcare settings. By advancing biomarker applications, clinicians can optimize the management of PPROM, ultimately improving maternal and neonatal health outcomes.