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OPTIMIZATION OF MANAGEMENT OF PREGNANT WOMEN AFTER MYOCARDITIS: PROGNOSTIC CRITERIA AND TACTICS

An A.V., Sharipova F.X.
Tashkent medical academy

XULOSA

Ushbu tadqiqotda o‘choqli miokardit tashhisi qo‘yilgan homilador ayollarni klinik boshqarish strategiyalari baholandi va prognostic mezonlari aniqlandi. Jami 74 nafar homilador ayol tekshirilib, ular miokardit tashhisi qo‘yilgan vaqtga ko‘ra guruhlarga ajratildi: homiladorlik davrida va homiladorlikdan oldin. Klinik, instrumental va doppler-ultratovush tekshiruvlari guruhlar o‘rtasida ona gemodinamikasi, yurak faoliyati va akusherlik natijalarida sezilarli farqlarni aniqladi. Logistik regressiya modellashuvi homiladorlikning noxush oqibatlari uchun asosiy prediktorlarni aniqladi. Ishlab chiqilgan prognostic modelga asoslangan individuallashtirilgan akusherlik yordamini joriy etish ona va homila prognozini sezilarli darajada yaxshilashga va sog‘liqni saqlash xarajatlarini kamaytirishga imkon berdi, ushbu toifadagi bemorlarni boshqarishda maqsadli strategiyalarning ahamiyatini ta’kidlaydi.

Kalit so‘zlar: *miokardit, homiladorlik, prognoz, exokardiografiya, akusherlik asoratlari.*

РЕЗЮМЕ

В настоящем исследовании проведена оценка стратегий клинического ведения и определены прогностические критерии для беременных с очаговым миокардитом. Было обследовано 74 беременных пациентки, разделенных на группы в зависимости от времени постановки диагноза миокардита: во время беременности и до зачатия. Клинические, инструментальные и допплерометрические исследования выявили значительные различия в показателях материнской гемодинамики, функции сердца и акушерских исходах между группами. Методом логистической регрессии были определены ключевые предикторы неблагоприятных исходов беременности. Внедрение индивидуализированной тактики ведения, основанной на разработанной прогностической модели, позволило значительно улучшить материнский и плодовый прогноз, а также снизить затраты на здравоохранение, что подчеркивает важность таргетных стратегий ведения данной категории пациенток.

Ключевые слова: *миокардит, беременность, прогноз, эхокардиография, акушерские осложнения.*

Cardiovascular diseases are a leading cause of maternal mortality and morbidity worldwide, presenting a formidable challenge in modern obstetrics [1,2]. Among these conditions, myocarditis represents a particularly high-risk pathology during pregnancy. It can lead to severe complications, including acute heart failure, life-threatening arrhythmias, preeclampsia, and adverse fetal outcomes such as growth restriction and demise [3,7,8]. The inflammatory nature of the disease, often triggered by viral infections, is exacerbated by the unique hemodynamic and immunological changes of pregnancy, creating a volatile clinical scenario.

The primary clinical problem lies in the diagnostic and management complexity of myocarditis in pregnant women. Its clinical presentation is often nonspecific, ranging from subtle rhythm disturbances to cardiogenic shock, which can delay diagnosis and the initiation of appropriate therapy [7, 11]. Furthermore, there is a lack of robust, evidence-based guidelines specifically tailored to this patient population. This results in significant variability in clinical practice and suboptimal management, which directly contributes to poor maternal and fetal

prognoses [4,9].

The urgency and clinical relevance of this study are therefore dictated by the pressing need for reliable tools to improve risk stratification and guide management. The ability to accurately predict which patients are at higher risk for adverse outcomes is crucial for personalizing care, optimizing the timing and mode of delivery, and allocating healthcare resources effectively. The development of a prognostic model based on readily available clinical, electrocardiographic, and echocardiographic data addresses a critical gap in current obstetric and cardiological practice.

Therefore, the aim of the current study is to optimize the management strategy for pregnant women with myocarditis through the development of prognostic criteria and evaluation of the effectiveness of proposed interventions.

MATERIAL AND METHODS

Study Design and Population.

A prospective cohort observational study was conducted at the Perinatal Center in Tashkent. The study enrolled a total of 74 pregnant women who were admitted for delivery and subsequently underwent comprehensive clinical evaluation and observation.

Participants were stratified into two primary groups based on the presence and timing of myocarditis diagnosis:

- Main group (MG), comprising 44 pregnant women diagnosed with focal myocarditis:

- MG-1: 14 patients (31.8%) with myocarditis diagnosed during pregnancy.

- MG-2: 30 patients (68.2%) with chronic focal myocarditis diagnosed before pregnancy.

- Control group (CG): 30 pregnant women without clinical, instrumental, or laboratory signs of myocarditis or other cardiovascular pathology.

Clinical Evaluation and Data Collection.

Clinical examination and data collection involved detailed anamnesis, including obstetric, gynecological, and somatic medical histories. Information was systematically gathered regarding maternal age, parity, obstetric outcomes, gynecological diseases, infectious diseases before or during pregnancy, and previous pregnancies and complications. Anthropometric assessments included height, weight, body mass index, and external obstetric examination. Standard vital signs, including systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR), were documented at baseline and monitored during follow-up visits.

Instrumental Investigations.

All pregnant women underwent the following instrumental investigations:

1. Electrocardiography (ECG). Standard 12-lead ECG was performed using Edan SE-3 (Edan Instruments Inc., China). The ECG analysis included assessment of cardiac rhythm, detection of arrhythmias, myocardial ischemic changes, conduction abnormalities, and other myocardial disturbances.
2. Echocardiography (EchoCG). Detailed echocardiographic evaluation was carried out using Mindray DC-70 (Mindray Bio-Medical Electronics Co., Ltd, China). Echocardiographic parameters included left ventricular end-diastolic dimension (LVEDD), left ventricular end-systolic dimension (LVESD), interventricular septum thickness, left ventricular posterior wall thickness, left atrial dimension, aortic root diameter, right ventricular dimension, left ventricular ejection fraction (LVEF), left ventricular end-diastolic and end-systolic volumes (LVEDV and LVESV), mean pulmonary arterial pressure (mPAP), diastolic dysfunction indices, presence of mitral and tricuspid regurgitation, valve insufficiency, and pericardial effusion.
3. Ultrasound and Doppler Examination of the Fetoplacental System. Comprehensive fetal ultrasound included fetal anatomy, biometry, and growth assessment, performed using standard obstetric protocols. Doppler examination of maternal uterine arteries, fetal umbilical artery, middle cerebral artery, thoracic aorta, venous duct, and tricuspid valve blood flow velocities were assessed to detect fetoplacental blood flow disturbances.

Statistical Analysis.

Statistical processing of collected data was performed using Microsoft Excel and Statistica for Windows 6.0 software packages. Normality testing of continuous variables was conducted using Kolmogorov-Smirnov and Shapiro-Wilk tests. Continuous variables were expressed as mean ± standard deviation (M±SD), and categorical variables as frequencies and percentages (%). Student’s t-test was utilized to compare normally distributed continuous variables, with significance defined as $p<0.05$. The assessment of categorical data was performed by χ^2 test with Yates correction for continuity. Prognostic analysis involved calculating sensitivity, specificity, diagnostic accuracy, and odds ratios (ORs) with corresponding 95% confidence intervals (CIs) using binary logistic regression methods.

Ethical Considerations.

The study was conducted according to the ethical principles outlined in the Declaration of Helsinki and approved by the institutional review board of the Perinatal Center in Tashkent. All participants provided written informed consent prior to inclusion in the study.

RESULTS

Demographic and Obstetric Characteristics

The analysis of demographic characteristics revealed that pregnant women in both subgroups of the main group were significantly older compared to the control group (29.4±0.6 years vs. 26.5±0.4 years; $p<0.05$). The incidence of gynecological complications was significantly higher in the myocarditis groups. Pelvic inflammatory disease (PID) was documented in 31.8% (n=7) of MG-1

and 30.0% (n=9) of MG-2, compared to 13.3% (n=4) in the control group (p<0.05). In analyzing obstetric complications, preeclampsia was significantly more frequent in MG-1 (21.4%, n=3) than in MG-2 (10.0%, n=3) and markedly higher than in controls (3.3%, n=1; p<0.05). Additionally, threatened preterm labor was noted more often in MG-1 (28.6%, n=4) compared to MG-2 (13.3%, n=4) and controls (3.3%, n=1).

Table 1

Comparative characteristics and complications in the study groups

Parameter	MG-1 (n=14)	MG-2 (n=30)	CG (n=30)	p-value
Mean Age, years	28.9±0.5	29.6±0.7	26.5±0.4	<0.05
History of PID, % (n)	31.8% (7)	30.0% (9)	13.3% (4)	<0.05
Preeclampsia, % (n)	21.4% (3)	10.0% (3)	3.3% (1)	<0.05
Threatened Preterm Labor, % (n)	28.6% (4)	13.3% (4)	3.3% (1)	<0.05
Mild Hyperemesis Gravidarum, % (n)	42.9% (6)	20.0% (6)	6.7% (2)	<0.05

Hemodynamic and Echocardiographic Findings.

Baseline heart rate (HR) was significantly elevated in myocarditis patients compared to controls (96.9±17.1 bpm vs. 88.8±11.9 bpm; p<0.05). Echocardiographic assessment demonstrated significant variations between myocarditis and control groups. Patients with myocarditis had significantly increased cardiac dimensions and volumes and lower left ventricular ejection fraction (LVEF), reflecting compromised myocardial contractility.

Table 2

Key echocardiographic parameters in the study groups

Parameter	Main Group (n=44)	Control Group (n=30)	p-value
LVEDD, mm	50.7±3.9	48.7±2.6	0.022
LVESD, mm	32.2±3.5	30.1±2.2	0.007
LVEDV, ml	124.0±21.3	112.1±15.5	0.014
LVESV, ml	42.9±11.2	35.8±7.0	0.005
LVEF, %	65.1±5.8	68.1±2.6	<0.05
mPAP, mm Hg	17.6±6.1	12.7±1.9	<0.001

LVEDD - Left Ventricular End-Diastolic Dimension; LVESD - Left Ventricular End-Systolic Dimension; LVEDV - Left Ventricular End-Diastolic Volume; LVESV - Left Ventricular End-Systolic Volume; LVEF - Left Ventricular Ejection Fraction; mPAP - Mean Pulmonary Artery Pressure.

Predictive model for adverse pregnancy outcomes.

A logistic regression-based predictive model was developed. Significant predictors included maternal age over 25 years, history of viral infections during pregnancy, gynecological inflammatory diseases, preeclampsia, preterm birth threats, tachycardia (>80 bpm), ECG abnormalities, and valvular regurgitations. The resulting model demonstrated a sensitivity of 57.8%, specificity of 91.6%, and overall diagnostic accuracy of 80.4%. Scores derived from the model enabled stratification into risk categories:

- 1–15 points: Low risk of adverse outcomes.
- 16–45 points: High risk of adverse outcomes, necessitating meticulous obstetric management.

DISCUSSION

The results obtained from the present study highlight significant clinical implications for the management of pregnant women with focal myocarditis. Our analysis demonstrated a marked elevation in heart rate and altered echocardiographic parameters, including increased LVEDD, LVESD, and reduced LVEF in patients with myocarditis. Such hemodynamic changes correlate with previously reported findings that cardiac remodeling and impaired myocardial function are common in pregnancy complicated by inflammatory myocardial disease [6], [11].

A key observation was the significant association between myocarditis and obstetric complications such as preeclampsia, threatened preterm labor, and altered fetal-placental blood flow patterns. These results corroborate existing data that cardiovascular disorders substantially increase the risk of adverse pregnancy outcomes [9], [11]. The presence of chronic inflammatory gynecological diseases, notably PID, further amplifies these risks.

Our logistic regression model provided reliable predictive capability, with specificity reaching 91.6%. Similar risk-stratification approaches have been successfully validated in international guidelines, underscoring the clinical relevance of precise risk assessment [3], [4], [11]. An important practical aspect identified is the optimal strategy for labor induction and delivery management. We advocate for individualized timing and method selection, aligning with recent ESC recommendations [3, 9,11].

CONCLUSION

The current study underscores the considerable impact of focal myocarditis on maternal and fetal outcomes during pregnancy. A comprehensive clinical and instrumental evaluation, including echocardiographic and Doppler ultrasound monitoring, is imperative for effective management. Our logistic regression-based predictive model reliably stratifies pregnant women into

low and high-risk categories, enabling tailored management strategies. The proposed clinical guidelines for labor induction, delivery, and postpartum care can significantly mitigate complications. Implementation of this structured approach is not only clinically advantageous but also economically justified, substantially reducing healthcare costs.

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