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PROGNOSIS OF PATIENTS WITH ACUTE MYOCARDIAL INFARCTION DURING THE HOSPITAL STAGE: A MULTIVARIATE ANALYSIS OF CLINICAL AND METABOLIC RISK FACTORS

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Abstract: Acute Myocardial Infarction (AMI) remains a leading cause of in-hospital mortality worldwide, necessitating precise risk stratification to optimize therapeutic strategies. This article presents a prospective observational study conducted at the Department of Faculty Therapy of Andijan State Medical Institute. Using the IMRAD framework, the research investigates the prognostic determinants of the hospital course in 120 patients admitted with AMI. The study evaluates the predictive value of traditional scales such as GRACE and Killip, alongside novel metabolic markers including lipid peroxidation products and autonomic tone. The results demonstrate that while hemodynamic stability and time to reperfusion are primary prognosticators, the metabolic milieu characterized by oxidative stress and sympathetic overactivity significantly influences the development of early complications like arrhythmias and heart failure. The study concludes that a comprehensive prognostic model integrating clinical, instrumental, and metabolic parameters improves the accuracy of short-term outcome prediction in the local population.

Keywords: acute myocardial infarction, hospital prognosis, risk stratification, GRACE score, oxidative stress, sympathoadrenal system.

ПРОГНОЗ БОЛЬНЫХ С ОСТРЫМ ИНФАРКТОМ МИОКАРДА НА ГОСПИТАЛЬНОМ ЭТАПЕ: МНОГОФАКТОРНЫЙ АНАЛИЗ КЛИНИЧЕСКИХ И МЕТАБОЛИЧЕСКИХ ФАКТОРОВ РИСКА

Аннотация: Острый инфаркт миокарда (ОИМ) остается ведущей причиной госпитальной смертности во всем мире, что требует точной стратификации риска для оптимизации терапевтических стратегий. В данной статье представлено проспективное наблюдательное исследование, проведенное на кафедре факультетской терапии Андижанского государственного медицинского института. Используя структуру IMRAD, исследование изучает прогностические детерминанты госпитального течения у 120 пациентов, поступивших с ОИМ. В исследовании оценивается прогностическая ценность традиционных шкал, таких как GRACE и Killip, наряду с новыми метаболическими маркерами, включая продукты перекисного окисления липидов и вегетативный тонус. Результаты показывают, что, хотя гемодинамическая стабильность и время до реперфузии являются первичными прогностическими факторами, метаболическая среда, характеризующаяся окислительным стрессом и симпатической гиперактивностью, существенно влияет на развитие ранних осложнений, таких как аритмии и сердечная недостаточность. Исследование делает вывод, что комплексная прогностическая модель, интегрирующая клинические, инструментальные и метаболические параметры, повышает точность краткосрочного прогнозирования исходов в местной популяции.

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Ключевые слова: острый инфаркт миокарда, госпитальный прогноз, стратификация риска, шкала GRACE, окислительный стресс, симпато-адреналовая система.

O‘TKIR MIOKARD INFARKTI BILAN KASALLANGAN BEMORLARNING KASALXONA BOSQICHIDA PROGNOZI: KLINIK VA METABOLIK XAVF OMILLARINING KO‘P FAKTORLI TAHLILI

Annotatsiya: O‘tkir miokard infarkti (OMI) butun dunyo bo‘ylab kasalxona ichidagi o‘limning asosiy sababi bo‘lib qolmoqda, bu esa terapevtik strategiyalarni optimallashtirish uchun xavfni aniq tabaqalashni talab qiladi. Ushbu maqolada Andijon davlat tibbiyot institutining Fakultet terapiyasi kafedrasida o‘tkazilgan prospektiv kuzatuv tadqiqoti natijalari keltirilgan. IMRAD tuzilmasiga asoslangan ushbu ish OMI bilan yotqizilgan 120 nafar bemorda kasalxona bosqichining prognostik omillarini o‘rganadi. Tadqiqot GRACE va Killip kabi an’anaviy shkalalar bilan bir qatorda lipid peroksidatsiyasi mahsulotlari va vegetativ tonus kabi yangi metabolik markerlarning prognostik qiymatini baholaydi. Natijalar shuni ko‘rsatadiki, gemodinamik barqarorlik va reperfuziyagacha bo‘lgan vaqt asosiy prognozlovchilar bo‘lsa-da, oksidlovchi stress va simpatik giperfaollik bilan tavsiflanuvchi metabolik muhit aritmiya va yurak yetishmovchiligi kabi erta asoratlar rivojlanishiga sezilarli ta’sir ko‘rsatadi. Tadqiqot klinik, instrumental va metabolik parametrlarni integratsiya qiluvchi keng qamrovli prognostik model mahalliy aholi orasida qisqa muddatli natijalarni bashorat qilish aniqligini oshiradi degan xulosaga keladi.

Kalit so‘zlar: o‘tkir miokard infarkti, kasalxona prognozi, xavfni tabaqalash, GRACE shkalasi, oksidlovchi stress, simpato-adrenal tizim.

INTRODUCTION

Acute Myocardial Infarction (AMI) represents one of the most critical emergencies in cardiovascular medicine, characterized by high morbidity and mortality particularly during the acute hospital phase. Despite significant advancements in reperfusion therapies and pharmacological management, the prognosis of patients hospitalized with AMI varies widely. The in-hospital period is a vulnerable window where complications such as cardiogenic shock, life-threatening arrhythmias, and mechanical defects can abruptly alter the clinical trajectory. Consequently, early and accurate risk stratification is paramount not only for determining the urgency of invasive interventions but also for identifying patients who require intensive monitoring and adjunctive therapies.

Traditional prognostic models like the GRACE (Global Registry of Acute Coronary Events) and TIMI (Thrombolysis in Myocardial Infarction) risk scores utilize age, heart rate, systolic blood pressure, creatinine, and killip class to predict mortality. While these tools are invaluable, they primarily focus on hemodynamic and demographic variables. Emerging evidence suggests that the pathophysiology of AMI is deeply influenced by the patient's underlying metabolic and neurohumoral status. The extent of myocardial injury and the subsequent healing process are modulated by factors such as oxidative stress intensity and autonomic nervous system regulation.

At Andijan State Medical Institute, we recognized a need to validate global prognostic markers within the context of the local population while exploring the added value of biochemical indicators. Specifically, the role of lipid peroxidation and sympathetic drive in determining short-term outcomes warrants further investigation. This study aims to evaluate the prognosis of patients with acute myocardial infarction during the hospital stage by analyzing a comprehensive set of clinical, hemodynamic, and metabolic risk factors. The hypothesis posits

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that a multidimensional assessment provides a superior prediction of in-hospital complications compared to standard clinical evaluation alone.

METHODS

Study Design and Setting This prospective observational cohort study was conducted at the intensive care unit and cardiology wards of the Andijan State Medical Institute Clinic. The recruitment period spanned from March 2024 to March 2025. The study protocol was approved by the institutional ethics committee and adhered to the principles of the Declaration of Helsinki.

Participants A total of 120 consecutive patients admitted with a confirmed diagnosis of Acute Myocardial Infarction (both STEMI and NSTEMI) were enrolled. Inclusion criteria were: onset of symptoms within 24 hours of admission, characteristic ECG changes, and elevated cardiac troponins. Exclusion criteria included non-cardiac causes of troponin elevation, active malignancy, and severe pre-existing renal failure dependent on dialysis.

Data Collection and Prognostic Variables Upon admission, all patients underwent a thorough clinical assessment. The GRACE risk score was calculated for each patient to estimate the probability of in-hospital death. Hemodynamic parameters including Heart Rate Variability (HRV) were monitored to assess autonomic function. Additionally, blood samples were collected to measure standard biochemical markers and specific markers of lipid peroxidation, such as malondialdehyde (MDA).

Outcome Measures The primary endpoint was the occurrence of Major Adverse Cardiovascular Events (MACE) during the hospital stay, defined as a composite of cardiac death, reinfarction, cardiogenic shock, or severe ventricular arrhythmias. Secondary endpoints included the development of acute heart failure (Killip class progression) and the length of hospital stay.

Statistical Analysis Statistical processing was performed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation, and categorical variables as percentages. Univariate and multivariate logistic regression analyses were conducted to identify independent predictors of poor hospital prognosis. The predictive accuracy of risk models was assessed using the area under the receiver operating characteristic (ROC) curve. A p-value of <0.05 was considered statistically significant.

RESULTS

Baseline Characteristics and Clinical Course The study cohort had a mean age of 62.5 ± 10.4 years, with a male predominance (70 percent). Among the 120 patients, 45 percent presented with ST-elevation myocardial infarction (STEMI) and 55 percent with non-ST-elevation myocardial infarction (NSTEMI). During the hospital phase, 18 percent of patients experienced at least one MACE. The mortality rate was 5.8 percent, primarily driven by cardiogenic shock in late presenters.

Predictive Value of Clinical Scores The analysis confirmed the robust prognostic value of the GRACE score. Patients in the high-risk category (>140 points) had a significantly higher rate of in-hospital complications compared to those in the low and intermediate-risk categories. However, we observed cases where patients with intermediate GRACE scores deteriorated unexpectedly, suggesting that hemodynamic variables alone did not capture the full risk profile.

Metabolic and Neurohumoral Predictors The study revealed a strong correlation between metabolic markers and prognosis. Patients who developed complications exhibited significantly higher baseline levels of MDA, indicating intense oxidative stress. This aligns with recent findings by Juraboyev and Tashtemirova [9], who assessed lipid peroxidation processes in ischemic heart disease and noted their critical role in pathology. In our cohort, elevated lipid

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peroxidation was an independent predictor of arrhythmia occurrence. Furthermore, HRV analysis indicated a state of rigid sympathetic dominance in patients with poor outcomes. This supports the work of Tashtemirova [8], regarding the functional activity of the sympathoadrenal system; excessive sympathetic drive was associated with larger infarct sizes and pump failure.

Multivariate Prognostic Model In the multivariate logistic regression analysis, four independent predictors of adverse hospital prognosis were identified: (1) GRACE score >140, (2) Killip class ≥III on admission, (3) High levels of oxidative stress markers, and (4) Delayed reperfusion (>6 hours from symptom onset). The inclusion of metabolic markers improved the predictive accuracy (AUC) of the model from 0.78 (GRACE alone) to 0.85 (Combined model).

DISCUSSION

The findings from this study at Andijan State Medical Institute underscore the multifactorial nature of prognosis in acute myocardial infarction. While time-to-reperfusion remains the "golden variable" for survival, the patient's internal physiological environment plays a decisive role in the immediate post-infarction period.

The Metabolic Dimension of Prognosis The significant association between lipid peroxidation products and adverse events highlights the damaging role of reperfusion injury and ongoing inflammation. As highlighted by Juraboyev and Tashtemirova [9], lipid metabolism disorders and peroxidation are active drivers of ischemic damage, not just bystanders. Patients with high oxidative burden are more prone to "no-reflow" phenomenon and myocardial stunning, which worsens the hospital prognosis. Therefore, antioxidant strategies might be a relevant consideration for improving outcomes in this specific subgroup.

Autonomic Dysregulation as a Warning Sign The predictive value of autonomic dysfunction observed in our study mirrors the concepts discussed by Tashtemirova [10] regarding diagnostic criteria in complex cardiac syndromes. A hyperactive sympathetic nervous system increases myocardial oxygen demand and lowers the threshold for ventricular fibrillation. Our data suggests that signs of autonomic imbalance (tachycardia disproportionate to fever, low HRV) should be viewed as "red flags" for imminent deterioration, warranting closer monitoring even in patients who appear hemodynamically stable initially.

Refining Risk Stratification Current prognostic models are excellent for population-level statistics but can be refined for individual precision. By integrating the assessment of metabolic stability and neurohumoral tone, clinicians can better identify the "vulnerable patient" who is at high risk of complications despite successful revascularization.

CONCLUSION

The observational study conducted at Andijan State Medical Institute leads to the following conclusions regarding the hospital prognosis of patients with acute myocardial infarction:

Composite Risk: The hospital prognosis is determined by a complex interplay of anatomical factors (extent of ischemia), hemodynamic status (Killip class), and the patient's metabolic response to injury.

Metabolic Markers: Elevated markers of lipid peroxidation and signs of sympathetic overactivity are independent predictors of adverse in-hospital events, providing prognostic information complementary to the GRACE score.

Predictive Model: A comprehensive approach that combines standard risk scoring with an assessment of the patient's oxidative and autonomic status offers the highest accuracy in predicting short-term outcomes.

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Therefore, we recommend that the prognostic assessment of AMI patients in the hospital setting should extend beyond basic hemodynamics to include markers of metabolic stress, enabling more personalized and preemptive intensive care management.

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