



Early Prediction of Subclinical Cardiac Dysfunction Using Integrated Biomarker and AI-Based Risk Modelling: A Prospective Cohort Study

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ABSTRACT:

Early detection of subclinical cardiac dysfunction remains a major challenge in preventive cardiology. This study aimed to evaluate the effectiveness of an integrated model combining circulating biomarkers and artificial intelligence (AI)-based predictive analytics in identifying individuals at risk of developing cardiovascular disease (CVD). A prospective cohort of 1,200 asymptomatic adults was followed over a period of three years. Biomarkers including high-sensitivity troponin, NT-pro BNP, and inflammatory markers were analysed alongside clinical and lifestyle variables. Machine learning algorithms were applied to develop a predictive model. The integrated approach demonstrated significantly higher predictive accuracy compared to traditional risk assessment tools. These findings highlight the potential of combining biological and computational methods for early cardiovascular risk stratification.

Key words: Cardiology, artificial intelligence, biomarkers, cardiovascular disease, early diagnosis, predictive modelling, heart dysfunction

INTRODUCTION

Cardiology is a medical specialty focused on diseases of the heart and blood vessels, which remain a leading cause of mortality worldwide. Despite advances in treatment, many cardiovascular conditions are diagnosed only after significant disease progression. Early identification of subclinical cardiac dysfunction is therefore essential for effective prevention and management.

2. MATERIALS AND METHODS

2.1 Study Population

A total of 1,200 asymptomatic individuals aged 30–65 years were enrolled from multiple international centers. Participants had no prior history of cardiovascular disease but exhibited at least one risk factor such as hypertension, obesity, or family history.

2.2 Biomarker Analysis

Blood samples were collected to measure:

- High-sensitivity cardiac troponin
- N-terminal pro-B-type natriuretic peptide (NT-proBNP)
- C-reactive protein (CRP)

2.3 AI-Based Predictive Model

A machine learning model was developed using supervised learning techniques. Variables included demographic data, clinical parameters, lifestyle factors, and biomarker levels. The model was trained and validated using cross-validation techniques.

2.4 Outcome Measures

The primary outcome was the development of detectable cardiac dysfunction, assessed through echocardiography and clinical evaluation over a three-year follow-up period.

3. RESULTS

The integrated AI-biomarker model achieved an accuracy of 87%, significantly outperforming traditional risk scoring systems (72%). Elevated levels of NT-pro BNP and troponin were strong predictors of early cardiac dysfunction. The model successfully identified high-risk individuals up to two years before clinical symptoms appeared.

4. DISCUSSION

The findings demonstrate that combining biomarkers with AI-based analysis enhances early detection of cardiovascular disease. Recent advancements in cardiology also emphasize the growing role of artificial intelligence in improving diagnostic precision and predicting disease outcomes. Emerging technologies have shown the ability to predict heart failure years before onset, highlighting the transformative potential of AI in cardiac care.

Traditional diagnostic approaches rely heavily on symptomatic presentation, which often occurs late in disease progression. In contrast, the integrated model allows for proactive intervention, potentially reducing morbidity and mortality.

5. CLINICAL IMPLICATIONS

The implementation of AI-driven predictive tools in routine clinical practice could revolutionize preventive cardiology. Early identification of high-risk individuals enables timely lifestyle interventions and targeted therapies, reducing healthcare costs and improving patient outcomes.

6. LIMITATIONS

This study has limitations, including the relatively short follow-up period and the need for validation in diverse populations. Additionally, access to advanced AI technologies may be limited in resource-constrained settings.

7. FUTURE DIRECTIONS

Future research should focus on expanding the model to include genetic data and imaging biomarkers. Integration with wearable health technologies could further enhance continuous monitoring and risk prediction.

8. CONCLUSION

The integration of biomarkers and artificial intelligence represents a promising approach for early detection of subclinical cardiac dysfunction. This strategy has the potential to transform preventive cardiology and reduce the global burden of cardiovascular diseases.

REFERENCES

1. World Health Organization. (2023). Cardiovascular diseases (CVDs).
2. Braunwald E. Heart disease: a textbook of cardiovascular medicine. 2020.
3. Libby P. Inflammation in atherosclerosis. (2021). Nature.
4. McCarthy CP et al. (2019). High-sensitivity troponin in clinical practice. JAMA.
5. Yancy CW et al. (2017). Heart failure guidelines. Circulation.
6. Krittanawong C et al. (2020). AI in cardiovascular medicine. Eur Heart J.
7. Deo RC. (2015). Machine learning in medicine. Circulation.
8. Topol EJ. (2019). Deep medicine: AI in healthcare. Nat Med.
9. Omland T et al. (2018). NT-proBNP in risk prediction. J Am Coll Cardiology.
10. Attia ZI et al. (2019). AI-enabled ECG analysis. Lancet.