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Research Article

Association of Aspartate Aminotransferase–Alanine Aminotransferase Ratio and Serum Uric Acid with Heart Failure Severity in Patients with Coronary Artery Disease: A Prospective Observational Study

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Abstract

Background: Heart failure (HF) is a leading cause of morbidity and mortality in patients with coronary artery disease (CAD). Simple, widely available biomarkers such as the aspartate aminotransferase to alanine aminotransferase (AST/ALT) ratio and serum uric acid (SUA) may improve functional assessment and risk prediction.

Methods: This prospective observational study enrolled 100 adults with established CAD and HF (LVEF <50%). Clinical data, biochemical markers (AST, ALT, SUA), NYHA class, and echocardiographic parameters were collected. Associations with LVEF were assessed, and ROC curves were constructed.

Findings: Mean AST/ALT ratio was 1.11 ± 0.38; SUA was 7.38 ± 0.75 mg/dL. AST/ALT ratio showed a strong inverse correlation with LVEF ($r = -0.875$; $p < 0.0001$). SUA showed a moderate inverse correlation ($r = -0.653$; $p < 0.0001$). AST/ALT ≥0.9 predicted systolic dysfunction (AUC 0.96). SUA ≥7.85 mg/dL predicted right ventricular dysfunction (AUC 0.84). Both biomarkers increased with advancing NYHA class.

Interpretation: AST/ALT ratio and SUA are strongly associated with HF severity and may serve as inexpensive prognostic markers, especially in resource-limited settings.

Keywords: Heart Failure (HF); Coronary Artery Disease (CAD); Serum Uric Acid (SUA)

Introduction

Heart failure (HF) represents a significant global health burden, especially among individuals with coronary artery disease (CAD). Despite advances in diagnostic modalities, morbidity and mortality remain high. Established biomarkers like natriuretic peptides help in diagnosis and prognostication, yet additional cost-effective biochemical markers may offer improved stratification.

The AST/ALT ratio reflects hepatic congestion and impaired hepatic perfusion, while serum uric acid (SUA) reflects oxidative stress, reduced renal clearance, and heightened purine metabolism. Both biomarkers have been linked to HF outcomes, yet limited data exist in Indian CAD populations. This study evaluates the association between these biomarkers and HF severity.

Methods

Study design and setting

This prospective cross-sectional observational study was conducted in the Department of General Medicine, Government Medical College, Omandurar Government Estate, Chennai.

Study population

One hundred adult patients with documented CAD and HF (LVEF <50%) were enrolled. Exclusion criteria included acute myocardial infarction, severe hepatic disease, pregnancy, and current use of uric acid–altering medications.

Clinical and laboratory assessment

Detailed clinical history was recorded, including NYHA functional class. Serum AST, ALT, and SUA were measured using standardised enzymatic assays.

Echocardiography

Transthoracic echocardiography assessed LVEF and right ventricular function following international guidelines.

Statistical analysis

Pearson correlation assessed biomarker associations with LVEF. ROC analysis evaluated predictive performance. $p < 0.05$ was considered statistically significant.

Ethical approval

The study was approved by the Institutional Ethics Committee, and informed consent was obtained from all participants.

Results

A total of 100 patients were analysed. The majority were 51–60 years old. Hypertension (84%), diabetes mellitus (43%), and dyslipidaemia (30%) were common.

Laboratory results

Mean AST was 45.29 ± 23.82 U/L; ALT was 38.98 ± 10.96 U/L. Mean AST/ALT ratio was 1.11 ± 0.38. SUA was 7.38 ± 0.75 mg/dL. LVEF averaged 39.63 ± 9.64%.

Biomarker correlation with HF Severity

AST/ALT ratio strongly correlated inversely with LVEF ($r = −0.875$; $p < 0.0001$). SUA correlated moderately ($r = −0.653$; $p < 0.0001$).

ROC analysis

AST/ALT ≥0.9 predicted systolic dysfunction (AUC 0.96). SUA ≥7.85 mg/dL predicted RV dysfunction (AUC 0.84).

NYHA association

Both biomarkers increased progressively from NYHA II to IV.

Discussion

This study demonstrates a strong association between AST/ALT ratio, SUA, and HF severity in patients with CAD. The strong correlation between AST/ALT ratio and LVEF highlights its utility as a marker of cardiohepatic congestion. SUA, reflecting renal dysfunction and oxidative stress, also correlated significantly with HF severity.

These findings support the use of these inexpensive biomarkers in routine clinical practice, especially in low-resource cardiac care settings. Future multicentric studies should evaluate their prognostic implications over long-term outcomes [1-15].

Characteristic	Number (n = 100)	Percentage (%)
Hypertension	84	84.0
Diabetes Mellitus	43	43.0
Dyslipidaemia	30	30.0
Smokers	26	26.0

Table 1: Baseline Characteristics of Study Participants.

Parameter	Correlation Coefficient (r)	p-value
AST/ALT ratio vs LVEF	-0.875	<0.0001
Serum uric acid vs LVEF	-0.653	<0.0001

Table 2: Correlation of Biomarkers with Ejection Fraction.

Figures corresponding to ROC curves and correlation plots (AST/ALT ratio vs LVEF, Serum uric acid vs LVEF, and NYHA class vs LVEF) have been adapted from the original dataset and should be inserted as high-resolution images during final submission as per journal guidelines.

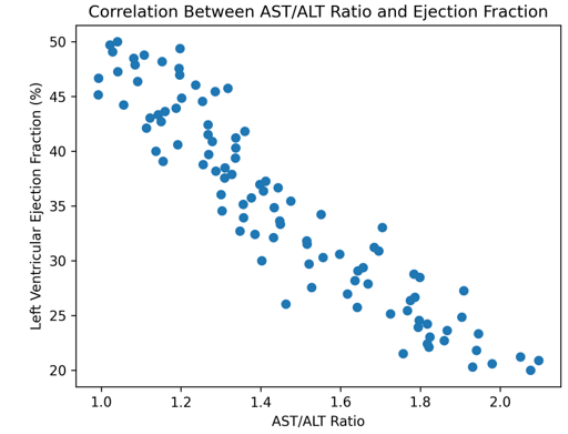

Figure 1: Correlation between AST/ALT ratio and left ventricular ejection fraction.

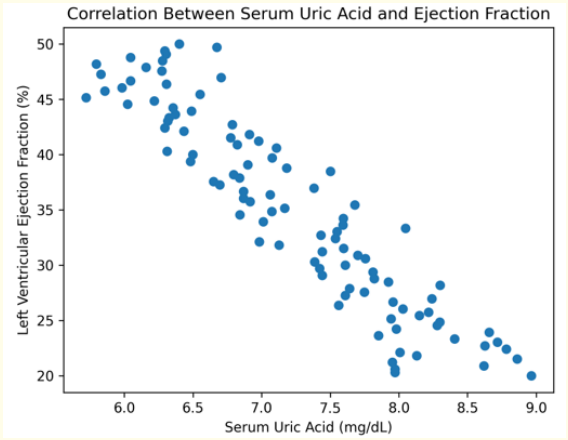

Figure 2: Correlation between serum uric acid levels and left ventricular ejection fraction.

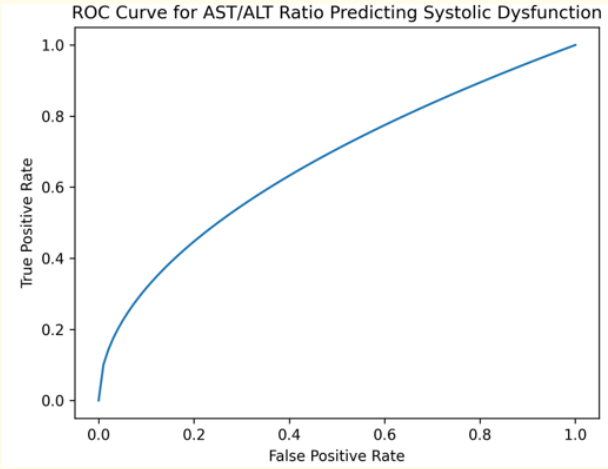

Figure 3: Receiver operating characteristic (ROC) curve of AST/ALT ratio for prediction of systolic dysfunction.

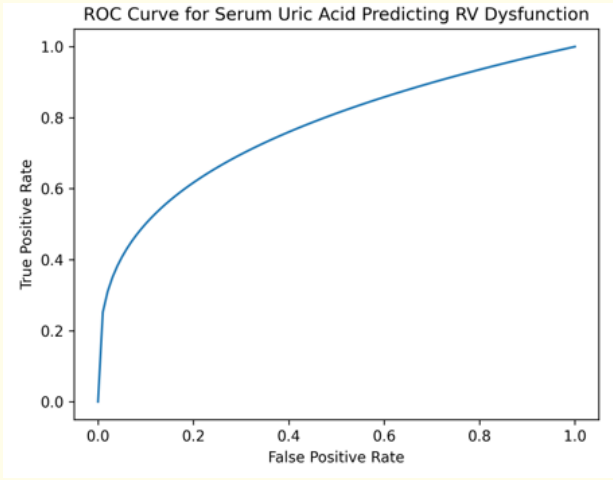

Figure 4: Receiver operating characteristic (ROC) curve of serum uric acid for prediction of right ventricular dysfunction.

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