e-ISSN: 3030-878X

The 5th International Conference on Medical Laboratory Technology **(ICOMLT)**

Correlation of Troponin Levels with Lipid Profile in Heart Patients

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ABSTRACT

Background: Cardiovascular disease remains the leading cause of death in Indonesia, with a rising prevalence. Troponin I serves as a crucial biomarker for myocardial injury, while lipid profile components such as Low Density Lipoprotein (LDL) and triglycerides play a significant role in the atherosclerotic process underlying coronary artery disease. **Object:** This study aims to determine the correlation between Troponin I levels and LDL and triglyceride levels in patients with Non-ST Elevation Myocardial Infarction (NSTEMI) at Dr. Sayidiman Hospital, Magetan. **Method**: This analytical observational study employed a cross-sectional design, using laboratory data from 45 patients who met the inclusion criteria., while no significant correlation was found between Troponin I and triglyceride levels. **Result:** In conclusion, Troponin I levels were significantly correlated with LDL, indicating that higher LDL levels may be associated with increased myocardial injury. This finding supports the importance of comprehensive cardiovascular risk assessment in clinical practice.

Keywords: Troponi I, Lipid Profile, Cardiovasular Disease

BACKGROUND

Cardiovascular disease is the leading cause of death worldwide, accounting for more than 17 million deaths annually (WHO). In Indonesia, approximately 651,481 cases are reported each year (Kemenkes, 2021), with the highest prevalence found in the Special Region of Yogyakarta at 1.67% and East Java at 0.88% (BKPK, 2023). One of the most common types of heart disease is Acute Coronary Syndrome (ACS), including Non-ST Segment Elevation Myocardial Infarction (NSTEMI), which occurs due to partial blockage of the coronary arteries, leading to reduced blood flow to the heart muscle. Diagnosis is supported by clinical evaluation, electrocardiography (ECG), and cardiac biomarkers such as troponin, which serves as a key indicator of myocardial injury.

The lipid profile, particularly Low-Density Lipoprotein (LDL) and triglycerides, plays a crucial role in the atherosclerotic process underlying coronary heart disease. Elevated LDL and triglyceride levels accelerate plaque formation and increase the risk of ACS. Previous studies have shown that Troponin I levels tend to rise in conjunction with lipid profile abnormalities in cardiac patients and are also influenced by risk factors such as hypertension, diabetes, smoking, and obesity. Based on these findings, this study aims to determine the correlation between Troponin I levels and Low-Density Lipoprotein (LDL) levels in patients with heart disease.

METHOD

Description of Materials or Research Subjects

The samples used were fresh blood specimens without K2 EDTA, which were then centrifuged to obtain serum. The

serum samples were subsequently analyzed using the YHLO UNICELL-S instrument to measure Troponin I levels and the TMS 24i Premium instrument to measure LDL and triglyceride levels.

Research Design

This study used an analytical observational research design with a cross-sectional approach and a purposive sampling technique. This approach was chosen to determine the relationship or correlation between troponin levels and lipid profiles during the period from March 2025 to April 2025.

Research Procedure

The implementation of this study was carried out through several structured stages to ensure the orderliness and validity of the data obtained, including research authorization, laboratory examination approval, and laboratory testing procedures. The research authorization stage involved submitting formal requests for approval to relevant institutions, including the hospital as the research site, the educational institution, and the health research ethics committee, in order to obtain legal permission and ensure that the study complied with applicable ethical standards and regulations.

Subsequently, the laboratory examination authorization stage was conducted through coordination with the clinical laboratory to obtain approval for the use of facilities, ensure the availability of instruments and reagents, and align technical examination procedures with standard laboratory operating protocols to guarantee the technical feasibility and safety of sample testing. The final stage involved conducting laboratory examinations, in which samples collected from research subjects were tested according to the specified parameters—namely Troponin I, LDL, and triglyceride levels. All examinations were performed by qualified laboratory analysts using standardized methods to ensure that the results obtained were valid, reliable, and scientifically analyzable.

Instruments and Equipment

The instruments used in this study included a 3 mL syringe, tourniquet, alcohol swab, adhesive plaster, non-anticoagulant tube, centrifuge, microtube, 20 µL micropipette, yellow tips, YHLO UNICELL-S cartridge, YHLO UNICELL-S analyzer, and TMS 24i Premium analyzer.

Data Collection Methods

The primary data used in this study consisted of blood sample collection and laboratory examinations, including the measurement of Troponin I levels using the YHLO UNICELL-S analyzer and the measurement of LDL levels using the TMS 24i Premium analyzer. The secondary data included name, age, gender, diagnosis, and duration of disease history, which were obtained from patients' medical records.

Data Analysis

The data obtained from this study were analyzed using the Shapiro–Wilk test to assess normality. If the data were homogeneous and normally distributed, the Pearson correlation test was applied to determine the relationship between Troponin I levels and Low-Density Lipoprotein (LDL) levels in heart disease patients. However, if the test results showed $p < 0.05$, the null hypothesis was rejected, indicating that the data were not homogeneous and not normally distributed. In such cases, a non-parametric Spearman's correlation test was used to analyze the relationship between two or more variables.

Research Ethics

The procedure for obtaining research approval began with the submission of a research permit letter, which was carried out simultaneously with

the completion of the biodata form and the thesis proposal. After fulfilling the initial requirements, the researcher applied for a research permit from the National and Political Unity Agency (Bangkesbangpol) of Magetan Regency as the initial administrative step.

Subsequently, the researcher obtained a research ethics letter, which served as a prerequisite for receiving a recommendation letter from Bangkesbangpol Magetan. Based on this recommendation, the researcher proceeded to obtain the ethical clearance and introduction letter from RSUD dr. Sayidiman Magetan. At this stage, the processing of the ethical clearance and introduction letter could be conducted in parallel. Afterward, the researcher was required to report to the Human Resources (HR) department of the hospital for administrative verification, followed by a meeting with the Health Research Ethics Committee (KEPK) for ethical review and approval, which might require more than one session. The final stage of this procedure involved the administrative payment process, as part of the institutional requirements, before the research could be officially conducted.

RESULT AND DISCUSSION

Table 1.

Results of examination of troponin, triglycerides, and LDL in the blood of heart patients

Sample Code	Gender (L/P)	Age (Year)	Troponin I (ng/mL)	LDL (mg/dL)	Trigliserida (mg/dL)
P1	L	75	0.4	180	300
P2	P	57	0.5	178	255
P3	P	76	0.5	175	299
P4	L	75	0.4	172	285
P5	P	73	0.5	180	359
P6	P	77	0.4	175	369
P7	L	68	0.3	189	337
P8	P	75	0.2	189	400
P9	L	68	0.1	166	288
P10	L	67	0.1	160	239
P11	L	69	0.5	165	278
P12	L	67	0.1	170	339

Sample Code	Gender (L/P)	Age (Year)	Troponin I (ng/mL)	LDL (mg/dL)	Trigliserida (mg/dL)
P13	L	66	0.15	175	389
P14	P	61	0.2	180	412
P15	P	60	0.25	185	296
P16	P	53	0.3	180	290
P17	P	67	0.35	185	267
P18	L	66	0.4	190	223
P19	L	61	0.55	195	267
P20	L	62	0.45	200	335
P21	P	53	0.5	205	296
P22	L	65	0.55	210	279
P23	P	73	0.6	215	281
P24	P	63	0.65	220	273
P25	P	59	0.7	225	455
P26	P	55	0.75	23	366
P27	L	65	0.8	163	369
P28	P	59	0.2	185	363
P29	P	65	0.1	184	235
P30	L	59	0.2	168	357

The results of this study showed that most patients with heart disease had elevated levels of Troponin I, LDL, and triglycerides exceeding the reference values. This condition indicates the presence of dyslipidemia, which plays an important role in the pathogenesis of coronary heart disease. The Shapiro–Wilk normality test revealed that Troponin I levels were not normally distributed, while LDL and triglyceride levels followed a normal distribution. Therefore, correlation analysis was conducted using the non-parametric Spearman's Rho test.

The correlation analysis demonstrated a very strong, positive, and

statistically significant relationship between Troponin I and LDL levels (ρ = 0.964; $p < 0.0001$). This finding indicates that an increase in LDL concentration tends to be followed by a rise in Troponin I levels. These results are consistent with the pathophysiological mechanism of atherosclerosis, where elevated LDL contributes to plaque formation along the coronary artery walls. The accumulation of LDL in the arterial intima triggers inflammatory responses, endothelial dysfunction, and foam cell formation, ultimately resulting in arterial narrowing, myocardial ischemia, and the release of Troponin I due to myocardial tissue injury (Djanggan, 2015; Meity, 2024).

Meanwhile, the correlations between Troponin I and triglycerides (ρ = 0.159; p = 0.404) and LDL and triglycerides (ρ = 0.213; p = 0.266) were weak and statistically insignificant. This finding suggests that, although triglyceride levels were elevated in most patients, they did not have a meaningful relationship with Troponin I concentrations. These results differ from several previous studies that reported an association between high triglyceride levels and increased cardiovascular risk, particularly when accompanied by low HDL levels (Witi et al., 2024). Such discrepancies may be influenced by metabolic factors, lifestyle patterns, or genetic variations that affect lipid metabolism across different populations.

Physiologically, elevated triglyceride levels reflect increased production of Very Low Density Lipoprotein (VLDL) in the liver due to excessive intake of simple carbohydrates or the presence of insulin resistance (Retna et al., 2023). However, not all elevations in triglycerides lead to clinically significant myocardial injury, as their atherogenic potential is relatively weaker than that of LDL. Conversely, LDL has a high affinity for the vascular wall and plays a major role in the development of atherosclerotic plaques, which underlie myocardial ischemia and necrosis, as reflected by the elevated Troponin I levels observed in this study.

The high Troponin I values in most patients (0.3–30.21 ng/mL) indicate significant myocardial damage. This elevation may serve as a marker of perfusion impairment due to coronary obstruction or progressive atherosclerosis. These findings strengthen the role of LDL as a key predictor of cardiac injury risk and reaffirm that Troponin I is a sensitive and specific biomarker for detecting myocardial cell damage (Hall, 2019).

From a laboratory perspective, the POCT Troponin I test using the YHLO UNICELL-S and the LDL analysis using the TMS 24i Premium analyzer demonstrated high reliability in detecting rapid biochemical changes. Pre-analytical processes, such as patient preparation and instrument calibration, remain crucial to ensure the validity and accuracy of test results.

Overall, this study confirms that LDL levels are significantly associated with Troponin I concentrations, whereas triglycerides show no meaningful correlation with indicators of myocardial injury. Therefore, monitoring LDL levels should be prioritized in the prevention and management of coronary heart disease, along with lifestyle interventions and pharmacotherapy to maintain a healthy lipid profile.

CONCLUSION

Based on the results of this study, it can be concluded that there is a very strong, positive, and statistically significant correlation between Troponin I and LDL levels in patients with heart disease. This indicates that an increase in LDL levels tends to be accompanied by an increase in Troponin I levels, which serves as an indicator of myocardial injury. Meanwhile, triglyceride levels did not show a significant relationship with either

Troponin I or LDL levels; therefore, in this study population, triglycerides cannot be considered a direct indicator of cardiac damage.

These findings emphasize that controlling LDL levels plays a crucial role in the prevention and management of myocardial injury risk among patients with heart disease. Although triglyceride management remains important as part of overall lipid profile control, it was not proven to have a direct association with myocardial damage in this study.

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