

ARTICLE / INVESTIGACIÓN

Evaluation of ejection fraction in patients with Acute Myocardial Infarction in Mosul City, Iraq

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DOI. 10.21931/RB/2022.07.04.14

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Abstract: Between 1 January 2021 and 1 July 2021, 120 blood samples from acute myocardial infarction (AMI) patients—60 as controls and 60 patients—of both sexes who were accepted to the cardiac surgery unit at AL- Salam teaching hospital, the intensive cardiac care unit, and outpatient clinics in Mosul City/Iraq, were taken. In the presented research, the ejection fraction regarding patients with AMI was evaluated by echocardiography, and the blood-liver enzyme levels (ALP and AST \ ALT ratio) were examined in those patients. The findings indicate that patients with AMI in the age range of 35 to 45 years have a (52.41) % ejection fraction (EF) rate, which is closer to (51.344%) than it is in samples from healthy controls. In addition to that, findings indicate that patients in an age range of 46 to 56 years have heart failure with a mid-range EF (HFmrEF), with a (48.13%) percentage, whereas this heart failure type in healthy controls has been preserved ejection fraction (HFpEF) with (53.368 %). In the case of the comparison of the AST/ALT ratio and EF across all of the age groups that have been tested, the results suggest a significant level ($P \leq 0.050$) relation between the ALP enzyme and EF for the patients within the (35-45 years) age group additionally, as there has been a positive and weak linear connection ($r = 0.10650$) and a nominal p-value ($p = 0.47240$) at a threshold of probability $\leq P 0.050$, the link and correlation between the AST/ALT ratio and cardiac EF have been investigated.

Key words: ALP enzyme, AMI patients, Ejection Fraction, AST \ ALT ratio.

Introduction

Worldwide, one of the significant causes of mortality is AMI¹. The patient's age is one of the essential factors diagnosed as a risk factor in AMI patients, as the death rate increases among patients, especially within the older age groups². Elevated levels of liver enzymes are closely related to the development of the risk of cardiovascular disease (CVD). Their increase may lead to a rise in stenosis and thus lead to blood clots³. Elevated levels of ALP enzyme in the blood serum lead to vascular calcification and affect the heart's blood supply⁴. The increase in the rate of these calcifications increases the risk of developing cardiovascular diseases in the general population, especially in patients with acute myocardial infarction⁵. The AST/ALT ratio is considered a strong indicator of myocardial damage. It can be relied upon after a heart infarction as a rapid measurement vital sign available in clinical laboratories. It can be easily performed to diagnose patients at risk of developing CVD and can help prevent complications. After an MI⁶, AST/ALT ratio is commonly used as a marker of liver disease; in MI patients, elevated AST/ALT is often an indicator of myocardial damage⁷. Ejection fraction or left ventricular ejection fraction (LVEF) is a medical term that refers to the ratio of the amount of blood ejected from the ventricle to the amount of blood remaining in the ventricle during a one-time ventricular contraction. The ejection fraction is usually measured only in the left ventricle as it pumps oxygen-rich blood to all cells of the body⁸; various patients are suffering from left ventricular dysfunction and post-heart

attack heart failure, a high-risk long-term condition¹. Left Ventricular Ejection Fraction (LVEF) after AMI is an important and reliable indicator for assessing the heart's integrity and ability to function properly⁹. The present study aims to determine the relationship and correlation between EF on echocardiography and liver function in acute myocardial infarction patients.

Materials and methods

Study Samples

Between 1 January 2021 and 1 July 2021, 120 blood samples from AMI patients—60 as controls and 60 patients—of both sexes who were accepted to the cardiac surgery unit at AL- Salam teaching hospital, the intensive cardiac care unit, and outpatient clinics in Mosul City/Iraq, were collected. Samples have been divided into two groups (control and patients) and three age groups (35-45), (46-56) and (57-80) years for both genders (5 ml) of intravenous blood has been withdrawn for patients and healthy by medical syringes capacity (5ml). The samples were placed in a centrifuge quickly (3000 rpm) for 12 minutes for serum purposes. The serum was divided into several Eppendroff tubes and kept freezing at a temperature of (-20c) until the physiological and chemical tests were carried out.

Citation: Al-Nafoly D M, Alameen A M, Alshamaa S D. Evaluation of ejection fraction in patients with Acute Myocardial Infarction in Mosul City, Iraq. *Revis Bionatura* 2022;7(4) 14. <http://dx.doi.org/10.21931/RB/2022.07.04.14>

Received: 20 July 2022 / **Accepted:** 15 October 2022 / **Published:** 15 November 2022

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Determination of Aspartate Transaminase (AST)

Principle

The concentration of (AST) enzyme activity in the blood serum has been measured using a kit supplied by the Italian company (Giese Diagnostics) using a chemistry analyzer.

Determination of Alanine Aminotransferase Transaminase (ALT)

Principle

The concentration of the enzyme activity (ALT) in the blood serum has been measured using a ready-made estimation kit (Kit) supplied by the Italian company (Giese Diagnostics) using a chemistry analyzer.

Determination of Alkaline Phosphatase (ALP)

Principle

The concentration of the enzyme activity (ALP) in the blood serum has been measured using a ready-made estimation kit (Kit) supplied by the Italian company (Giese Diagnostics) using a chemistry analyzer. The alkaline Phosphatase enzyme is hydrolyzed to p-nitro phenyl phosphate (4-NPP) to produce (4-np) P-nitro phenol. The enzyme activity in the sample has been measured at a wavelength of 305 nm.

Assessment of Ejection Fraction in AMI Patients

Ejection fraction in acute myocardial infarction patients has been evaluated by Echocardiography (ECO) according to Simpson's method by measuring the area in simplicity and estimating the volume of content, and then calculating the area in contraction and then evaluating the size of the remaining ventricle by applying the following formula¹⁰.

$$EF = \frac{\text{diastolic volume} - \text{systolic volume}}{\text{diastolic volume}}$$

Statistical Analysis

The SPSS v. 19 from IBM Company, US, has been used for all statistical analysis. $P \leq 0.05$ are considered significant when using the x2 test to compare groups statistically.

Results

According to Table 1's findings and Figure 1, patients with myocardial infarction who are between the ages of 35 and 45 had an EF rate of 52.41 %, which is close to the healthy control samples' EF rate of 51.344 %. In other words, heart failure in patients and healthy control samples has a preserved ejection fraction (HFpEF), whereas heart failure in elderly patients aged 57 to 80 years has a mid-range ejection fraction (HFmrEF). The rates between healthy

samples and patients are also similar (43.048 % and 43.76 %, respectively).

The patients in the 46 to 56-year-old age range have an EF of heart failure with the mid-range EF type (HFmrEF), with a (48.13%) percentage, whereas the healthy control sample's ejection fraction is of the preserved ejection fraction type (HFpEF), with a percentage of (53.368 %).

Relationship Between Liver Enzymes and Ejection Fraction

In the case when comparing the ratio of AST/ALT enzymes and the heart's ejection fraction across all age groups tested, the results, as presented in Table (2) demonstrate a significant level ($P \leq 0.050$) association between the ALP enzyme and EF for the patients who are the age group (35-45 years). Results for the correlation and relationship between cardiac ejection fraction and AST/ALT enzymes are depicted in Figure 2. They reveal a weak and positive linear correlation ($r = 0.10650$) and no statistically significant differences ($p = 0.4724$) at a probability level of ($P \leq 0.050$).

Discussion

The results of our study agree to some extent with many studies conducted to assess ejection fraction in patients, including patients with myocardial infarction¹¹⁻¹³. Another study conducted by (14) to evaluate EF in patients with heart failure revealed that the elderly patients have preserved EF HFpEF, while the elderly patients in our study have a midrange EF type HFmrEF. If the ejection fraction of the heart's left ventricle is $\leq 40\%$, it is considered heart failure with reduced ejection fraction (HFrEF). If the ejection fraction of the left ventricle of the heart is 40% and $<50\%$, it is considered heart failure with mid-range ejection fraction (HFmrEF), but if the is $LVEF \leq 50\%$, it is considered a preserved ejection fraction HFpEF¹¹. so far, at present it remains ejection fraction EF is the first measure for diagnosing heart failure HF, one of the most common causes of which is a weakness or defect in the left ventricular muscle of the heart, which often occurs in patients with acute myocardial infarction^{12,15}. HF and liver disease are among the most common mortality causes worldwide¹⁶. The heart's inability explains heart failure to sufficiently pump blood to all body organs due to a synthetic and functional heart disorder. Heart failure is measured by assessing the EF of the left ventricle of the heart LVEF¹⁵. An elevated AST/ALT ratio leads to an increased ejection fraction, and this convergence may be caused by the fact that patients are in the early stages of the disease. Many researchers in different countries¹⁷⁻¹⁹ have studied the correlation between liver defect and heart failure. The researcher (20) reveals

Variable (EF)	Age groups		
	Age 35-45	Age 46-56	Age 57-80
Patients	1.18 ± 52.41*	1.17 ± 48.13*	1.41 ± 43.76*
Control	1.00 ± 51.34	1.23 ± 53.46	0.93 ± 43.04

Table 1. Ejection fraction of patients and healthy people (control) for all age groups.

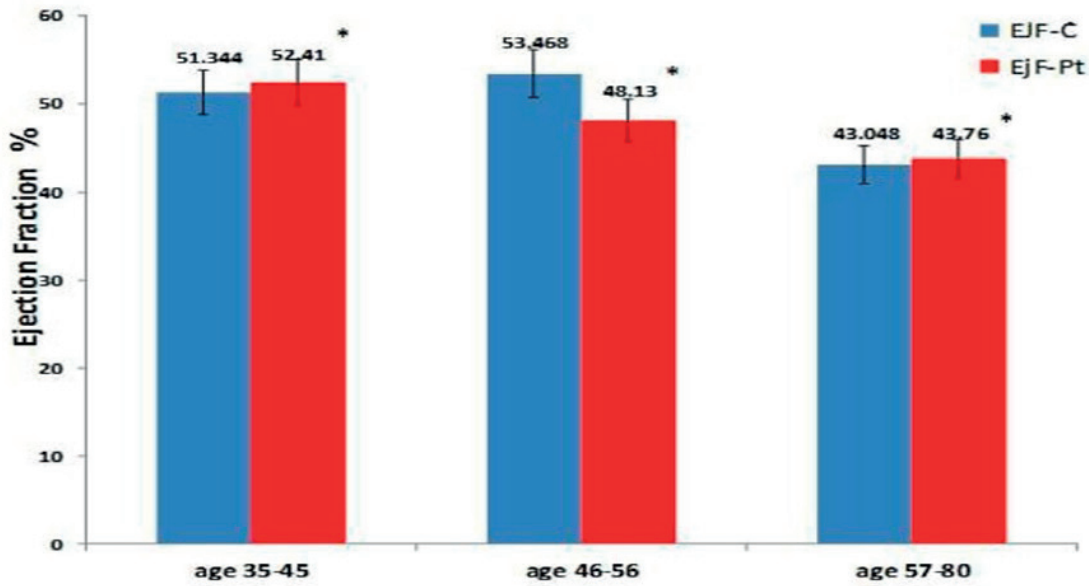


Figure 1. Ejection fracture of cardiac and healthy patients (control) for all age groups.

Liver Function	Age groups	Ejection Fraction		P-VALUE
		EF < 50	EF > 50	
ALP > 150 U/L	35 - 45	0	23	0.024
	46 - 56	24	0	0.463
	57 - 80	13	0	0.0761
AST/ALT ≥ 2	35 - 45	0	23	0.4432
	46 - 56	24	0	0.364
	57 - 80	13	0	0.610

P ≤ 0.05 Significant, EF, Ejection Fraction

Table 2. Correlation between liver enzymes and ejection fraction.

that the deficiency in liver enzymes and the increased AST enzyme levels indicate heart failure that requires medical attention for hospital stewards. In the study conducted by researcher²¹, there are normal levels of ALP enzyme or moderately high serum in patients, which disagrees with our study's results, as shown in Table (2). In a study conducted by the researcher (19) to find correlation between EF ejection fracture and liver functions in HF patients, he concludes that patients with ≤ 40% ejection fraction have an increase in the process of the liver by 92.50%, whereas there is an increase in the function of the liver by 61.7% in patients with ejection fraction > 40%.

The interaction between liver and heart diseases is predictable. There is a close interconnectedness between them, and the reason is that the liver receives 25% of the blood pumped by the heart²² and not only cardiovascular system is damaged by heart failure in the long term but the damage is done to the rest of the body organs and various tissues^{23,24}. In a study conducted by the researcher (15), it has been intended to create a relationship between EF and liver function in patients who have heart failure, by which it is concluded that the levels of ALP, ALT and AST enzymes are elevated in patients' serum who have an average ejection fraction ≤ 40% and lower levels in patients with an

average ejection fraction > 40%. This is somewhat consistent with our findings, as shown in Table (2). Many studies have shown an increase or rise in ALP enzyme levels in the blood serum of HFpEF patients^{17,19,25}. People with liver diseases related to heart failure are often not symptomatic for prolonged periods and are accompanied by a defect in liver enzymes or abnormal levels, which is the first sign of liver disease²⁶⁻²⁹.

Conclusions

The findings suggest that liver function and ejection fraction are related in those with AMI.

Author Contributions

The experiments were designed and carried out by all authors. The data were examined, and Duaa Mohammed Al-Nafoly wrote the manuscript. The article was read and approved by all the authors.

Funding

This research received no external funding.



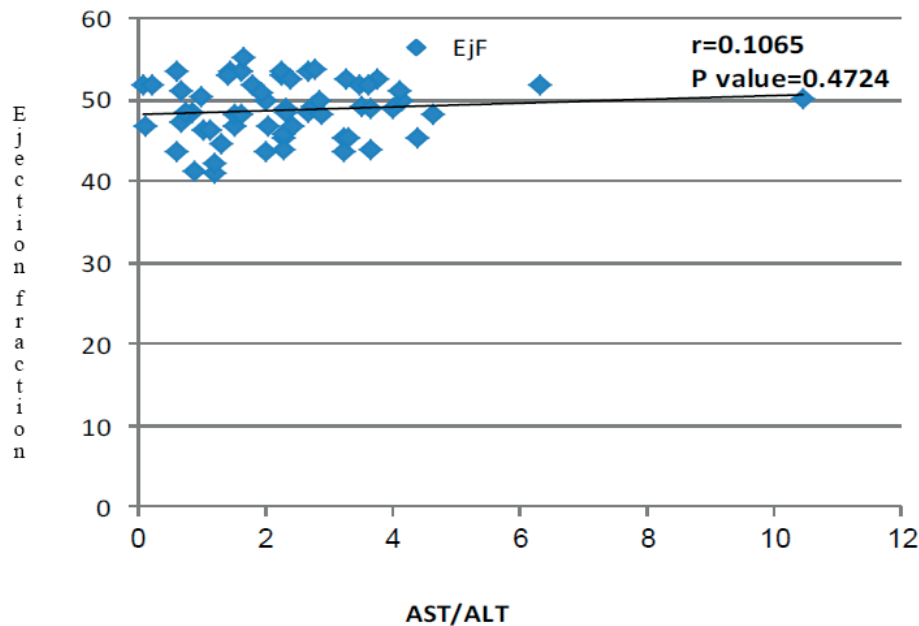


Figure 2. The correlation between ejection fraction and AST/ALT ratio.

Institutional Review Board Statement:

The Medical Research Ethics Committee at Mosul Univ. and Iraqi Medical Hospitals approved this work. The research's blood sample collection and all patient consent requirements have been approved. All patients' identities have been kept private as necessary.

Acknowledgments

The Dept. of Biology, College of Science, Univ. of Mosul, support this research. Many thanks to the nurses and doctors at the cardiac surgery unit at AL- Salam teaching hospital, the intensive cardiac care unit, and outpatient clinics in Mosul City/Iraq, who helped to complete the present research.

Conflicts of Interest

The funders did not have any impact on the design of this study; in the collection, analyses, or interpretation of data, manuscript writing, or decision to publish results.

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