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Study of the inflammatory Status in patient with Acute Myocardial Infarction

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Introduction:

Acute Myocardial infarction is a Life-threatening condition that occurs when blood flow to heart muscle is abruptly cut off causing tissue damage, is a common cause of presentation in emergency departments (EDs) [1]. Early detection and rapid rule out of acute myocardial infarction (AMI) have always been one of the great concerns to reduce mortality, morbidity, and hospitalization costs and avoid doing further diagnostic and unnecessary interventions in low-risk patients [1, 2]. Routinely, serial electrocardiograms (ECGs), biomarkers, and clinical decision rules have been used for the risk stratifications and diagnosis of Acute Coronary Syndrome [3].

Vasculitis is a general term for inflammation of blood vessel walls which can result in stenosis, occlusion, aneurysm or rupture.

Inflammatory mediators are directly involved in the pathogenesis of the vulnerable plaque, leading to occlusion of the coronary vessel and subsequent necrosis of the myocardial territory served by the vessel.

The role of inflammation in ischemic heart disease had been outlined and identified several years ago [3,4]. Initial observational studies have shown that patients with acute coronary syndromes have elevated inflammatory markers (leukocytosis, neutrophilia, increased erythrocytes sedimentation rate, fibrinogen, and C reactive protein [CRP]) [5].

Inflammation plays an important role in several stages of the cardiovascular continuum. In recent decades a plethora of studies have provided new data highlighting the role of inflammation in atherogenesis and atherothrombosis in two-way interactions with various cardiovascular risk factors and further influencing these dynamic processes [6].

Inflammatory Biomarkers and Atherosclerosis given the role of inflammation in atherosclerosis. During the inflammatory process, inflammatory mediators are released into the blood circulation, and these mediators can be used as a biomarker for predicting cardiovascular risk.

Among the biomarkers reported to date, plasma CRP is the most widely studied indicator of vascular inflammation, as it identifies low but persistent levels of inflammation. Nevertheless, the increase in CRP levels is non-specific, as they rise in any inflammatory context, and results on its predictive value have been contradictory [7,8]. The European Society of Cardiology guidelines for cardiovascular prevention do not advise routine assessment of CRP levels as part of risk assessment [9], while the American College of Cardiology guidelines suggest considering use of CRP levels if a risk-based treatment decision is uncertain after quantitative risk measurement [10].

Notwithstanding, high-sensitivity CRP (HS -CRP) assays, which are able to assess lower levels of CRP (such as those associated with low-grade inflammation), have

emerged as important ancillary tools for understanding the association between inflammation and ischemic events (11, 12, 13, 14). Several studies have shown that hs-CRP levels can predict CV events, both in the general population and in individuals with previous CVD (13, 14, 15). Various reports have shown that hs-CRP level can discriminate CV risk independently of lipid parameters, highlighting its potential role as a risk marker (13,15, 16).

Accumulation of polymorphonuclear leukocytes (PMN) and their activation are key features of inflammatory reaction associated with acute myocardial ischemia-reperfusion [17]. Experimental studies have shown that influx of PMNs into tissues results in tissue injury beyond that caused by ischemia alone [18,19]. It has also become apparent that the recruitment of PMNs during ischemia-reperfusion involves numerous mediators [17,20]. The causative role of PMNs in reperfusion injury in animals is supported by the observations of reduction in microvascular dysfunction and tissue injury by strategies that prevent PMN influx in tissues by either a decrease in the number of circulating PMNs [21] or prevent PMN activation [22]. Other studies [23] have shown that inhibition of release of PMN-derived mediators of tissue injury [23] or blockade of adhesion molecules on PMNs [24,25] and/or endothelial cells [26-27] also reduce tissues injury.

Several markers involved in the formation and lysis of arterial thrombosis have been identified, among which Fibrinogen, plasmin-α2 antiplasmin, prothrombin, activated factor VII and D-dimer can be noted. It is anticipated that the levels of these enzymes change with the incidence of coronary artery thrombosis [1, 28, 29].

the D-dimer was used as a diagnostic marker in venous thromboembolism [30], but few studies recently demonstrated the diagnostic value of D-dimer in the diagnosis of MI and ACS [28, 29,31-34].

Aim of study:

To evaluation of the effect of inflammatory status in patient with acute myocardial infarction

Patient and Method:

The study was conducted from 5 October to 1 December 2022 in the critical care unit of Baquba teaching hospital. Inclusion criteria were patients with typical chest pain which define as substernal pain, provoked by exertion or relieve by rest or drugs and the basic requirement is Troponin positive.

Sampling

samples of 50 patients was divided in four group and compare with 19 samples of control group.

First group consist of 6 patients with acute myocardial infarction alone.

Second group consist of 17 patients of acute myocardial infarction with hypertension.

Third group consist of 7 patients of Acute myocardial infarction with Diabetes millets (DM).

Fourth group consist of 20 patients had acute Myocardial infarction with Diabetes mellitus and hypertension.

Information from patient were collected according to interviewing questionnaire decided by researcher it was include age, sex, medical history.

Measurement tool:

Blood sample was taken to determine CBC, Ferritin, HS CRP, ESR, and d-Dimer.

For Complete blood count use EDTA tube in CBC devise take 2-5 minutes

HS CRP The blood sample is separated by a centrifuge, in order to obtain a blood serum, as the analysis is performed on the blood serum, not the blood itself.

ESR uses a black tube called ESR tube in ESR fast Detector take 30. min.

Ferritin uses gel tube and take 45 min. D-dimer use sodium citratetube.

Statistical analysis:

In this study, the data were presented as Mean ± SD, and we used T-test to determine the statistical significant. The different were considered statistically significance when P-value is <0.05, whereas, when the P-value >0.05 the difference considered non-significance.

Result:

1- Estimation of WBC count in patients with acute myocardial infarction AMI.

Several studies reported that the counts of WBCs are changed in patients with MI (39). In this study, as depicted in table 1, the number of WBC in MI and MI with DM were increased compared to Control, yet this did not achieve statistical significance, whereas in patients who suffered from MI combined with HT, and MI with DM and HT, the increased in WCB count was significance.

Table 1: Shows the comparison of WBC account between health individuals and patients with Myocardial infarction (MI), Myocardial infarction association with hypertension (HT), Myocardial infarction association with diabetes mellitus (DM), and Myocardial infarction association with HT and DM. The data represent as Mean ±SD. The difference is considered statistically significant when the P-value <0.05. *P<0.05, **P<0.001, ***P<0.0001, no significant (N.S) P>0.05.

Control	MI	P-value
7.7089±2.04505	9.4083±0.95311	N.S
Control	MI+HT	P-value
7.7089±2.04505	11.9065±4.50466	**
Control	MI+DM	P-value
7.7089±2.04505	7.8414±2.21256	N.S
Control	MI+DM+HT	P-value
7.7089±2.04505	16.5020±10.02104	**

2- Estimation of Neutrophil count in patients with acute myocardial infarction AMI.

The levels of Neutrophil (NEU) may play part in the development of MI (40). As illustrated in table 2, our study finds that, in all patients group, the count of NEU was increased, yet the increase was only significant in patients with MI+HT and MI+DM+HT.

Table 2: Shows the comparison of NEU account between health individuals and patients with Myocardial infarction (MI), Myocardial infarction association with hypertension (HT), Myocardial infarction association with diabetes mellitus (DM), and Myocardial infarction association with HT and DM. The data represents Mean ±SD. The difference is considered statistically significant when the P-value <0.05. *P<0.05, **P<0.001, ***P<0.0001, no significant (N.S) P>0.05.

Control	MI	P-value
4.3689± 1.59253	5.9500± 0.69210	N.S
Control	MI+HT	P-value
4.3689± 1.59253	8.9347± 5.45256	**
Control	MI+DM	P-value
4.3689± 1.59253	5.1986± 1.71814	N.S
Control	MI+DM+HT	P-value
4.3689± 1.59253	9.9740± 7.58411	*

3- Estimation of Lymphocytes count in patients with acute myocardial infarction AMI.

The lymphocytes may play a part in the development of MI (42). As illustrated in table 3, in our study found that, in all patients group, the count of lymphocytes didn't achieve statistical significance.

Table 3: Shows the comparison of LYM account between health individuals and patients with Myocardial infarction (MI), Myocardial infarction association with hypertension (HT), Myocardial infarction association with diabetes mellitus (DM), and Myocardial infarction association with HT and DM. The data represent as Mean ±SD. The difference is considered statistically significant when the P-value <0.05. *P<0.05, **P<0.001, ***P<0.0001, no significant (N.S) P>0.05.

Control	MI	P-value
3.6147±2.26112	2.5667±0.55377	N.S
Control	MI+HT	P-value
3.6147±2.26112	4.0465±3.27873	N.S
Control	MI+DM	P-value
3.6147±2.26112	1.2829±0.65944	N.S
Control	MI+DM+HT	P-value
3.6147±2.26112	3.0178±1.79973	N.S

4-Estimation of Platelets count in patients with acute myocardial infarction AMI.

Several studies reported that the counts of platelets are changed in patients with MI (43). In this study, as depicted in table 4, the number of platelets in MI with HT and MI with DM + HT were increased compared to Control, yet this did not achieve statistical significance, in patients who suffered from MI with DM decrease significant, and in patents with MI the increased in platelets count was significance.

Table 4: Shows the comparison of PLT account between health individuals and patients with Myocardial infarction (MI), Myocardial infarction association with hypertension (HT), Myocardial infarction association with diabetes mellitus (DM), and Myocardial infarction association with HT and DM. The data represent as Mean ±SD. The difference is considered statistically significant when the P-value <0.05. *P<0.05, **P<0.001, ***P<0.0001, no significant (N.S) P>0.05.

Control	MI	P-value
257.3158±48.90473	397.3333±54.14302	**
Control	MI+HT	P-value
257.3158±48.90473	280.8235±99.84315	N.S
Control	MI+DM	P-value
257.3158±48.90473	177.1429±32.89594	**
Control	MI+DM+HT	P-value
257.3158±48.90473	251.0500±104.17115	N.S

5- Estimation of ferritin in patients with acute myocardial infarction AMI.

The levels of ferritin may play a part in the development of MI (44). As illustrated in table 5, our study found that, in all patients group, the level of Ferritin was increased, yet the increase was only significant in patients with MI+DM+HT.

Table 5: Shows the comparison of ferritin level between health individuals and patients with Myocardial infarction (MI), Myocardial infarction association with hypertension (HT), Myocardial infarction association with diabetes mellitus (DM), and Myocardial infarction association with HT and DM. The data represent as Mean ±SD. difference is considered statistically significant when the P-value <0.05. *P<0.05, **P<0.001, ***P<0.0001, no significant (N.S) P>0.05.

Control	MI	P-value
65.0811±37.18260	175.2667±96.56815	N.S
Control	MI+HT	P-value
65.0811±37.18260	71.6700±64.55857	N.S
Control	MI+DM	P-value
65.0811±37.18260	403.1571±313.63458	N.S
Control	MI+DM+HT	P-value
65.0811±37.18260	186.73166±123.8811	**

6- Estimation of HS CRP level in patients with acute myocardial infarction AMI.

Several studies reported that the level of HS CRP is changed in patients with MI (46). In this study, as depicted in table 6, the level of HS CRP in MI and MI with DM were increased compared to Control, yet this did not achieve statistical significance, whereas in patients who suffered from MI combined with HT, and MI with DM and HT, the increased was significance.

Table 6: Shows the comparison of HS CRP level between health individuals and patients with Myocardial infarction (MI), Myocardial infarction association with hypertension (HT), Myocardial infarction association with diabetes mellitus (DM), and Myocardial infarction association with HT and DM. The data represent as Mean ±SD. The difference is considered statistically significant when the P-value <0.05. *P<0.05, **P<0.001, ***P<0.0001, no significant (N.S) P>0.05.

Control	MI	P-value
4.3916±3.73574	42.3633±29.09106	N.S
Control	MI+HT	P-value
4.3916±3.73574	72.9679±63.61593	*
Control	MI+DM	P-value
4.3916±3.73574	57.8200±50.08427	N.S
Control	MI+DM+HT	P-value
4.3916±3.73574	72.9679±63.61593	**

7- Estimation of ESR level in patients with acute myocardial infarction AMI.

The levels of ESR may play a part in the development of MI (48). As illustrated in table 7, our study found that, in all patients group, the level of ESR were increased significance, except the increased in patients with MI not significant.

Table 7: Shows the comparison of ESR level between health individuals and patients with Myocardial infarction (MI), Myocardial infarction association with hypertension (HT), Myocardial infarction association with diabetes mellitus (DM), and Myocardial infarction association with HT and DM. The data represent as Mean ±SD. The difference is considered statistically significant when the P-value <0.05. *P<0.05, **P<0.001, ***P<0.0001, no significant (N.S) P>0.05.

Control	MI	P-value
19.5789±16.91257	40.0000±34.82097	N.S
Control	MI+HT	P-value
19.5789±16.91257	45.9000±31.33493	*
Control	MI+DM	P-value
19.5789±16.91257	57.5000±25.00000	**
Control	MI+DM+HT	P-value
19.5789±16.91257	52.8400±34.64537	**

8- Estimation of D-Dimer level in patients with acute myocardial infarction AMI.

The levels of D-Dimer may play a part in the development of MI (50). As illustrated in table 8 , in our study found that, in all patients group, the level of D-Dimer didn't achieve statistical significance.

Table 8: shows the comparison of D-Dimer level between health individuals and patients with Myocardial infarction (MI), Myocardial infarction association with hypertension (HT), Myocardial infarction association with diabetes mellitus (DM), and Myocardial infarction association with HT and DM. The data represent as Mean ±SD. The difference is considered statistically significant when the P-value <0.05. *P<0.05, **P<0.001, ***P<0.0001, difference is considered no significant (N.S) P>0.05.

Control	MI	P-value
0.4311±0.37303	0.8933±0.91288	N.S
Control	MI+HT	P-value
0.4311±0.37303	0.7067±0.94590	N.S
Control	MI+DM	P-value
0.4311±0.37303	0.3600±0.21486	N.S
Control	MI+DM+HT	P-value
0.4311±0.37303	0.5195±0.26307	N.S

Discussion:

The role of inflammation in ischemic heart disease has been outlined and identified several years ago [1,2]. Initial observational studies have shown that patients with acute coronary syndromes have elevated inflammatory markers (leukocytosis, neutrophils , increased erythrocytes sedimentation rate, fibrinogen and C reactive protein [CRP]) [3].

Inflammatory processes play a pivotal role in atherogenesis. Emerging evidence suggests that plasma markers of chronic low-grade vascular wall inflammation may help predict individuals at risk for plaque rupture. Elevated levels of P-selectin, sICAM-1, IL-6, TNF-a, and CRP have been shown to predict future vascular risk in a variety of clinical settings. CRP, a hepatic acute-phase reactant produced in response to IL-6, appears to be the strongest predictor of future cardiovascular risk. Furthermore, the addition of CRP testing to lipid testing may improve upon lipid-based testing alone (35).

In study of Inflammatory Markers for Arterial Stiffness in Cardiovascular Diseases There is ample evidence of a crosstalk between arterial stiffness and systemic inflammation, and inflammation plays an important role in the development of arterial stiffness. Inflammatory markers may be useful additional tools in the assessment of the cardiovascular risk, atherosclerotic plaque remodeling, and preclinical atherosclerotic changes in clinical practice and may be used to develop risk scores for possible future cardiovascular events. This might help to close the currently existing gap between predicted cardiovascular events and their real prevalence. Most of the inflammatory markers are inexpensive and easily measurable, widely available, standardized and may be included in the annual examination of patients at risk, considering that inflammation causes a reversible increase of arterial stiffness (36).

in other study found that Extensive experimental evidence suggests that MI is intricately associated with activation of an inflammatory reaction. Inflammatory mediators are directly involved in the pathogenesis of the vulnerable plaque, leading to occlusion of the coronary vessel and subsequent necrosis of the myocardial territory served by the vessel. Cardiomyocyte necrosis triggers both a systemic inflammatory response, mobilizing bone marrow-derived immune cells, and a local reaction, leading to recruitment of circulating inflammatory cells that serve to clear the infarct from dead cells and matrix debris (37).

There is several marker has been used to detect inflammatory process such as use cytokines and chemokine, induction of pro-inflammatory cytokines is a hallmark of the

post-infarction inflammatory response, and other investigation (37). investigation has been used levels of C reactive protein (CRP), interleukin 1β (IL-1β) and stromal-derived factor 1α (SDF-1α) at the time of acute myocardial infarction (AMI) and at 1 and 6 months, (38).

In our study we used the classic marker due to some marker expensive and unavailable.

In our study we found WBC in table 1 effected in group of MI with HT and in group of MI with HT and DM were increase compared to control which in line with Ignacio M. et.al(39) who found that An increase in white blood cell count (leukocytosis) is associated with increased mortality during AMI and represents an independent prognostic factor to develop HF and cardiogenic shock.

While WBC in group of myocardial infarction and group MI with DM show there is no effect which is not agree with Nikolaos F. (37). Who found that Chemokine and cytokines play a critical role in recruitment of inflammatory leukocytes in the infarcted myocardium. Cytokine-mediated induction of adhesion molecules in endothelial cells and integrin activation in leukocytes trigger adhesive interactions.

In our study we found NEU in table 2 increased significant in patient with MI with HT and in patient with MI+DM+HT which in line with Gopalkrishna S.et.al (40)Who found increase in neutrophil recruitment occurred within 6 hours and remained elevated (peaking at 24 hours) throughout the 15-day observation period . The number of neutrophils in the blood followed a similar pattern, except for a transient decline at 12 hours followed by a robust rebound at 24 hours. The neutrophils in the blood were activated as assessed by cell surface expression of a key adhesion molecule CD11b which is crucial for adhesion/ transmigration to the infarct.

While neutrophil in group of myocardial infarction and group MI with DM show there is no effect which is not agree with Kai j. et.al (41) who found that neutrophil correlates with major adverse cardiovascular events in patients with AMI , implying neutrophil reduction may have more favorable outcomes. However, the mechanisms that determine neutrophil generation and recruitment to the infarcted heart remain unclear.

In our study we found lymphocyte in table 3 show no significant in all group and this not agree with Hofmann U. et.al (42) who found following AMI, mature B lymphocytes infiltrate into the MI zone (peaking at day 5 post-AMI), and augment the pro-inflammatory response by secreting the chemokine CCL7, which in turn induces mobilization from the bone marrow of pro-inflammatory Ly6C^{hi} monocytes .

In our study we found platelets in table 4 show there is effected in group of MI and group of MI with DM which is in line with Kornela H.et.al (43).who found The platelets

get activated at an early stage of reperfusion, and then, platelets' accumulation occurs within the ischemic myocardium .while not effect in MI with HT and MI with DM + HT,

In our study we found ferritin as show in table 5 there is effected in group of MI with DM and HT which is in line with M.P.Holay. et.al (44) who found the authors documented a more than five-fold higher risk of acute myocardial infarction (AMI) in patients with ferritin values above 200 µg/L, an effect maintained after multivariate analysis.

While in others group ferritin was not effected which is in line with M.W. Knuiman.et.al (45) who found that an early trial from 2003 did not observe any correlation between ferritin and coronary heart disease or stroke during long-term follow-up (17 years).

In our study we found HS CRP as show in table 6 there is effected in group of MI with HT and group of MI with DM and HT which is line with Nicoleta O. et.al (46) who found a positive correlation between CRP and the severity of coronary stenosis, The more elevated CRP values are at the moment of AMI, the more severe the coronary atherosclerotic lesions at angiography and the more reduced was LVEF at 1 month after AMI.

While in group of MI and MI with DM show no significant which is not agree with Yuqing Z. et.al (47). who found Hs-CRP can not only reflect the inflammatory degree, but also promote the inflammatory response and plaque rupture.

In our study we found ESR as shown in table 7 there is effected in 3 group patient.

Which in line with Chuang L. et.al (48) ESR has been found to intimately correlate with the incidence of MI and cardiac morality in the general population.

While in group of MI alone not effected which is not agree with Natale D. et.al (49) Who found the study by Brunettietal, the average ESR levels in patients receiving untimely reperfusion consistently increased by nearly three times from admission to 4 days in the hospital, while the CRP level had reached a plateau within 2 days.

In our study we found increase in d-dimer not significant and this not agree with Chaofeng S.et.al (50) who found the increase in the level of D-D indicates that the activity of fibrinolytic enzyme increases, which increases the viscosity of blood, thereby increasing the aggregation of platelets, resulting in the occurrence of atherosclerotic lumps after the thrombus formed by fibrin and platelets adheres to the blood vessel wall, aggravating the degree of CHD lesions .

Conclusions:

Based on the results of this study, it seems that the measurement of inflammatory marker level can be appropriate as a marker with high sensitivity and relatively high specificity, and according to the results which show not highly significant this because few samples of patient and control people.

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