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Research Article

Study of Some Modern (Von Willbrand Factors and Copeptin) and Routine (Troponin I and hs-CRP) Biochemical Markers in Patients with Ischemic Heart Diseases in Karbala Province

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Abstract:

Present study was diagnosed at Cardiologist, Imam AL-Hassan Al-Mujtaba Teaching Hospital and Karbala center for heart diseases and surgery in Imam Al-Hussein Teaching Hospital from March to August 2024.comfort might result from this decreased blood flow. High blood pressure, high cholesterol, smoking, diabetes, obesity, and a sedentary lifestyle are the primary risk factors. This study's goal is to assess and contrast a few biochemical markers in Karbala province people who have ischaemic heart disease and those who do not. This study was designed as a cross-sectional study. 100 individuals were involved, divided into Two main group with age range 25-85 years as Group 1 without Ischemic Heart Diseases divided into two subgroups (Without risk factors and With risk factors (Hypertension, diabetes mellitus, obesity ,smoking),Group 2 with Ischemic Heart Diseases divided into three subgroups(Stable angina ,Unstable angina and Myocardial infraction). All the patients included in the current study were diagnosed by Cardiologist in Imam Al-Hassan Al-Mujtaba Teaching Hospital, and Karbala Center for Heart Diseases and Surgery in Imam Al-Hussein Teaching Hospital from March 2024 to August 2024. In the present study, copeptin in patients was measured regularly and other biochemical factors include VWF, hsCRP, and Troponin I were also analyzed and the results of these biochemical signatures have been analyzed by employing enzyme-linked immunosorbent assay (ELIAS). The result of current study showed that the concentration of troponin I is higher in myocardial infraction group than other groups (without risk factors, with risk factors, stable angina, unstable angina) and the concentration of hs-CRP is higher without risk factors, stable angina, unstable angina and especially in myocardial infraction This result implies that copeptien is higher in unstable angina and in myocardial infraction continuing tordial infraction.

Keywords: Ischemic heart diseases (IHD), Von willbrand factors (VWF), High-sensitivity C-reactive protein (hs-CRP).

Introduction

IHD is one of the most common causes of death in the world, and cases are growing rapidly. In both developed and developing countries, IHD is the most predominant type of the disease and all countries that are affected by it, exhibit high incidences of morbidity and mortality (Ahmed et al., 2022). Ischaemic heart disease is a condition which is precipitated by a decrease in oxygen supply to the myocardium. Most are as a result of artery blockage due to deposits of cholesterols on the arterial walls. According to German ischaemia means "a decreased blood supply." Heart muscle is supplied with blood through the coronary arteries; if the coronary artery is affected, the blood supplying the heart may gradually be cut off. Whether or whether debris visible downstream in the blood flow will narrow or close big coronary arteries very fast or coronary artery final branches (Anusha et al., 2020). Plaque can also give rise to blood clot formation as well as blood vessel blockage that may result in heart attack and death (Suryati and Suyitno, 2020). Diabetes, obesity, hypertension, hyperlipidaemia, and ageing are identified risk factors accounting increased cases of coronary heart diseases, (Shu et al., 2024, p.323). Von Willebrand factor (VWF) is an adhesive glycoprotein which exists as a large multimer and has fondamental importance in haemostasis . Initially, the VWF, via binding, gathers platelets at sites of local vascular damage by spanning between the injured endothelial lining and platelets. Second, VWF also acts as a carrier protein for coagulation factor VIII (FVIII) and has therefore a protective, stabilising effect on FVIII against degradation, cellular uptake or binding to the surface of activated platelets and endothelial cells. It has been synthesized solely in endothelial cells and megakaryocytes tissues (Denorme et al., 2019). VWF is involved in coagulation and the general plasma level of VWF increases with age. Wang et al. (2023) asserts that high VWF increases the risk of thrombogenesis, atherosclerotic plaque formation, inflammation, and the proliferation of vascular smooth muscle cells.Juxtaposed to this haemostatic role, VWF may be impaired possibly tracing the onset of CAD and its effects. VWF may also play a part in inflammation of atherosclerosis. VWF plays a direct role in the support of leukocyte extravasation and recruitment at high shear rate conditions. By this function, VWF may modulate inflammatory processes at sites of the atherosclerotic lesions (Kozlov et al., 2022).Increased VWF levels were associated with a higher risk of ischaemic heart disease (IHD) (Mihyawi et al., 2022). Muscles are regulated by molecules called troponins which affect the contraction in muscles. Cardiac troponin I (cTnI), C and cardiac troponin T (cTnT) are the amounts occurring in the myocardium. All three are components of the contractile system in the heart muscle fibers. They are not skeletal muscle troponin they have different genes. This applies to cTnI, for which there is an immunoassay, and the same applies to cTnT for myocardial damage or infarction. Cardiac troponin is only found in myocardial tissue. (Potter and others, 2022). As already pointed out, higher levels of Troponin T are associated with a worse diastolic function, and these diastolic function impairments may partly underlie the increased hazard ratio for heart failure. (Peder and others, 2019). Copeptin is the carboxylterminus of the AVP precursor peptide, a 39 amino acid glycosylated peptide (Jalleh and Torpy DJ.2021). The principal physiological functions of AVP are cardiovascular homeostasis, regulation of endocrine stress response, and a control of fluid balance and osmotic pressure. Copeptin, in cooperation with AVP is synthesized in the neurohypophysis and released in a coordinated manner, and has become an easy to measure biomarker of AVP and holds great promise in clinical utility (Mu et al., 2022). In CV, copeptin has a diagnostic and prognostic value. The score can be employed to rapidly screen out the absence of acute myocardial infarction (AMI), rapidly assess mortality of heart failure (HF) and stroke (Mu et al., 2022). Copeptin and heart failure prognosis has also been investigated. Accumulating evidence indicates that copeptin is a useful prognostic marker for both mortality and morbidity in heart failure patients following an acute myocardial infarction (Jalleh and Torpy

DJ.2021). In older patients, copeptin level increase can predict the development of heart failure, according to Fredrika et al. Although elevated hsCRP in the general population significantly is associated with MFI, stroke, PAD, and sudden cardiac death in healthy subjects without prior cardiovascular disease history. In patients with acute or stable coronary syndromes it predicts further events and death. Thus, hsCRP augments work of prediction in individuals, with or without preclinical atherosclerosis, all groups of blood pressure, metabolic syndrome severity, cholesterol and Framingham coronary risk score levels. Cardiovascular risk factors include having values of hsCRP of less than 1, 1–3 and more than 3 mg/L are considered to be at lower, moderate and higher risk respectively. In this article clinical indications for hsCRP testing in cardiovascular disease risk profiling are described along with a compilation of epidemiological data on the association of CRP and the atherothrombotic process (Bassuk et al., 2004).

Materials and Methods:

Study design

60 of the patients with ischemic heart diseases and 40 from the patients without ischemic, heart diseases.Those patients that have cancer, autoimmune diseases, renal failure, asthma and patients under 25 years of age were excluded from the study.s, 40 without ischemic heart diseases. Subjects with cancer ,Autoimmune diseases ,renal failure ,Asthma and Patients age less than 25 year were excluded from the study.

Population under investigation

The research featured 100 percipients divided into two groups:

1.Group 1 without Ischemic Heart Diseases (40) divided into two subgroups:

A. Without risk factors (15).
B. With risk factors (Hypertension, diabetes mellitus, obesity ,smoking) (25).

2. Group 2 with Ischemic Heart Diseases (60) divided into three subgroups:

A. Stable angina (30).
B. Unstable angina (15).
C. Myocardial infraction (15).

Statistical analysis

The data was statistically analysed using the SPSS computer program. The mean standard deviation (SD) of the data is displayed. The P value, or least significant difference, found for the comparison between the groups was used to determine the differences between groups, and the results were considered to have statistical significance.

Ethical approval

The College of Applied Medical Science/University of Karbala's Ethical Committee documented ethical approval. Additionally, the study receives approval from the Iraqi Ministry of Health's Karbala health department, the Imam AL Hasan Al Mujtaba Hospital, and the Imam Hussain Medical Educational Hospital's Karbala Centre for Cardiac Diseases and Surgery for research ethics. All participants were informed of the study's goals, and their verbal consent was acquired.

Techniques used to determine VWF ,Copeptin, and Troponin I

The concentrations of VWF ,Copeptin, and Troponin I was measured using an a sandwich immune detection method using ELISA.

Results:

Troponin I

The result in figure (1) showed the concentration of troponin I significantly increasing ($P<0.00001$) in Myocardial infraction (0.066±0.013 ng/ml) compared with other parameters (without and with risk factors, Stable angina ,unstable angina) (0.022±0.002, 0.019±0.004, 0.041±0.011, 0.039±0.005 ng/ml) respectively.

In another hand no significant increasing between stable angina and Un stable angina and may be the troponin as indicator in case Myocardial infraction only

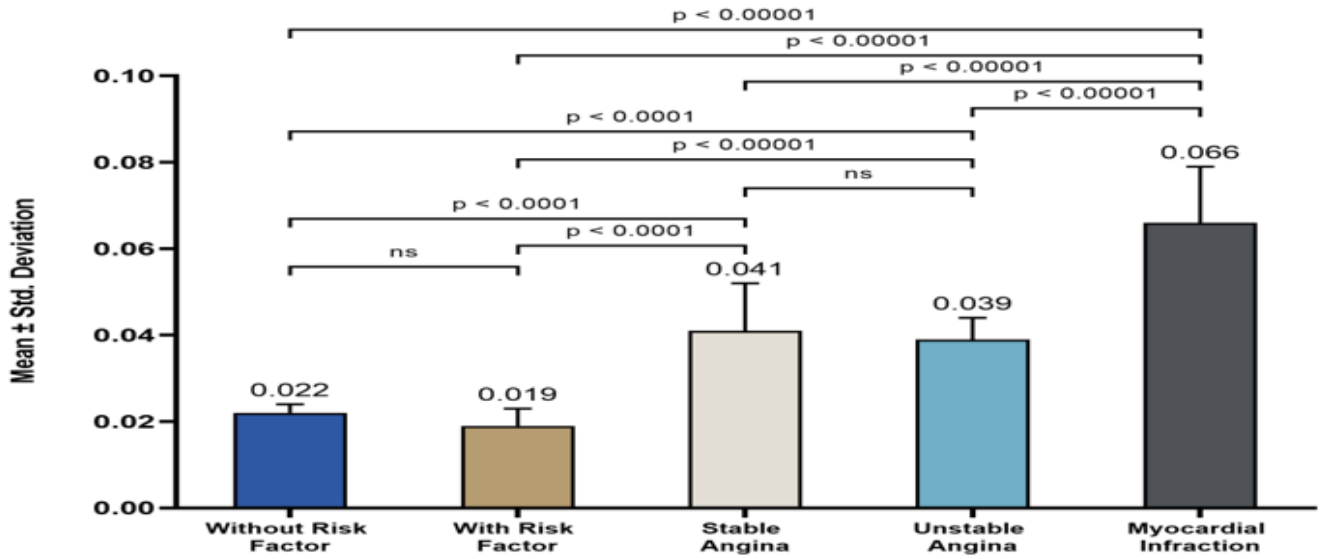

Figure (1) The Concentration of Troponin in patients with and without ischemic heart diseases.

High-sensitivity C-reactive protein (hs-CRP)

The result in figure (2) showed the concentration of hs-CRP highly significantly increasing (P<0.00001) in myocardial infraction (7822.60 pg/ml) compared with other parameters (without and with risk factors, stable angina ,unstable angina (117.21±7.50, 249.77±74.30, 200.00±53.12, 417.7±127.16 pg/ml) respectively and also unstable angina (417.75±127.16 pg/ml) is significant increasing (P<0.0001) compared with stable angina (200.00±53.12 pg/ml) this result indicate hs-CRP as predictor because it significantly increase in unstable angina and continually highly increasing in myocardial infraction.

In another hand the result showed in patients with risk factor significant increase compared without risk factor P<0.001 (249.77±74.30 , 117.21±7.50 pg/ml) respectively because this patient have another disease .

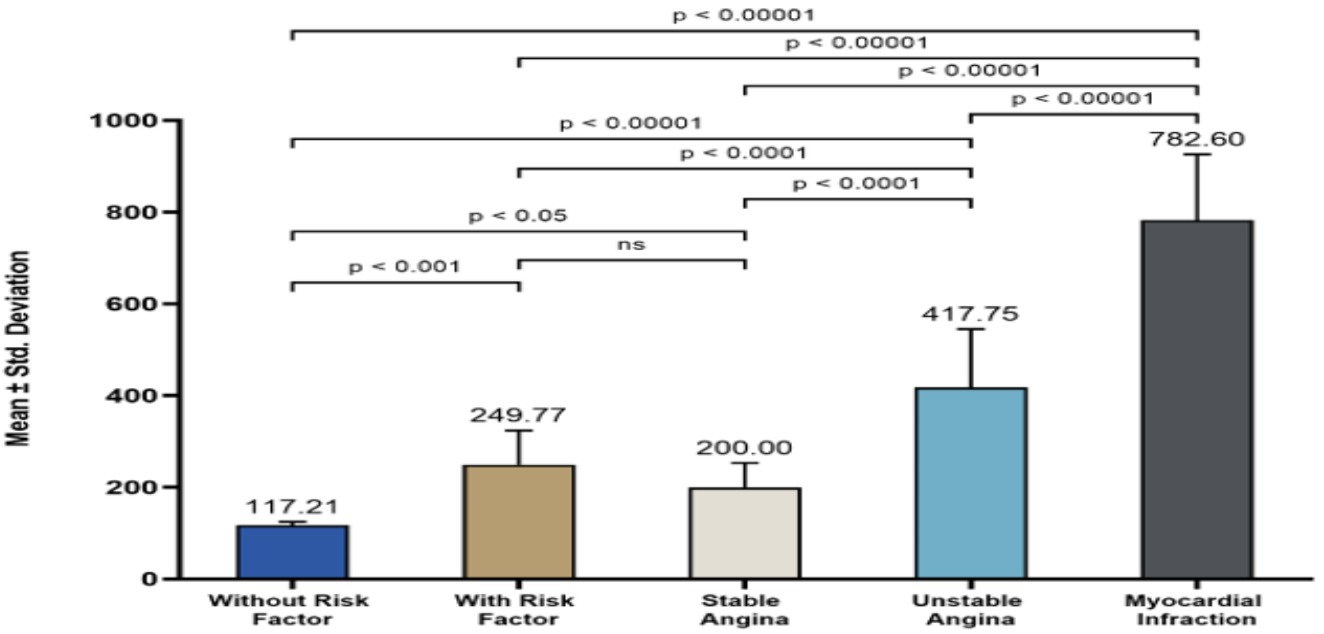

Figure (2): The Concentration of high-sensitivity C-reactive protein (hs-CRP) in patients with and without Ischemic heart diseases .

Copeptin:

The result in figure (3) showed the concentration of copeptin significantly increasing (P<0.0001) in Myocardial infraction (907.75±125.57 pg/mL) compared with other parameters(without and with risk factors, Stable angina ,unstable angina (253.51±10.88,394.57±101.96,425.18±105.53, 517.57±126.84 pg/ml) respectively.

in another hand the result showed a significant increase (P<0.05) between stable angina and unstable angina (425.18±105.53, 517.57±126.84 pg/ml) respectively.

and no significant increasing in copeptien between stable angina and group with risk factor. (425.18±105.53,3 pg/ml).

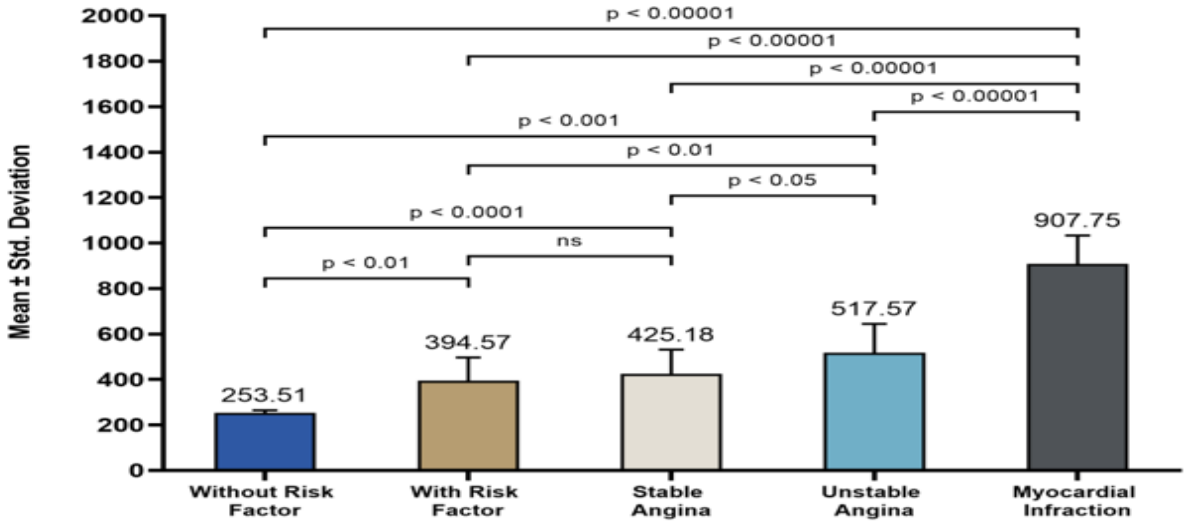

Figure (3): The Concentration of Copeptin in patients with and without ischemic heart diseases.

Von Willbrand Factor (VWF)

The result in figure(4) showed the concentration of VWF highly significantly increasing (P<0.00001) in Myocardial infraction (4.57 ± 0.99 ng/ml) compared with other parameters (without and with risk factors, Stable angina ,unstable angina) (0.24±0.16, 0.94±0.80, 1.44±0.65, 2.92± 0.35 ng/ml) respectively and also unstable angina (2.92 ng/ml) is significant increasing (P<0.00001) compared with stable angina (1,44±0.65 ng/ml)

this result indicate the VWF as predictor because it significantly increase in Unstable angina and continually highly increasing in Myocardial infraction.

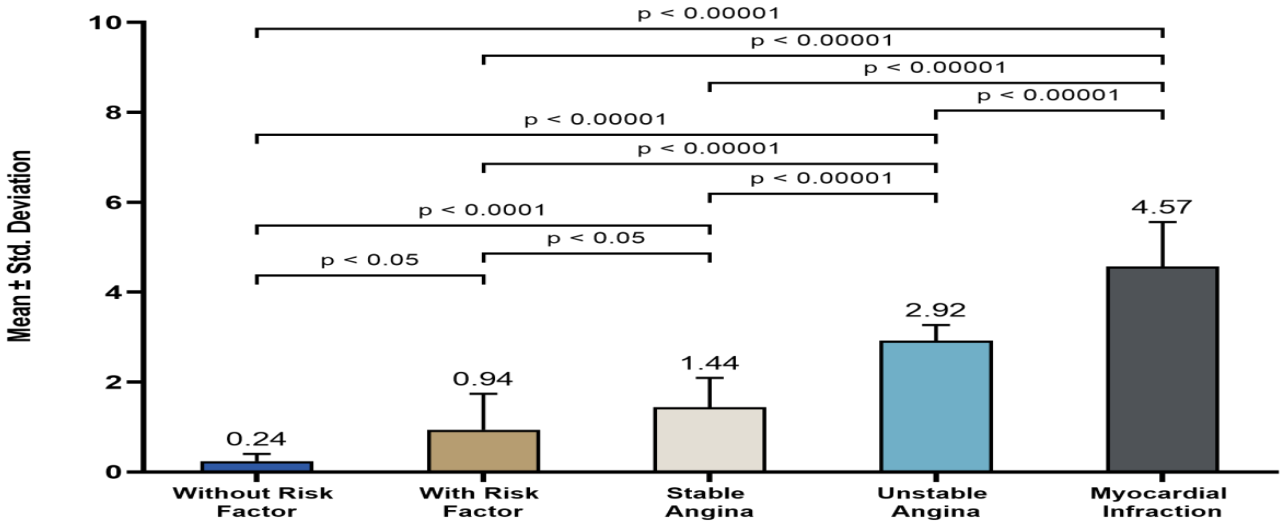

Figure (4) : The Concentration of Von Willbrand Factors in patients with and without Ischemic heart diseases.

Discussion:

CAD associated with increased concentration of cTnI. Current principal diagnostic test to diagnose AMI is cTn I because of its high sensitivity and specificity, (Chen et al.,2023). It emerges from the normal myocardium, cTc has relatively high serum baseline levels in patients with angina and does not show a large increase in serum Troponin I level because angina does not cause much myocardial damage (Danek et al., 2017). : It is with regard to this that Aydin et al. (2019) postulated that the peak level of this biomarkercan be detected 18-24hs after chest discomfort and remains elevated for 10 days. In this regard, cTnI is one of the diagnostic criteria for MI. Hence, troponin is only used as a rapid preliminary test in the emergency department. Other biomarkers include cTnI that increases in the blood when heart muscle is damaged following acute myocardial infarction (Cortés et al., 2024). Serum hs-CRP levels are strongly correlated with unfavourable cardiac events of individuals based on Zhou and al., 2024.Although hs-CRP levels in stable coronary disease patients or patients with ACS are already recognised as highly potent independent predictors to help doctors identify the patients which of them at a later date is likely to be affected by cardiovascular disease. They may also be useful in a stand along fashion as an independent predictor of the recurrence outcomes (Bouzidi et al., 2020). Inflammation acts an activator of the liver and this initiates the production of hs-CRP. In their study, Banait et al (2022) observed that hs-CRP is involved in the advancement of atherosclerosis, a condition where the blood vessels become narrowed and can harden and thicken due to plaques forming on the arterial walls Adding to this, chronic inflammation is damaging to the inner layers of the blood vessels hence making them prone to deposit formation that leads to the narrowing of arteries to restrict blood flow. When theseplaques rupture, blood clots may occur that block the bloodstream in the heart and may cause a heart attack (Suryati and Suyitno, 2020). Polyakova et al., 2020 established that the degree of coronary artery lesion, the size of the myocardial necrosis area, the risk of recurrent AMI, the risk of new-onset AMI, ventricular tachycardia, heart failure decompensation/development, and death may be associated with the level of hs-CRP in the patients with AMI.The copeptin level of patients with myocardial infar Copeptin is an objective biomarker for both risk assessment and risk stratification in the setting of CVD, including the rapid exclusion of AMI, prognosis of HF and stroke mortality. Copeptin is essential in differential diagnosis of CVDE, its risk assessment and severity including AMI, HF and stroke. Because C-terminal part of pro-arginine vasopressin is cosecreted with copeptin and is highly stable in biological fluids, copeptin is one of the markers used for cardiovascular disease.Yield of copeptin is renowned to increase immediately, reach a higher peak at third or fifth day after AMI, and remain stable later. From the findings, it can be deduced that it might be an ideal biomarker for MI, ischaemic stroke as well as heart failure (Roczek et al., 2021). In CAD, whereby Davuit et al investigated the plasma copeptin level of radio patients, higher copeptin level enhances the mortality and risk of MACE (Shi and Qian, 2033). As copeptin release in response to ischaemia was less than other acute stimuli such as AMI, it is important to appreciate that negative copeptin results do not exclude CAD (Keller et al., 2010). Morange et al (2004) found that patients who once encountered myocardial infraction had higher level of Von Willebrand factor (VWF) compared with the normal subjects.The VWF is a plasma protein which carries coagulation factor VIII, an aspect of intrinsic coagulation pathway, and also has a function of binding platelets and leukocytes to the site of vascular injury. Upon entering the bloodstream, ULVWF prodrug multimers promote platelet capture, and ULVWF string multimers are associated with spontaneous thrombogenesis (Okhota et al., 2020). Several conventional cardiovascular risk factors such as increased age, smoking, hypercholesterolaemia, diabetes mellitus and hypertension were found to be independent factors that caused increased blood levels of VWF. High VWF levels in patients with atrial fibrillation may estimate stroke and vascular events

(Parvathareddy et al., 2024).Bettino, the dysfunction of VWF may contribute to the development of CAD and subsequent outcomes (Kozlov et al., 2022).

Conclusion:

Brings about an abrupt rise of Troponin I in patients diagnosed with myocardial infarction. The data in Table 2 showed that both stable and unstable angina as well as myocardial infraction had significantly higher hs-CRP values than control group. Both copeptin and VWF are significantly upregulated in myocardial infraction and unstable angina.

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