REVIEW ARTICLE

Dual antiplatelet including clopidogrel and aspirin, cardiac MRI, and speckle tracking echocardiography parameters in ST-elevation myocardial infarction patients

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ABSTRACT

Coronary artery disease is the medical term for atherosclerotic coronary disease, which causes the coronary arteries to constrict and inadequately provide blood to the heart. ST-segment elevation myocardial infarction, non-ST-segment elevation myocardial infarction, & unstable angina are the three conditions that comprise acute coronary syndromes. Studied cases with STEMI have been advised to take several drugs in addition to early reperfusion treatment, such as antiplatelet & anticoagulant medications. The goal of antiplatelet medications is to stop platelets from aggregating together. Oral dual antiplatelet medication, which combines lifetime aspirin with an oral P2Y12 receptor inhibitor, is the main antiplatelet therapy in STEMI. Aspirin ought to be administered to all studied cases immediately following diagnosis, and a low dose of treatment should be continued indefinitely. Heart mortality and severe adverse cardiac events are strongly and independently correlated with the presence & size of scarred tissue seen by cardiac MRI. Scar transmurality measured by cardiac MRI in studied cases with healed infarcts & ventricular dysfunction predicts patient survival and functional recovery following revascularization. Patients with heart illnesses that have a history of ST-segment elevation myocardial infarction may be at risk for unfavorable results based on echocardiographic evaluation of cardiac structure & function. Because speckle tracking echocardiography (STE) is quick and simple to do, it can be used in acute settings as well. It can be used for further risk stratification following revascularization, before invasive coronary angiography, or in cases when a diagnosis is unclear, if available.

Keywords: STEMI, cardiac MRI, Speckle tracking echocardiography.

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INTRODUCTION

Cardiomyocyte necrosis is consistent with myocardial ischemia, a spike or decrease in cardiac troponin with at least 1 value over the upper limit reference's 99th percentile, and at least 1 of the following are indicators of myocardial infarction (MI).[1]

- Symptoms consistent with myocardial ischemia.
- Recently assumed LBBB.
- An ECG shows a new abnormal Qs wave.
- Coronary thrombus evidenced by coronary angiography.
- Evidence of myocardial ischemia as determined by imaging techniques like PET scans. [2]

An early diagnosis must be made within ten minutes of the initial medical contact (1) to start the proper treatment for STEMI. The epidemiology of STEMI patients is still rising. According to data from the Global Registry of Acute Coronary Events, about 36% of ACS instances were related to STEMI. Cardiovascular disease (CVD) is becoming more common and more severe in emerging nations. A Western diet, which is often high in refined carbohydrates and saturated fats, is one reason for this rise in unhealthy lifestyle choices in these areas. Furthermore, compared to wealthy nations, CVD strikes younger people in developing countries.[3]

Additionally, men are more likely than women to get STEMI earlier in life because of the premenopausal protective impact of estrogen. Advances in reperfusion therapies & preventive measures have been linked with a decrease in STEMI mortality. Post-STEMI comorbidities are also

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declining, which can be attributed to better care systems and therapy utilization, as per the most recent guidelines. Patients without PCI or CABG surgery had higher in-hospital mortality (12.43% to 14.91%).[4]

The development of thrombosis on a coronary atherosclerotic plaque is the primary mechanism responsible for total coronary occlusion in STEMI; additional processes include coronary spasm, coronary embolism, and spontaneous dissection of the coronary arteries. The diagnosis of myocardial ischemia has been typically based on symptoms like persistent chest pain. Still, other unusual symptoms, such as jaw discomfort, nausea, or weariness, have also been found, and they are more common in women than in males. A twelve-lead ECG ought to be interpreted as quickly as feasible in the event of persistent chest discomfort, with the goal of recording and analyzing the results no later than 10 minutes following the initial medical contact. When Brugada syndrome, ventricular paced rhythm, and LB are present, the characteristic ST-segment elevation pattern on the ECG has been disrupted, making the identification of STEMI difficult. [5]

Research analyzing coronary artery calcium with computed tomography has demonstrated that a significant number of people considered to be at high cardiovascular risk based on risk model evaluation have been at very low risk of CV events. Coronary artery calcium scoring appears to be a very useful method for directing preventive treatments.[6]

Prevention of CAD

Prevention attempts to decrease the burden of atherosclerosis because most STEMI instances have been caused by thrombus development on a ruptured coronary atherosclerotic plaque. Several tactics have been suggested for CVD primary prevention. Advice on changing one's lifestyle to lower one's risk of CVD should be given to everyone, regardless of risk score. One of the main risk factors for atherosclerotic diseases, such as MI, is smoking, which also deteriorates the results of intervention. After PCI, smoking patients have an increased risk of death & morbidity. Cigarette smoking is linked to coronary artery disease through several mechanisms, including oxidative endothelial damage, which accelerates atherosclerosis and damages endothelium, platelet activation & thrombosis & activation of the sympathetic nervous system, which constricts coronary blood vessels. Eating at least 5 portions of fruit & vegetables each day has been advised for a healthy and balanced diet. [7]

Exercise is known to have a positive effect on coronary heart disease. It has a preventive role against coronary artery disease (CAD), as CAD incidence is halved in physically active people compared to sedentary ones. 8

Management of Acute STEMI:

Occluded coronary artery recanalization is the primary means of immediate, successful myocardial reperfusion in the acute treatment of STEMI. Primary PCI has emerged as the recommended reperfusion method because of its favorable outcomes when performed within 120 minutes of diagnosis in patients with STEMI, as compared to fibrinolysis. The establishment of STEMI networks contributed to better clinical results and a shorter time to reperfusion .9

Reperfusion therapy

According to guidelines, individuals with STEMI-studied cases presenting within twelve hours after symptom start & for whom PCI cannot be completed within 2 hours are advised to have fibrinolysis after exclusion of contraindications. 11

If fibrinolysis is first, PCI and coronary angiography should come next. Fibrinolysis is generally being used less frequently, while primary PCI is being used more frequently.12

Concomitant Pharmacological Treatment

Anticoagulation therapy

Anticoagulation treatment has aimed to stop the generation of thrombin. One type of low molecular-mass heparin is enoxaparin. These medicines must be administered intravenously throughout primary PCI. Patients with heparin-induced bleeding disorders or those at high risk of bleeding can utilize bivalirudin, a direct thrombin inhibitor.13

Antiplatelet therapy

Antiplatelet medications aim to stop platelets from aggregating. The main antiplatelet therapy in STEMI is oral dual antiplatelet medication, which combines lifetime aspirin with an oral P2Y12 receptor inhibitor. Guidelines have illustrated the ideal dual antiplatelet therapy duration.14

Aspirin ought to be administered to all studied cases immediately following diagnosis, and a low dose of therapy should be continued indefinitely. There are three possible reasons for choosing an oral P2Y12 inhibitor. When a studied case is at high risk of bleeding, especially if they need to take oral anticoagulation therapy for the rest of their life, clopidogrel is still the recommended medication, especially if the newer agents are contraindicated or not available. Patients undergoing fibrinolysis should only be on aspirin and clopidogrel for a year as their dual antiplatelet medication .15

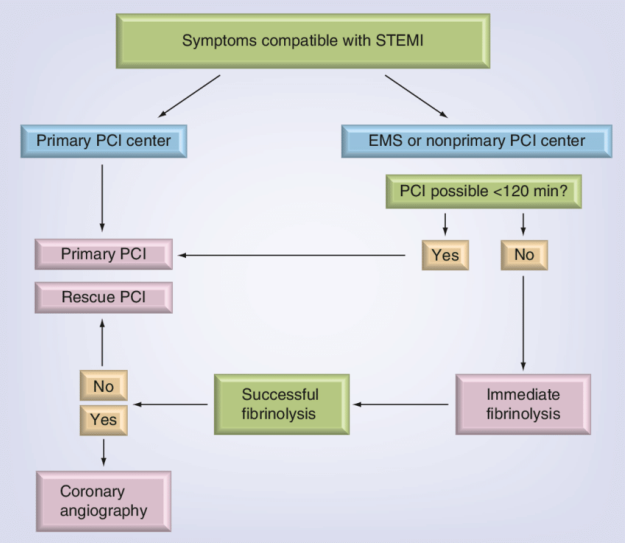

Figure 1: Management of Acute STEMI[10]

Routine secondary prevention therapies

Before patients with STEMI are discharged, several pharmacological therapies have been explored and established, in addition to anticoagulation and antiplatelet medications. After MI, the use of angiotensin-converting enzyme inhibitors has been linked to a substantial decrease in death and morbidity, β-adrenergic receptor blockers following myocardial infarction, particularly in those who have heart failure or systolic dysfunction. One of the most crucial components of secondary prevention for CVD is lipid-lowering medication.16

Cardiac MRI

Cardiac magnetic resonance imaging is a crucial imaging technique for examining people who may have heart disease. It has established itself as the gold standard for investigating cardiac mass, volume, and function and enables tissue characterization noninvasively.17

Cardiac MRI used for evaluation of cardiac volumes & function:

Quantitative cardiac chamber segmentation has been a crucial step in evaluating cardiovascular illness. Ventricular volumes, systolic function, and mass measurements enable prognostic assessment. For instance, the cardiac wall thickness in hypertrophic cardiomyopathy and the ejection fraction in heart failure serve as important markers for resynchronization or defibrillator therapy (26). heart MRI enhances the delineation of the endocardial.[18]

CMR Assessment of myocardial structure & function

The initial steps in myocardial assessment still involve measuring the size, shape, wall thickness, and function of the heart. These are obtained within the first ten minutes of a CMR scan using an aortic valve short-axis view, a short-axis cine stack, and four long-axis lines .19

Cardiac MRI for advanced structure and function

Apical HCM is a CMR example of an extended phenotype. CMR demonstrates that the normal myocardium tapers towards the apex.[20]

Late gadolinium enhancement imaging for scar identification

Scar imaging was the one method that encouraged ordinary clinical practice to incorporate CMR. The initial application of the late gadolinium enhancement technique10 was to visualize infarction. Here, it was demonstrated that LGE transmurally had enough resolution to allow for the identification of microinfarcts and was a reliable indicator of viability. 21

Cardiac MRI for assessment of Myocardial Infarction Severity

Scarred tissue in acute MI patients, as well as in patients with healed or undetected myocardial infarctions, is strongly and independently correlated with severe adverse cardiac events and cardiac mortality.22

Speckle tracking echocardiography

Noninvasive imaging techniques are crucial for the early detection of cardiovascular problems in STEMI-studied cases, which has enhanced studied case outcomes. In studied cases of heart disease, the global longitudinal strain has been shown to provide insightful information on prognosis.23

STE for estimating the global LV longitudinal strain & strain rate

The automated function imaging method, which offers a new imaging modality based on longitudinal strain imaging, was applied to analyze the global left ventricular longitudinal strain. Because of the ROI's decreasing length, there is a negative strain in the longitudinal direction during this period.24

STEMI in studied cases with Acute Coronary Syndromes

Remarkably, it was shown that LVGLS exceeded WMSI in detecting ACS in cases with total coronary occlusion and that patients could benefit from immediate reperfusion therapy (36). Specifically, following AMI, LV LS polar maps can identify the extent and location of transmural necrosis.25

Role of speckle tracking echocardiography in STEMI

When a patient experiences an acute myocardial infarction (AMI), their ventricular architecture is complexly altered in both infarcted and non-infarcted zones. This might result in left ventricular remodeling, especially if they underwent late percutaneous coronary intervention (late PCI).26

Global longitudinal strain (GLS) reflects the function of subendocardial longitudinally orientated cardiac fibers, which are assumed to be susceptible to ischemia and elevated wall stress. A key factor in prognosis prediction is the precise measurement of infarction size & the recognition of sections with transmural necrosis extent. Global longitudinal strain is shown to have a significant role in big MI and is thought

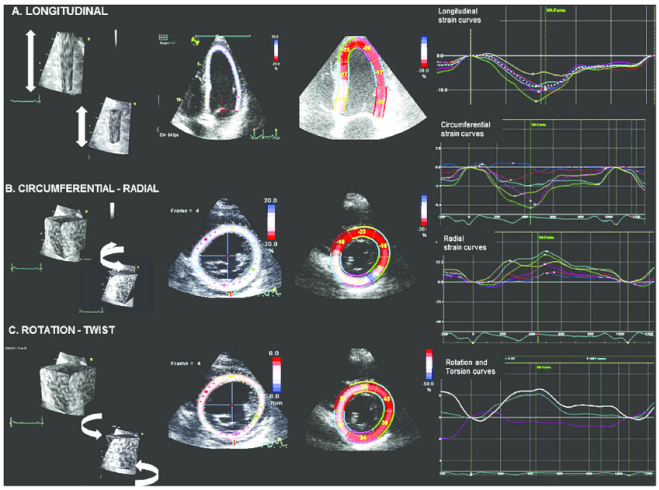

Figure 2: Role of speckle tracking echocardiography in STEMI. 29

to be a useful metric for measuring left ventricular function. Compared to LVEF, it has been more sensitive, according to 2D echocardiography .27

Precise diagnosis, characterization, and measurement of myocardial infarction have been necessary to evaluate the effect of treatment and assist in assessing studied cases suffering from ischemic heart disease. After MI, the size of the infarct (IS) and the transmural extension of necrosis affect both the global and regional LV performance and the presence of myocardial viability. When GLS, LVEF, and WMSI were assessed using CMR as a reference method, a substantial association was discovered; this correlation was greater than what was shown when they were evaluated using 2D echo. Variations in left ventricular geometry may result in cardiac failure & potentially fatal arrhythmias.28

CONCLUSION

Because speckle tracking echocardiography (STE) is quick and simple to do, it can be used in acute settings as well. It can be used for further risk stratification following revascularization, before invasive coronary angiography, or in cases when a diagnosis is unclear, if available.

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