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Clinical Profile and Complications in Patients with ST-Elevation Myocardial Infarction-A Systematic Review

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Abstract **Review Article**

ST-elevation myocardial infarction (STEMI) is a major cause of morbidity and mortality. Our study shows that AWMI predominates as the initial symptom of acute coronary syndrome (ACS), leading to a significant delay in first medical contact. Complications such as cardiogenic shock and arrhythmia are frequently observed. This study was conducted with the aim of understanding the clinical profile of ACS in people attending our institute. A total of 20 articles were identified during the year 2003 to 2023 in PubMed, Embase, and Google Scholar. Search. The mean age of the subjects was 55.75 ± 12.5 years, and the majority were male (75%). The differential diagnosis of ST-segment elevation includes four main processes: ST-elevation myocardial infarction (STEMI), premature repolarization, pericarditis, and QRS complex abnormalities (left bundle branch block, left ventricular hypertrophy). ST-segment elevation secondary to, or pre-excitation). Other processes that may be associated with ST segment elevation include hyperkalemia, pulmonary embolism, and Brugada syndrome. The biggest barrier to consistent STEMI care in developing countries is the lack of community care systems, which needs improvement. All patients received routine anti-ischemic therapy, followed by initial PCI or revascularization with thrombolytic therapy, and routine post-MI treatment. Complications and outcomes were evaluated by electrocardiogram, echocardiography, and other examinations, if necessary. ST-segment elevation myocardial infarction has a good outcome in young patients. Smoking and dyslipidemia are the main risk factors for STEMI in young people. The majority of young patients with dyslipidemia were unaware of their previous disease. Our results recommend the implementation of community adaptation and screening programs for dyslipidemia in young people, and the strengthening of smoking prevention programs.

Keywords: Acute ST Elevation Myocardial Infarction; Percutaneous Coronary Intervention; Thrombolysis.

INTRODUCTION

Myocardial infarction is more common in the elderly, but the incidence has also increased in younger people [1]. Early detection and recognition of risk factors can help prevent mortality and morbidity [2]. The epidemiological changes in India over the past two decades have been dramatic. Within a short period of time, the epidemiology has evolved from infectious diseases to non-communicable diseases (NCDs) such as CAD. The introduction of coronary care units has reduced acute myocardial infarction (AMI) mortality from 30% to 15% [3]. On the other hand, with the spread of reperfusion therapy for ST-elevation myocardial infarction (STEMI), the 30-day mortality rate has gradually decreased. Less than 30% is 5% [4]. Mortality rates from STEMI remain high in developing countries such as Bangladesh due to poor access to health facilities.

The prevalence of cardiovascular disease (CVD) has nearly doubled over the past three decades, from 271 million people in 1990 to 523 million people in 2019. Mortality rates from these diseases also increased steadily during this period, increasing from 12.1 million in 1990 to 18.6 million. In 2019, [5] it accounted for one-third of the total number of deaths worldwide [5-7]. Ischemic heart disease (IHD) is undoubtedly the most common form of cardiovascular disease [8]. Despite significant successes in treatment, IHD remains a leading cause of premature death, disability, and suffering worldwide [8, 9]. The prevalence of IHD is increasing worldwide, with a prevalence of 1,655 per 100,000 in 2017 and expected to exceed 1,845 by 2030 [10]. Moreover, IHD is considered a real threat to sustainable development in the 21st century [4]. STEMI is the most serious complication of coronary artery disease and one of the most common diagnoses in hospitalized patients.

More than half of heart attack deaths occur before the person reaches the hospital. Reperfusion therapy in STEMI plays an important role in significantly reducing mortality and morbidity [3]. Unfortunately, the overall utilization of acute reperfusion therapy in developing countries such as India lags significantly compared to Western countries due to financial and resource constraints. Juvenile ACS is the leading cause of sudden death. The incidence of ACS usually increases with age. However, recently, the incidence of ACS has increased in young people. In younger patients, STEMI reduces mortality and associated major adverse cardiovascular events (MACE), including: B. Cardiogenic shock or stroke. Additionally, younger patients have been reported to have higher success rates for initial percutaneous coronary intervention, with higher myocardial infarction grade thrombolysis and fewer bleeding complications [11].

Patients with ST-Elevation Myocardial Infarction

We found that young patients were more frequently smokers and had high dyslipidemia prevalence. The pathophysiology of STEMI in young patients can be different from that in the older population [12]. Although atherosclerosis and plaque rupture are the most common causes of STEMI, younger patients are more prone to having coronary spasms, coronary spontaneous dissection, and vasculitis as underlying factors for acute coronary artery blockage. Moreover, histopathological studies have shown that atherosclerotic plaques in the younger age group develop more quickly and contain more lipids with a relative lack of cellular scar tissue compared to plaques seen in older patients [13]. These plaques are considered highly vulnerable and prone to rupture; thus, they are more likely to cause STEMI than chronic stable angina at a younger age [14]. Indeed, in our analysis, the prevalence of dyslipidemia was high in younger patients (60%). Forty-four percent of those patients did not report having a history of dyslipidemia or receiving any treatment, with only 16% being aware or receiving treatment. Although diabetes and hypertension were more prominent in the elderly, potentially due to aging and a higher prevalence of obesity, [15] the dyslipidemia burden was similar between the 2 groups. Indeed, the immense burden of dyslipidemia among AMI patients has been reported locally and regionally [16,17].

Furthermore, coronary artery vasospasm complicating coronary atherosclerosis can lead to thrombus formation, which can cause AMI and even sudden cardiac death; however, spontaneous coronary reperfusion may occur in the early stages of myocardial infarction [18]. Cigarette smoking is a major risk factor for both atherosclerosis and spasm, and endothelium-mediated vasodilation has been found to be impaired in smokers [19]. In the present study, we found that smoking was a prominent risk factor among young patients. Indeed, this is a well-documented risk factor for STEMI in youth, where several groups have reported smoking prevalence rates as high as 70%-90%, [20-22] which is more than that reported in our study (52%). In local epidemiological surveys, smoking is more prevalent among men (22%) than women (1%) [23]. This may explain in part the predominance of male STEMI patients (97.5%) in our study. Furthermore, male gender is a major risk factor for STEMI, where female patients frequently present with non-STEMI or unstable angina [24,25]. These findings shed light on the relationship between gender, smoking, and lipid profile in the early precipitation of STEMI. Several international guidelines have suggested early screening and treatment of dyslipidemia in patients as young as 25 years or younger, especially if they are smokers [26]. The early introduction of statin therapy has resulted in a reduction in AMI rates [27].

Severe Left Ventricular Dysfunction

Although not necessarily a mechanical complication of infarction, we present here severe left ventricular dysfunction without mechanical complications, as the prognosis is particularly poor. Clinical symptoms may include rosy pulmonary edema and severe hypotension, with signs of cold skin, hypoperfusion, oliguria, and cerebral and visceral hypoperfusion. Gallop rhythm, pulmonary congestion on chest radiograph, and extensive ST-segment elevation, especially anteriorly, are common. The prevalence of shock in patients with myocardial infarction is approximately 7%, and the associated historical mortality rate is approximately 80%. For patients seeking early treatment (within 12 hours of onset of infarction or reinfarction), emergency cardiac catheterization and revascularization (usually angioplasty) are often attempted. Although there are no controlled studies, observational studies suggest that successful angioplasty increases historical mortality by approximately 50%. For patients seen at a medical center without angioplasty capability, stabilization with inotropes, balloon pumps, and possibly intubation is warranted, with emergency transfer to a tertiary center where immediate revascularization is possible. It is planned. Importantly, the use of reperfusion therapy (thrombolysis or primary angioplasty) reduced the frequency of subsequent shock due to left ventricular dysfunction.

Right Ventricular Infarction

Although right ventricular dysfunction can be commonly detected in patients with inferior wall myocardial infarction, hemodynamically significant right ventricular impairment is rare, occurring in less than 10% of patients with inferior wall infarcts. In these patients, acute right ventricular failure results in underfilling of the left heart chambers. This puts the infarcted left ventricle at an undesirably low point on the Frank-Starling curve and results in a low cardiac output state with typically low pulmonary artery wedge pressure unless massive left ventricular dysfunction is also

present. The clinical manifestations of hemodynamically significant right ventricular infarction are the triad of hypotension, increased jugular venous pressure, and clear lung fields in a patient with an inferior wall infarction. A positive Kussmaul's sign (jugular venous distention on inspiration) may also be present. Patients with inferior wall infarction who initially have normal blood pressure but experience shock after small amounts of preload reducing agents, such as nitroglycerin or morphine sulfate, should also be suspected of having pronounced right ventricular involvement.

Incidence and pathophysiology

STEMI is most frequently triggered by acute thrombotic coronary artery occlusion at the site of a ruptured pre-existing atherosclerotic plaque, with plaque erosion and calcific nodules occurring in smaller proportions (approximately 30% and 5%, respectively). While historically 'vulnerable' plaques that have ruptured may appear mild or moderate at coronary angiography, in reality they are much more severe, as demonstrated in postmortem histological and intravascular imaging studies, [28] likely due to positive remodeling, where the vessel expands in response to plaque enlargement and encroachment on the lumen. Soft, or lipid-rich, plaques with a thin fibrous cap are particularly prone to rupture in response to repetitive cycles of shear stress, leading to exposure of the lipid core, localised platelet aggregation, fibrin deposition and formation of a propagating thrombus that eventually occludes the vessel. Coronary occlusion for more than 20 minutes results in irreversible damage to cardiac myocytes, and nearly half of potentially salvageable myocardium is lost within the first hour [29]. The extent of myocardial cell death is clearly dependent on the size of the myocardial territory supplied by the culprit artery, duration of the occlusion, and the presence of a collateral circulation; intuitively, larger myocardial infarcts are more likely to cause death or cardiac failure.

Diagnosis and triage

Diagnosis of STEMI is based on history and electrocardiogram (ECG) changes. Although STEMI may be silent or present with sudden cardiac death, the majority of patients present with typical ischaemic-type chest discomfort accompanied by ST segment elevation on the 12-lead ECG, often with reciprocal ST segment depression in other leads. Atypical clinical presentations are well recognised, particularly in diabetic and elderly patients, and there are several less common ECG variants that either indicate, or are highly suggestive of STEMI. Echocardiography may be a useful tool in ruling out acute STEMI by demonstrating absence of regional wall motion abnormalities. Raised cardiac biomarkers confirm a diagnosis of STEMI. Troponin measurements are favoured over other biomarkers because of superior sensitivity and specificity; however, the decision to administer reperfusion therapy should not await the results of cardiac enzyme assays owing to the need to institute such therapy emergently.

Management

The key priority in the management of STEMI is rapid restoration of vessel patency in order to maximise myocardial salvage ('time is muscle') [30]. Given this time dependence, reperfusion therapy is recommended in patients who present within 12 hours of symptom onset and have persistent ST elevation or new left bundle branch block. Beyond 12 hours, reperfusion therapy is only recommended in patients with ongoing ischaemic chest pain and persisting ST segment elevation, or in those with cardiogenic shock [31]. In our study, we discovered that 44% of young STEMI patients were unaware of their dyslipidemia status. The gap in their knowledge regarding the preexistence of such a condition is a potential driver of their premature presentation [32]. Therefore, strict implementation of screening programs for dyslipidemia starting at a young age, especially for those at risk, such as smokers or those with a family history of AMI, is warranted. The age at which screening is initiated may differ from one region to another, along with local guidelines [33]. Currently, the local guidance for dyslipidemia screening is focused on people aged 45 years or older [34]. However, the youngest patient present with STEMI in our study was a 26-year-old man. Therefore, regional calls to establish and implement screening programs for dyslipidemia in young individuals are proliferating [32,35]. On the same note, smoking remains an important modifiable risk factor for AMI in young individuals, and the high prevalence of this habit in the region has proven to be detrimental. Tackling both problems will require national coordinated efforts to establish screening guidelines as well as preventive task forces. Our work will serve as a regional and national reference for such diseases, along with its related comorbidities. Finally, we encourage further research on this topic and other related pathologies, such as stroke and renovascular diseases, in young patients to maximize our understanding and provide a basis for future regional guidance.

Moreover, a family history of premature coronary artery disease is frequently encountered as an important risk factor in youth [36]. This could be attributed to genetic disorders related to lipid metabolism [37]. Most previous reports have shown favorable outcomes in young adults with AMI [38]. However, identifying the variations of such risk factors for STEMI in the younger age group might have an important value for preventive measures and treatment plans.

The complexity of acute STEMI management lies in the many unexpected complications that can enamel its evolution, particularly heart failure, [39] rhythmic disorders, [40, 41] and mechanical complications [42]. These complications decline over

time, without completely disappearing, with the advent of the aforementioned new management strategies, and are always accompanied by an exceptionally high mortality rate and are one of the main causes of death in the early phase following MI [43].

Nowadays, due to the revolution and modernization of ACS management, only a few studies have addressed these complications and resulted in divergent results, both for the frequency and for the factors associated with the occurrence of these complications; some of the most cited factors for the occurrence of these complications were as follows: race/ethnicity [44, 45] and sex disparities; [45] the existence of chronic kidney disease; diabetes mellitus; high total cholesterol, low-density lipoprotein (LDL) cholesterol, and high-sensitivity C-reactive protein levels; [46] prior heart failure; anemia; multivessel disease; and anterior location. [47].

The present study was a single-center, retrospective case-control analysis. The data regarding newly-diagnosed diabetes and hypertension were missing for a number of patients, and thus were excluded from the analysis. Data regarding the number of vessels involved, number and type of stents deployed, cannot be retrieved for some patients also not included in the analysis. Furthermore, data on long-term all-cause mortality, re-hospitalization, recurrent AMI, stroke, and subsequent revascularization were not included since we lost follow up for large number of patients. Finally, our study design precludes the calculation of the prevalence and incidence of STEMI in young individuals, and our relatively small sample size may result in misjudgment of some analyses provided.

CONCLUSION

In conclusion, the majority of young patients with dyslipidemia are not aware of their pre-existing condition. In terms of outcome, younger patients are less likely to develop pulmonary edema and cardiogenic shock, and more likely to have a shorter length of hospital stay. Smoking prevention, adaptation, and implementation of a screening program for dyslipidemia with subsequent intervention for those at risk might decrease the burden of STEMI in young patients. Further regional studies on the burden and implications of AMI and dyslipidemia in young individuals are needed.

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