CASE REPORT

https://doi.org/10.3329/jmcwh.v20i1.77113

UNVEILING THE HIDDEN THREAT: ACUTE MYOCARDIAL INFARCTION IN A YOUNG FEMALE

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ABSTRACT

Myocardial infarction often manifests with unusual signs and symptoms in younger people, and the associated factors of risk vary from those in older individuals. Identifying the factors which are preventable and taking preventive measures can help avert myocardial infarction (MI) in these patients. However, inadequate number of studies and guidelines for evaluating and managing those suffering MI at younger age makes it harder for them to receive precise medical attention, despite this age group exhibiting the increasing incidence of MI. Traditional risk factors like raised blood cholesterol levels, raised blood pressure, smoking, male gender, obesity, and early cardiovascular disease history within the family are known contributors to early myocardial infarction. Additionally, risk factors that are untraditional include abuse of substance, thrombophilic disorder, coronary anomalies, autoimmune diseases, psychological stress, and allergic reactions play a significant role in the younger individuals' risk profile. Among thrombophilic disorders, inherited protein C and/or protein S deficiency is a rare cause. Protein S and Protein Care anticoagulant proteins that depend on vitamin K and are necessary for inhibiting activated clotting factors V and VIII. When someone inherits thrombophilia, a deficiency in these proteins result in a hypercoagulable state, which raises the risk of development of venous thromboembolism (TE) and rarely arterial thromboembolism. We present a case of a young female with protein S deficiency who experienced an acute MI. Prompt and effective management was crucial in treating her condition, ultimately preventing severe complications and ensuring a positive outcome.

Keywords: Young age MI, Thrombophilic state, Protein C, Protein S, risk factors, prevention.

Cite this article: Rahman A, Bhuiyan MAA, Akhi S, Goswami C, Zaman R, Chowdhury RN. Unveiling the Hidden Threat: Acute Myocardial Infarction in a Young Female .J Med Coll Women Hosp.2024; 20(1): 68-75.

INTRODUCTION

Cardiovascular diseases (CVD) continue to be the forefront reason for demise and illness worldwide, with the incidence rising day by day.MI, the most common type of CVD, typically occurs due to an atherosclerotic plaque and is usually seen in adults[1]. The clinical presentation, coronary anatomy and factors of risk of MIs in patients in the younger age group vary from that of adults who are older[2]. The prognosis for MI in case of younger subjects is better in the short-term in comparison to those in the middle aged group and elderly patients[3,4] . Individuals below the age of fifty years were found to have significantly lower mortality following admission into hospital with acute MI in the TUMAR study.

Individuals in the younger age group have also been found to have better survival rate in the long term when compared to the older subjects who suffer MI.

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However, the rate of survival of ten years is less in case of a person who suffered MI at 40 years of age when compared to a patient who faced MI at 60 years age[3]. Therefore, healthcare providers should be aware of the unique characteristics of MIs which are taking place prematurely and the requirement for an approach that is more comprehensive for such patients. Evidence strongly supports the necessity for early intervention to modify risk factors and adopt lifestyle changes in those suffering MI prematurely[5] .An earlier onset of CVD should alert healthcare professionals to an inherited disorder possibility. A hypercoagulable state due to protein S and protein C deficiency raises thromboembolism risk, which may manifest as venous thromboembolism (VTE) in the leg, pulmonary embolism (PE), stroke, or Budd-Chiari syndrome[6].

Protein S and protein C are vitamin K-dependent anticoagulant proteins, with protein C requiring protein S for its activation and for the inhibition of activated clotting factors V and VIII[7]. The occurrence of venous thrombotic events in individuals with protein C and or protein S deficiency is reported to be significantly greater than that of arterial thrombosis, with an incidence ratio of nearly 24:1[8].

However, it is quite rare for inherited thrombophilia to result in coronary artery thrombosis that eventually lead to an MI. Other factors, such as fibrinogen, heparin cofactor I, lipoprotein (a), and anticardiolipin antibodies, may also contribute to the formation of arterial thrombosis[7]. Here, we report a case of MI occurring at the age of 38years in a patient having inheritedprotein S deficiency.

CASE PRESENTATION

A 38 years old hypertensive woman was admitted to the coronary care unit of Medical College for Women and Hospital (MCWH) in the month of March 2018 with complaints of severe central compressive chest pain accompanied by sweating for 4 hours and vomiting three times. Upon admission, she was anxious but oriented, with no signs of anemia, jaundice, or pedal edema. Her vital signs were quite stable as follows: pulse rate of 92bpm, blood pressure of 110/70 mmHg, normal temperature, heart sounds S1 and S2 present without any additional sounds, clear lungs, respiratory rate of 22/min, and SpO_2 of 98% . Her complete blood count, liver function tests, serum creatinine, and serum electrolyte reports all were within the normal range.

Her initial ECG showed ST elevation in leads II, III, and aVF with reciprocal changes in leads I and aVL, along with ST depression in V2, leading to a diagnosis of Acute STEMI (Inferior with Posterior extension) Figure 1 and 2. Successful thrombolysis was doneusing Streptokinase (Figure 3) and antiplatelet and anti-ischemic medications were given. Due to her young age at the time of myocardial infarction, we investigated a possible non atherosclerotic state and discovered that she had aninheritedprotein S deficiency. Table-1 shows that her protein S level was below normal (16%).

Her hospital stay was uneventful, with no early or late complications, and she was discharged with a final diagnosis of Acute STEMI (Inferior with Posterior extension) with mild left ventricular systolic dysfunction (EF-50%). At discharge, she was advised to undergo a coronary angiogram (CAG) with revascularization. The patient's CAG was performed in late April, 2018 at the National Heart Foundation Hospital and Research Institute, Dhaka, revealing significant stenosis in the right coronary artery (RCA) and first obtuse marginal artery (OM1). Percutaneous coronary intervention (PCI) was successfully performed on both RCA and OM1 without any complications.

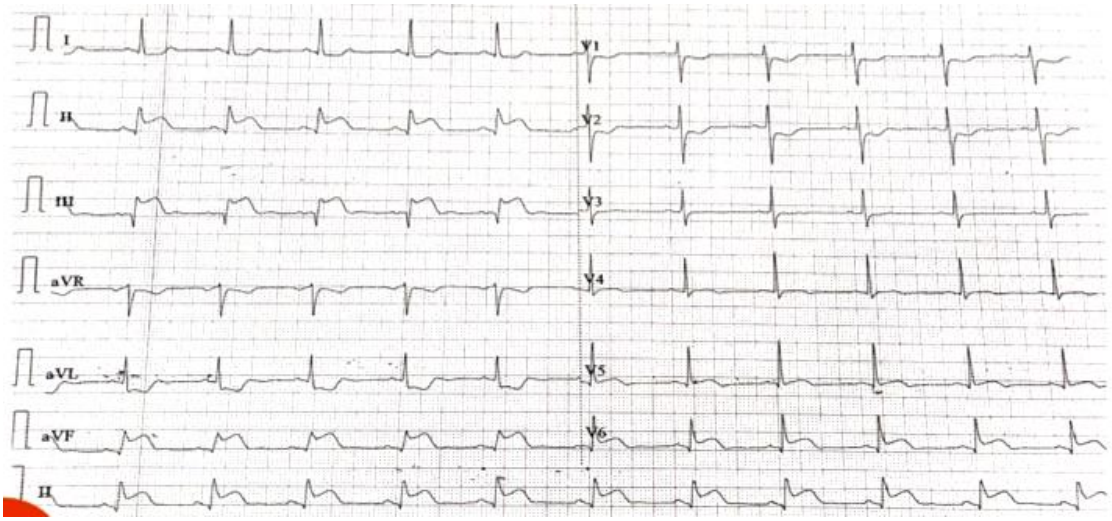


Figure 1: ECG report (on admission) showing STEMI inferior with posterior extension and high lateral ischemia.

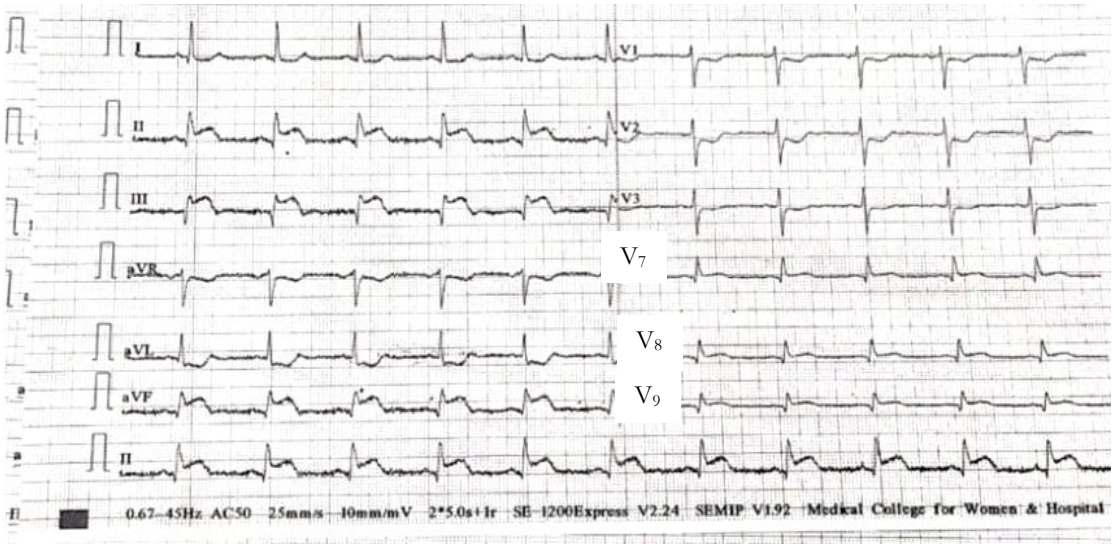


Figure 2: Posterior lead ECG Showing ST elevation in V_7 V_8 V_9

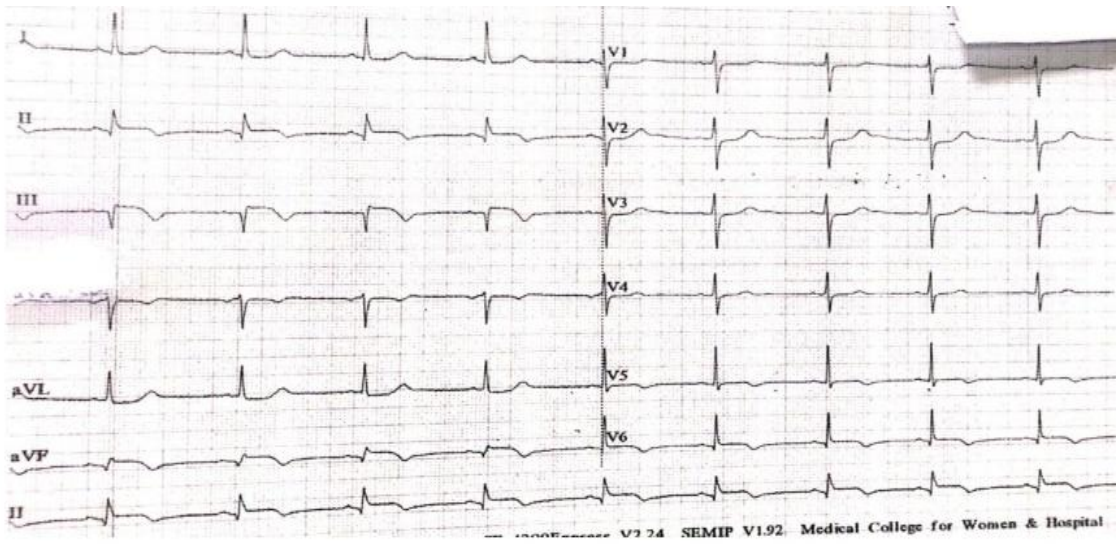


Figure 3 : Showing the ECG report of the patient following thrombolysis

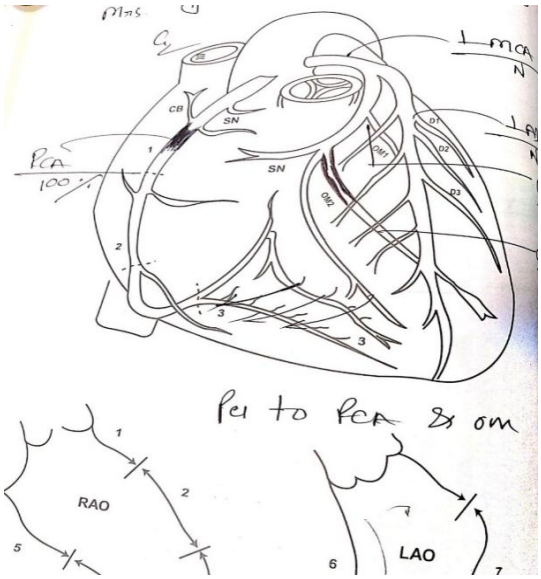
Investigations

Table 1: Investigation reports of the biomarkers related to the patient's condition

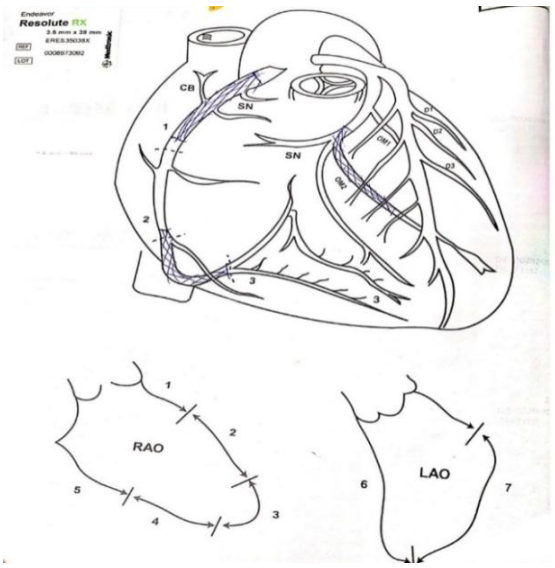
Test name	Results	Reference value
Serum Troponin-I	Positive	
Anti Phospholipid Antibody	4.24 U/ml	<10U/ml
Homocystine	6.63 umol/L	5.0-15.0umol/L
ANA	Negative	
Protein C	150%	70-130%
Protein S	16%	50-120%

ANA: Antinuclear Antibody

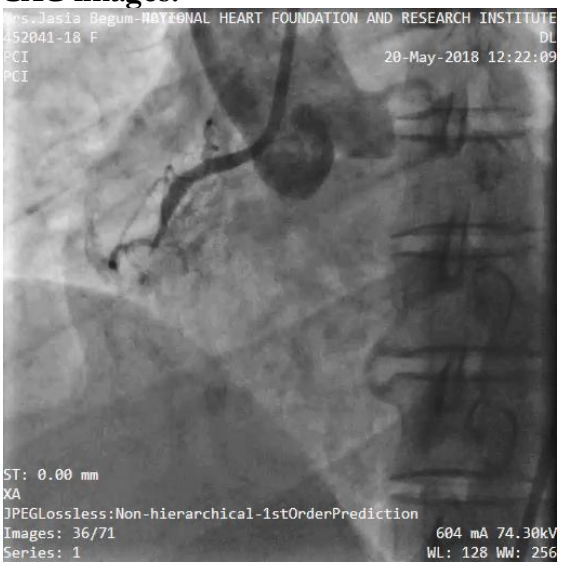
Post CAG



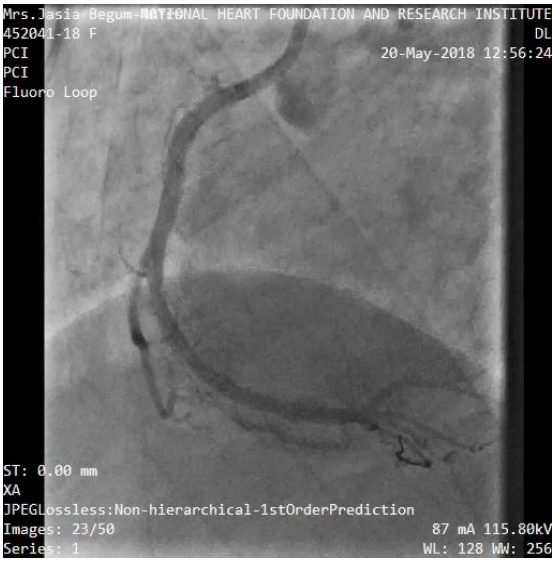
Post PCI



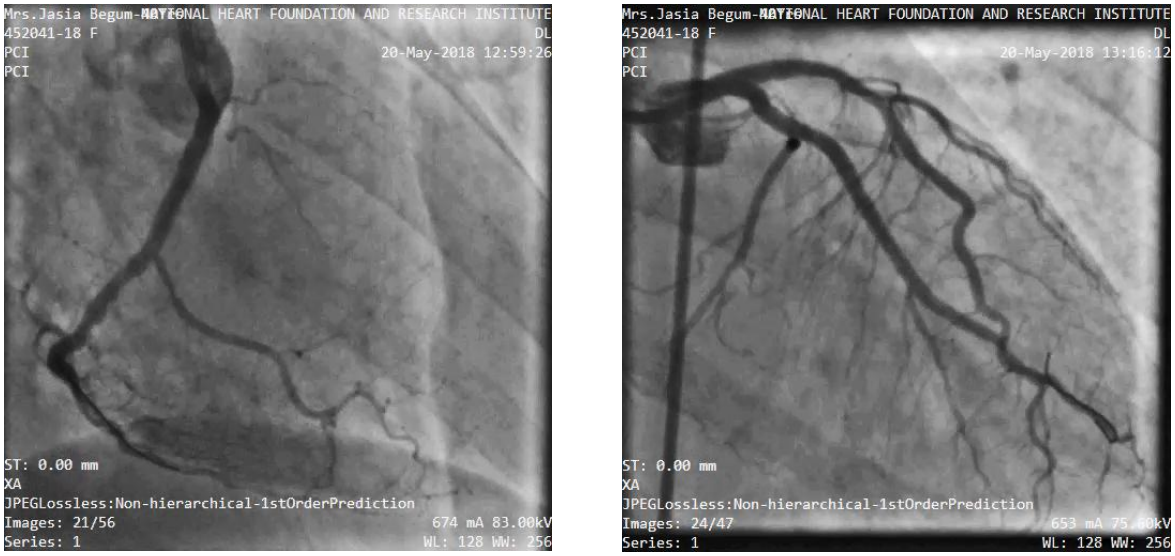
CAG images:



RCA before PCI



RCA after PCI



OM_1 before PCI **OM_1 after PCI**

Figure 4: Showing 2D M-mode Echocardiography Impression

- S/P-PCI
- Ischemic heart disease with regional wall motion abnormality present.
- Mild LV systolic dysfunction (EF-50%)

Treatment and follow up

The patient is on regular follow up with the following drugs and she is doing well. Here Tab: Tablet; Cap: Capsule.

- Tab. Aspirin 75mg
- Tab. Atorvastatin 20mg
- Tab. Rivaroxaban 10mg
- Tab. Metoprolol 25mg
- Tab. Ramipril 2.5mg
- Cap. Esomeprazole 20mg

DISCUSSION

There does not exist any definitive criteria for diagnosing MI. Most studies, however, have opted to define "young" individuals with CAD or acute MI using a cut-off age of 40–45 years. Based on experience[4], a stratified approach considering various factors appears to be more useful for these patients. Recent literature suggests making 2groups on the basis of the patients' age at which they first suffered from MI: 'very young' patients with MI is considered to be those having suffered from MI before the age of 40 years; those having suffered their first MI between 40 to 50 years age are considered as 'young MI' patients.

This classification also acknowledges the significant differences related to race, genetics, and gender. Regardless of whether the patient is classified as young or very young, both groups clearly require extensive secondary prevention[1,9,10].

Typically, damage due to atherosclerosis, and preexisting plaque rupture or erosion is considered when discussing premature MI. However, it is crucial to recognize that all MI types may be suffered by young adults. Although the recent definition of MI is comprehensive, there still remains scope to research into certain reasons for

elevation of troponin occurring only in young adults such as autonomic neurocardiogenic syndrome[11].

The risk factors (etiological) of MIs in young individuals differ from that of the older adults. Risk factors (traditional) contribute to approximately 80%–85% of premature MIs, while 15%–20% are linked to other factors that trigger inflammation and thrombosis, known as non-atherosclerotic risk factors[5,12]. About 5% of Mis in older individuals are attributed to these non-atherosclerotic factors[13-15].

Studies have reported several risk factors that lead to MI in young individuals. Those patients of young MI were found to be having risk factors (traditional) like higher ASCVD (Atherosclerotic Cardiovascular Disease) scores, peripheral vascular disease, and hypertension[1,7]. Typically, multiple risk factors in young MI cases may cumulate and raise the risk of mortality and morbidity[2] .All the involved factors (etiological) need to be assessed in order to protect effectively young MI subjects from having re-infarction or future cardiovascular events.

Acute coronary syndromes (ACS) can sometimes arise from non-atherosclerotic causes, such as congenital coronary artery anomalies, spontaneous coronary artery dissection, vasospasm, use of illicit drug, or hyper coagulable states like the one observed in our patient. When coronary disease is absent, the differential diagnosis should include inherited thrombophilia syndromes, particularly in young acute MI patients, as in our case. These syndromes typically involve protein S deficiency, protein C deficiency, hyper homocysteinemia, with factor V Leiden deficiency being the most common. In our patient, only protein C and protein S deficiencies were present, with normal levels of homocysteine and factor V Leiden.

Hereditary thrombophilia, also known as hypercoagulability, is an inherited condition that increases the likelihood of developing blood clots within venous or arterials thromboembolism, particularly in individuals under the age of 45 years. This condition is prone to recurrence. While a significant minority of those affected exhibit a detectable abnormality, most experience thrombosis only when additional risk factors[16] are present. Protein C deficiency, a disorder that increases the risk of clotting, can be either acquired or congenital, with the congenital form typically passed down through autosomal dominant inheritance. If a person has less than 60% of the normal plasma protein C level, they are considered heterozygous, while those with no detectable levels are homozygous. The homozygous state often affects newborns as purpura fulminans neonatalis, whereas the heterozygous state usually becomes clinically apparent in the third decade of life, as seen in the case discussed. Heterozygous protein C deficiency raises the risk of venous thromboembolism (VTE) by seven times[17]. Although rare, it can also cause arterial thrombosis in individuals with a family history of the condition or when triggered by smoking, potentially resulting in premature MI.

Premature MI is a major contributor to cardiovascular disease (CVD), which claimed 17.6 million lives globally in 2016[18]. In a study of 337 patients with heterozygous protein C deficiency, only 7.1%[19] had arterial thrombosis. Another study involving 255 consecutive patients who experienced ST-elevation MI (STEMI) before the age of 35 years found protein C deficiency in just one patient (0.4%)[20]. Additionally, a cohort family study found arterial events in only 8% of 144 subjects with protein S and protein C deficiencies. The low incidence of arterial

occlusion linked to protein S and/or protein C deficiencies[21] highlights the rarity of the case in which a young woman with acute MI was found to be deficient in those proteins.

It is hypothesized that theraised risk of arterial thrombosis in individuals with protein C deficiency may be due to the critical cytoprotective function of the protein C pathway[22]. Since protein S binds to and assists activated protein C in the breakdown of coagulation factors, a deficiency in protein S ultimately leads to a hypercoagulable state. Currently, protein S deficiency is more common than protein C deficiency in the general population[23]. In the case of our patient, deficiencies in protein S led to an early age of MI due to a persistent hypercoagulable state.

CONCLUSION

In recent years, acute MI has been increasingly recognized in younger age groups. For individuals under 40 years, the condition predominantly affects men. Risk factor analysis has shown that cigarette smoking and hypercholesterolemia are more commonly observed in younger patients. In addition to traditional risk factors, nontraditional factors such as drug abuse, thrombophilia, coronary anomalies, immune diseases, and allergic reactions should also be investigated. In our case, the patient was a female with hypertension as a traditional risk factor. Upon exploring nontraditional risk factors, we identified a thrombophilic state, confirmed by low levels of protein S.

CONFLICT OF INTEREST

There is no conflict of interest.

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