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Acute ST-segment elevation myocardial infarction in a 37-year-old male due to essential thrombocythemia: a case report

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Abstract

One of the causes of acute myocardial infarction in young adults without major cardiovascular risk factors is myeloproliferative neoplasms. Essential thrombocythemia (ET) is a clonal myeloproliferative neoplasm characterized by thrombocytosis with a tendency to develop thrombosis and hemorrhage. About half of patients with ET diagnosed at a young age are asymptomatic, and only about 5% of patients are diagnosed with ET due to major thrombotic or hemorrhagic events. We present the case of a 37-year-old previously healthy male patient who presented to the hospital with acute anterior ST-segment elevation myocardial infarction. The patient underwent urgent coronary angiography, revealing an acute occlusion in the proximal left anterior descending artery in the presence of two-vessel coronary artery disease. On the regular follow-up, persistent thrombocytosis was noted and further examinations revealed ET that was confirmed as an underlying cause of myocardial infarction. An elevated platelet count should not be overlooked in young patients with cardiovascular events as it can report about essential thrombocythemia or other myeloproliferative neoplasms that can cause life-threatening thrombotic events if not treated in time.

Keywords: essential thrombocythemia, thrombocytosis, myocardial infarction.

1. Introduction

Acute ST-segment elevation myocardial infarction is a common complication of atherosclerosis in older patients with traditional cardiovascular risk factors such as hypertension, dyslipidemia, diabetes mellitus and smoking. However, there are rare cases of myocardial infarction in young people with no or few traditional cardiovascular risk factors and without coronary heart disease. A possible cause for such cases is essential thrombocythemia (ET). ET is a chronic clonal myeloproliferative neoplasm characterized by thrombocytosis and a bone marrow megakaryocyte hyperplasia [1]. About 60% of people with this disease have a specific JAK2 mutation [2]. According to the World Health Organization, essential thrombocythemia is a disease that occurs when the platelet count is more than 450×10^9/l with the presence of JAK2, Calreticulin (CARL) or myeloproliferative leukemia (MPL) virus oncogene mutation, lacking clonal or reactive causes [3].

Elevated platelet count can lead to various thrombotic or hemorrhagic complications due to qualitative and quantitative alterations of platelets [4]. Myocardial infarction is one of them. The incidence of myocardial infarction in patients with known ET is approximately 5% [5]. We report the case of a 37-year-old previously healthy male who presented with an acute ST-segment elevation anterior myocardial infarction as the first clinical manifestation of ET.

2. Case report

On 24 August 2018, a 37-year-old previously healthy male patient presented to the emergency room via ambulance with a history of acute moderate squeezing chest pain radiating to the left arm and neck and associated with general weakness. The patient had no cardiovascular risk factors except for a family history of coronary heart disease and high levels of total and low-density lipoprotein cholesterol. The physical examination showed no abnormal findings (blood pressure of 119/89 mmHg, heart rate of 89 beats per minute). Laboratory tests revealed slightly elevated white blood cell count, significantly elevated platelet count, high cholesterol levels and elevated troponin I (Table). Electrocardiogram (ECG) showed significant ST-segment elevation in the anterior leads (Figure 1). Anterior ST-segment elevation myocardial infarction (STEMI) was diagnosed and the patient underwent urgent coronary angiography, revealing an acute occlusion in the proximal left anterior descending artery (LAD) in the presence of two-vessel coronary artery disease (100% stenoses in S1, S2 and S3, 95% stenosis in S6 and 75% stenosis in S4). Two drug-eluting stents (Orsiro 13 × 4 mm and Xience Xpedition 8 × 4 mm) were successfully implanted in the proximal left anterior descending artery (Figure 2). Echocardiography performed 3 days after the coronary event showed decreased left ventricular systolic function (Figure 3). Intravenous heparin that was started during angiography was continued for a total of 3 days in addition to dual antiplatelet therapy with aspirin and ticagrelor. Metoprolol, zofenopril, spironolactone and atorvastatin were also administered as a recommended treatment after myocardial infarction to reduce cardiac morbidity. The patient responded well to the treatment and has remained asymptomatic since then. On 29 August 2018, second coronary angiography was performed due to right

coronary artery occlusion. Five drug-eluting stents were implanted in different right coronary artery segments. The procedure was successful (Figure 4). On 31 August 2018, the patient was discharged from hospital to rehabilitation center.

On 24 October 2018, the patient showed up for a follow-up visit. The lipid profile test revealed normal levels of cholesterol due to effective treatment. However, laboratory tests showed an elevated platelet count (503×10^9/l) and an elevated homocysteine concentration (25.66 μmol/l). The patient received vitamin B_6, folic acid and vitamin B_{12} to lower homocysteine levels. Other test results were normal. On 07 November 2018, cardiac magnetic resonance imaging was performed to evaluate myocardial viability (Figure 5). Due to persistently elevated platelet count, a hematologist consultation was obtained for further guidance. The patient had a bone marrow biopsy and testing for JAK2 mutation that confirmed essential thrombocythemia with a positive JAK2 V671F mutation. Hematologist and cardiologist confirmed that essential thrombocythemia was the underlying cause of patient myocardial infarction. Due to dual antiplatelet therapy and the high risk of bleeding, a hematologist did not administer an extra cytoreductive ET treatment considering close monitoring of platelet count should be enough. Follow-up tests in 2019 consistently showed a slightly elevated platelet count (on 11 June 2019 – 555×10^9/l) that corresponded to the treatment goal of a platelet count below 600×10^9/l. Thus, additional ET therapy was not administered because a combination of aspirin and ticagrelor with an additional cytoreductive drug could result in severe bleeding complications.

On 11 July 2019, the patient had an electrophysiologist consultation. Holter monitoring readings revealed a short-term ventricular tachycardia (3 wide QRS complexes in a row) and echocardiography (15 June 2019) showed left ventricular ejection fraction of 30% and a cardiac aneurysm developed after myocardial infarction. An implantable cardioverter-defibrillator was successfully implanted due to the high risk of life-threatening ventricular arrhythmias and recurrent ischemic events for secondary prevention of sudden cardiac death. The patient continues to receive regular follow-up.

Table. Laboratory test results

Test (laboratory reference range)	Date			
	24 August 2018	**25 August 2018**	**27 August 2018**	**31 August 2018**
Complete blood count				
Red blood cells (4.4-5.6 × 10^{12}/l)	4.96	4.84	4.17	4.03
Hemoglobin (135-169 g/l)	149	146	122	119
White blood cells (4.4-5.6 × 10^{9}/l)	13.61	17.63	11.41	9.17
Platelets (166-308 × 10^{9}/l)	**577**	**528**	**418**	**609**
Lipid profile				
Total cholesterol (0-5.2 mmol/l)	-	**5.86**	-	-
LDL cholesterol (0-2.59 mmol/l)	-	**4.14**	-	-
HDL cholesterol (≥ 1.55 mmol/l)	-	**1.24**	-	-
Triglycerides (0-1.95 mmol/l)	-	0.95	-	-
Biochemical analysis				
Creatinine (57-113 µmol/l)	109	-	93	95
Glucose (4.1-6.6 mmol/l)	-	-	5.91	-
Potassium (3.6-5.1 mmol/l)	3.6	4.5	4	5.2
Sodium (136-144 mmol/l)	138	141	132	139
Alanine transaminase (0-45 IU/l)	-	**106**	-	-
Aspartate transaminase (0-35 IU/l)	-	**418**	-	-
C-reactive protein (0-7.5 mg/l)	-	**48.01**	**114.92**	**30.50**
Troponin I (0-0.04 µg/l)	**0.81**	**160.20**	**35.37**	**-**
Coagulation screen				
Prothrombin time (s)	21.7	**-**	**-**	**-**
International Normalizes Ratio (0.9-1.2)	0.93	**-**	**-**	**-**

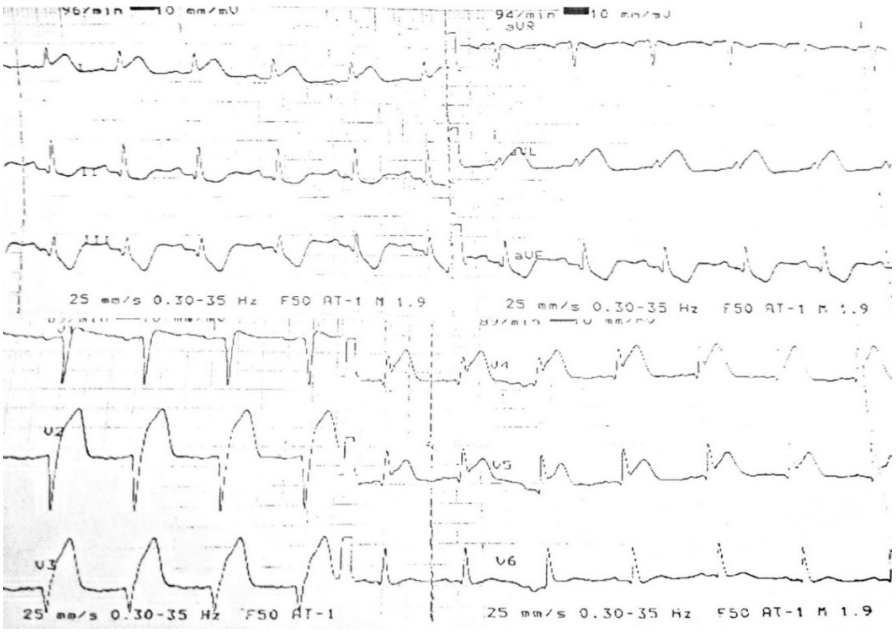

Figure 1. 12-lead ECG showing ST-segment elevation in leads I, aVL, V1-V5 with reciprocal ST-segment depression in the inferior leads (II, III, aVF).

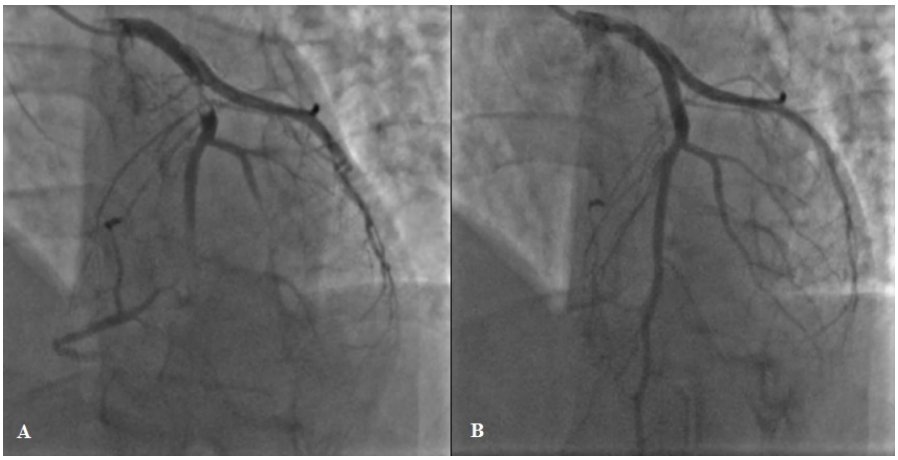

Figure 2. Left coronary angiograms: A – proximal left anterior descending artery (LAD) 95% occlusion, B – no LAD occlusion after stent implantation.

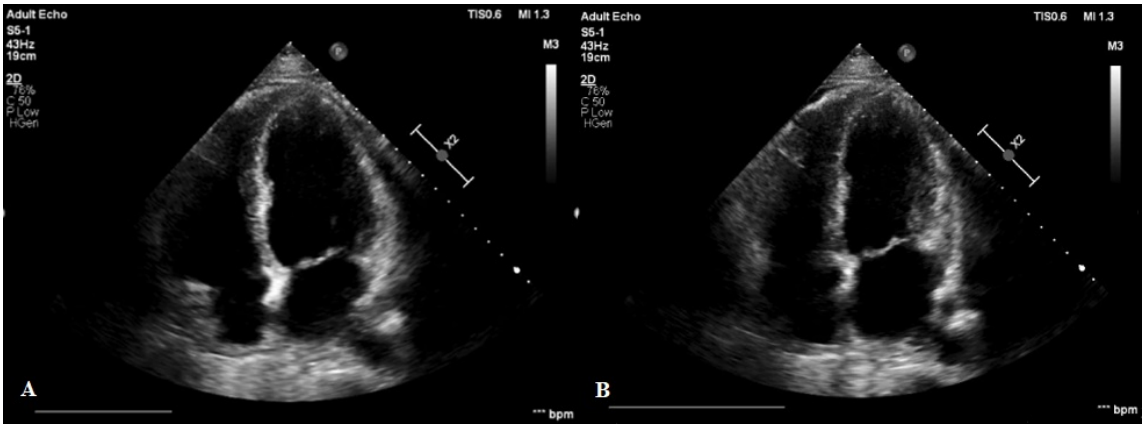

Figure 3. Echocardiograms: A – four-chamber view at end-diastole, B – four-chamber view at end-systole. Left ventricular ejection fraction 30%.

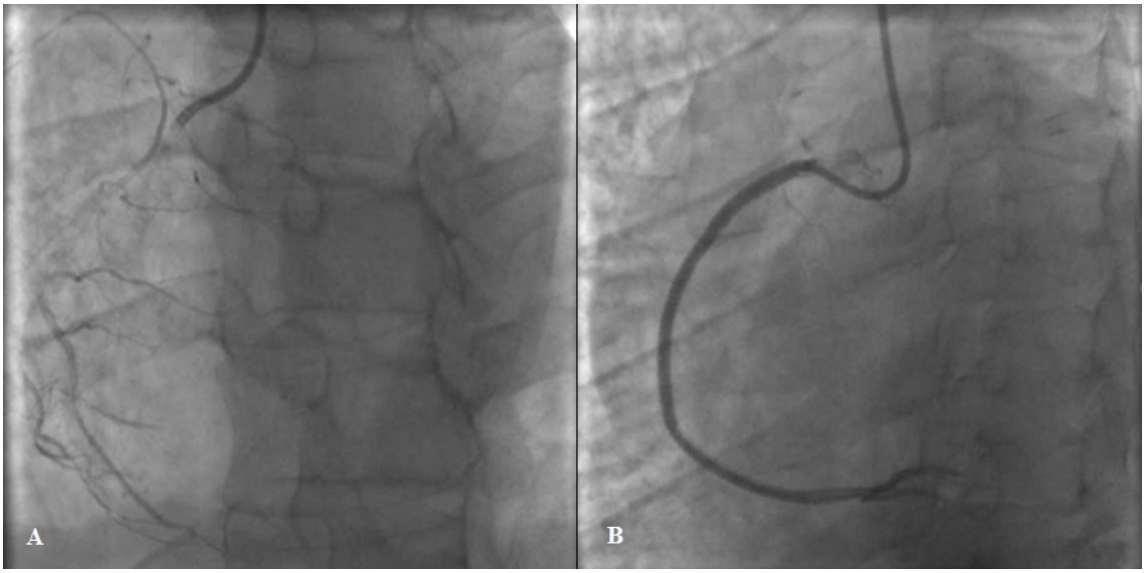

Figure 4. **Right coronary angiograms:** A – total right coronary artery occlusion, B – successful right coronary artery revascularization.

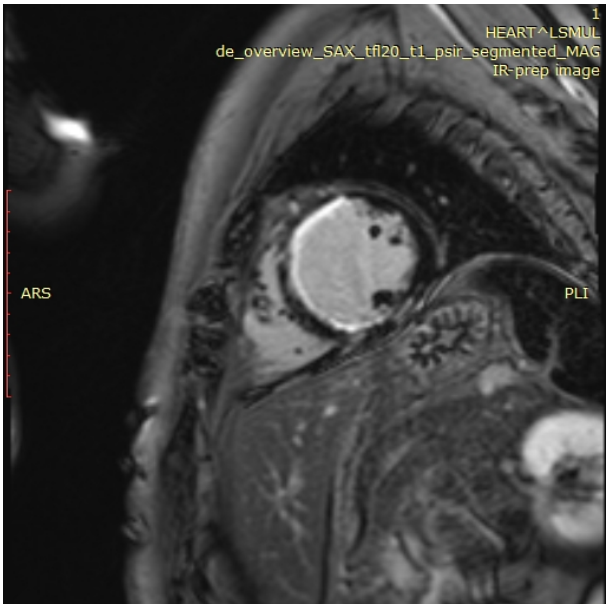

Figure 5. **Cardiac magnetic resonance imaging:** short-axis view demonstrates delayed subendocardial enhancement of the anterior and inferior left ventricle walls and interventricular septum.

3. Discussion

ET is one of the chronic myeloproliferative neoplasms characterized by clonal proliferation of hematopoietic stem cells leading to an overproduction of platelets [6]. Thrombocytosis results in various thrombotic and hemorrhagic complications. Arterial thromboses that include myocardial infarction, cerebral transient ischemic attack, stroke and peripheral arterial thromboses are more common than venous thromboses such as deep vein thrombosis, hepatic or portal vein thrombosis and venous thromboembolic events in patients with ET [7].

ET is a rare disease. The prevalence of ET in general population is 30 per 100000 individuals [8]. The median age at diagnosis is 65-70 years but the disease may appear at any age. ET is more prevalent in women [8].

Essential thrombocythemia usually presents with vasomotor symptoms (headaches, lightheadedness, visual disturbances, erythromelalgia, distal paresthesia) or may be asymptomatic [8]. In rare cases, this disease can present with severe complications related to thrombosis or bleeding. A systematic review of ET in young patients determined that about half of patients with newly diagnosed ET were asymptomatic, 30% experienced headaches, and only 4.7% of patients were diagnosed with ET due to major thrombotic or hemorrhagic event [9].

Acute coronary events occur in 9.4% of patients with ET and the incidence increases with age [10]. Acute coronary syndrome has a significant role in ET mortality especially in patients with untreated ET [11]. Acute coronary syndrome occurring as the first manifestation of ET is described in case reports [12].

Two main risk factors of developing thrombosis are a history of thrombosis and an age older than 60 years [3]. However, multiple studies have shown that the presence of JAK2 mutation and cardiovascular risk factors such as hypertension and smoking can significantly increase the risk of thrombosis [3, 13, 14].

It is essential to differentiate between reactive thrombocytosis frequently observed during acute myocardial infarction and myeloproliferative neoplasm. In cases of reactive platelet count elevation, normalization of platelet level must be confirmed with subsequent complete blood count [6]. Reactive thrombocytosis is much more common than ET, and it may occur due to a variety of medical and surgical conditions. Unlike ET, reactive thrombocytosis is not clonal.

The main goal of ET treatment is to lower the platelet count to reduce thrombotic and bleeding events. The goal in high-risk patients is to keep platelet count below 600×10^9/l [3]. Anagrelide and hydroxycarbamide (hydroxyurea) are the most commonly used cytoreductive drugs. Anagrelide is preferentially given to younger people because of the possible leukemogenic hydroxyurea effect [15]. Approximately 70% of patients receiving anagrelide or hydroxycarbamide are achieving complete platelet response, around 90% – complete or partial response, confirming that both drugs have great efficacy in preventing thrombosis and bleeding [15]. The management of patients with ET is dictated by the risk of thrombotic complications, as calculated by prognostic scores. Important factors in assessing the risk of thrombotic complications include a prior history of venous or arterial thrombosis, age over 60 years, JAK2 V617F mutation and cardiovascular risk factors [16].

However, there is a challenge to combine myocardial infarction and essential thrombocythemia therapy. The gold standard in the treatment of myocardial infarction is dual antiplatelet therapy that includes aspirin and $P2Y_{12}$ inhibitor for 12 months after stent implantation. But combined use of anagrelide and aspirin or another antiplatelet drug ($P2Y_{12}$ inhibitor) may result in a highly increased risk of life-threatening hemorrhage [17]. A possible solution to lower risk of bleeding is to substitute anagrelide with hydroxycarbamide [18] or closely monitor platelet count in patients receiving only dual antiplatelet therapy without cytoreductive therapy. However, if platelet count remains high despite dual antiplatelet therapy, hydroxyurea should be co-administered.

This case illustrates the importance of a comprehensive examination of young patients presenting with thrombocytosis and acute myocardial infarction, especially in the absence of atherosclerotic coronary artery lesions, because it can reveal essential thrombocythemia as an underlying cause of myocardial infarction. Early identification of ET and appropriate treatment is essential as it may prevent life-threatening thrombotic and hemorrhagic events and reduce the mortality and morbidity related to cardiovascular events.

Conflict of interest

The Authors have nothing to declare.

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