Acute Myocardial Infarction With Polycythemia Vera: A Rare Case

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Abstract

Background: Polycythemia Vera (PV) is one of the chronic myeloproliferative disorders that is rarely found, with a prevalence according to WHO around 2.3/100,000 inhabitants. The complication of PV is thrombosis, bleeding, and transformation into leukemia. Coronary events are common during the course of PV, approximately 11.4 % of patients had a myocardial infarction.

Case: A 65-year-old male presented with complaints of chests pain accompanied by cold sweat, nausea, and vomiting. There was no organomegaly. Laboratory results showed Hb 23.2g/dL, HCT 72.1%, RBC 9.4 x10^6/uL, WBC 21,000/µL, PLT 470,000/uL. CKMB 56.1 U/L, Troponin T 1,751 pg/mL. ECG examination showed: ST elevation in lead V2-V4. The molecular result obtained the positive mutation of JAK2V617F.

Discussion: Polycythemia Vera, in this case, was diagnosed based on the 2008 WHO criteria, which consisted of major criteria such as Hb> 18.5 g/dl in males and an increase in red blood cell volume; and the presence of JAK2V617F mutation, while Acute myocardial infarction (AMI) diagnosis in this case was based on the elevation of cardiac markers and ECG result. Acute myocardial infarction in PV was largely due to high RBC mass which increased blood viscosity.

Conclusion: This patient was diagnosed with polycythemia vera and acute myocardial infarction based on clinical examination, laboratory results, and ECG. One of the aims of good management in PV is reducing cardiovascular events which is the main cause of morbidity and mortality.

Keywords: Polycythemia Vera ; acute myocardial infarction ; JAK2 ; chronic myeloproliferative disorders

1. Introduction

Polycythemia Vera (PV) is one of the rare chronic myeloproliferative disorders, with a prevalence according to WHO around 2.3/100,000 population (1). PV is mostly found at the age of 50-70 years but can also occur at any age including young adults, adolescents, and children (2). PV often causes non-specific symptoms such as headache, fatigue, vertigo, visual disturbances, and a burning sensation in the epigastrium. Other complaints were also found such as abdominal pain, pruritus, fever, and melena (3). Laboratory

findings include elevated hemoglobin, hematocrit, and mutation JAK2V617F. WHO diagnostic criteria for PV include major symptoms, namely Hb > 18.5 in men and 16.5 g/dL in women, the mutation was found JAK2V617F. Minor symptoms include hypercellularity of bone marrow, erythroid, granulocytes, and megakaryocytes, serum EPO below normal values, formation of endogenous erythroid colloids. It is said to be positive if there are two major symptoms or one of the major symptoms plus one or more of the three minor symptoms (4).

Complications that cause major morbidity and mortality in patients with PV are cardiovascular complications due to thrombosis. A research from Rossi et al. described that 149 patients diagnosed with PV over 10 years, found 11.4% had a myocardial infarction (5). Malak et al. concluded that 4% of all patients with myeloproliferative disorders died of myocardial infarction (6). In thrombosis, JAK2 mutations cause activation and interaction of leukocytes and platelets that cause inflammation, causing vascular endothelial dysfunction. While erythrocytosis causes hyperviscosity of blood that triggers thrombosis (6). Another complication is bleeding and the risk of developing the disease into acute myeloid malignancy (AML/Acute Myeloid Leukemia).

2. Case

Mr. M, 65 years old, was referred from the hospital in Sampang, Madura with a diagnosis of suspected Acute Coronary Syndrome (ACS). The patient came with complaints of chest pain. Chest pain has been felt since 5 days ago, worsening since 12 hours before admission to the hospital. Chest pain accompanied by cold sweats, nausea, and vomiting. There was no fever. The patient had a history of hypertension and a habit of smoking 3 packs/day since 15 years ago. The physical examination showed that the patient had a weak condition, but the vital signs were normal. There were no dyspnea, crackles or wheezing sounds on patient's lung, also there were no arrhythmia, murmur or gallop sounds on his heart valves.

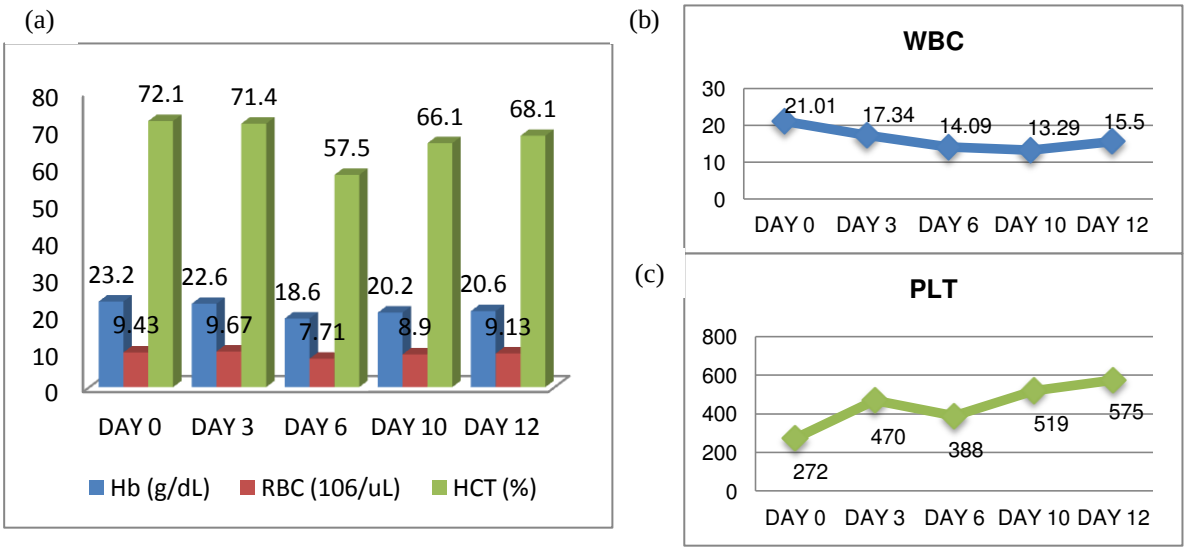

Fig. 1. Hematological examination: (a) Hb/haemoglobin, RBC/red blood cells, and HCT/hematocryte; (b) WBC/white blood cells; (c) PLT/platelet

Table 1. Blood Smears Evaluation

Parameters	Description
Erythrocyte	Normochromic normocytic anisopoikilocytosis (normocytes, ovalocytes, spherocytes, target cells)
Leukocyte	Increased numbers, dominated by segment neutrophils, immature granulocytes (+) (metamyelocytes), blast (-), toxic granule (-), atypical lymphocytes (+)
Thrombocyte	Normal numbers, giant platelets (+)
Conclusion	Increasing of erythrocyte density, leukocytosis with immature granulocytes (+) and atypical lymphocytes (+)

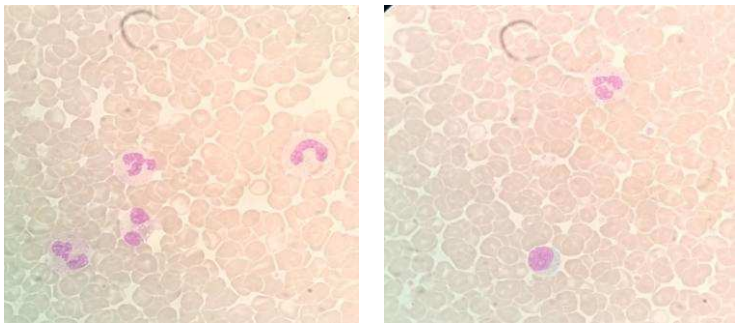

Fig. 2. Peripheral blood smear evaluation

Table 2. Immunological Examination Results

Parameters	Results	Reference Value
CKMB U/L	56.1	7.0-25.0
Troponin pg/mL	1753	<14
Conclusion	There is an increasing values in cardiac marker	

The clinician also checked the JAK2 mutation profile, which V617F point mutation detected. Electrocardiography (ECG) examination results in this patient showed an ST elevation in V_2-V_4 with the echocardiography examination results was a Coronary Heart Disease (CHD). Based on the examinations results, patient was diagnosed as Polycythemia Vera with Anteroseptal STEMI. The patient was treated with 0.9 % Sodium Chloride infusion 500 ml in 24 hours. Maximum oral fluid intake 1250 ml/24 hours, nasal cannula oxygenation 4 litres per minute, Furosemide injection 40 mg (intravenous), Arixtra inj 2.5 mg/24 hr subcutaneously, ASA 100 mg/24 hr, Clopidogrel 75 mg/24 hr, Bisoprolol 2.5 mg/24 hr, Ramipril 2.5 g/24 hr, ISDN 5 mg in 3 times a day, Alprazolam 0,5 mg/24 hours, therapeutic phlebotomy 2x/week.

3. Discussion

Polycythemia Vera is a myeloproliferative disease characterized by an increase in the production of red blood cells so that the mass of red blood cells increases and is often accompanied by an increase in the number of platelets causing hyperviscosity and an increased risk of thrombosis(2). Approximately 95% of PV

patients have mutations in JAK2V617F which is a mutation that disrupts the balance of homeostasis which results in excessive proliferation of hematopoietic cells and also stimulates inflammatory processes of blood vessels. Excessive proliferation of hematopoietic cells will cause abnormalities in the complete blood count and inflammation will trigger clinical symptoms in patients(6). The average age of PV is 60 years, although the disease can occur at any age. Men are more dominant in PV than women. The incidence of this disease is about ± 2.3 in 100,000 people per year. Thrombosis can occur in both the venous and arterial systems. Many factors are involved in it, namely the increase in the number of hematocrit and the occurrence of blood viscosity, the occurrence of platelet aggregation, and thrombogenesis, the presence of leukocytosis and intimal proliferation. The diagnosis of polycythemia was made according to WHO criteria and the diagnostic algorithm of the Polycythemia Vera Study Group (PVSG) (6).

Criteria for diagnosis of Polycythemia Vera according to the World Health Organization (WHO) (2). Major criteria: 1) Hemoglobin > 18.5 g/dL in men, > 16.5 g/dL in women or an increase in red blood cell volume; 2) The presence of JAK2V617F mutation. Minor criteria: 1) Bone marrow aspiration has hypercellularity of erythroid, granulocytes, and megakaryocytes; 2) Serum erythropoietin is below normal value; 3) Endogenous erythroid colony formation. It is said to be positive if there are two major symptoms or one of the major symptoms plus one or more of the three minor symptoms. PV can also be diagnosed using the diagnostic algorithm Polycythemia Vera Study Group (PVSG) (2).

The diagnosis of PV in this patient was based on history, physical examination, and laboratory tests. The patient complains of chest pain on history. Laboratory tests found at the initial hospital admission (normal values in brackets) (7) were Hb 23.2 g/L (150±20g/L), RBC 9.43X10/L($5\pm^{12}0.5X10^{12}$/L). HCT 72.1%(45±5%), WBC 21.01x10^9/l (4-10 x10^9/l) Neutrophils 82% (40 - 80 %), Lymphocytes 7% (20 - 40 %), Platelets 272 x10^9/l (280±130 x10^9/l). The results of the peripheral blood smear showed an increase in the number of red blood cells. Subsequently, JAK2V627F was examined and found to be positive for mutations. Based on laboratory results, this patient met 2 major criteria for PV according to WHO. For the diagnosis of AMI according to PERKI 2015(10), namely from anamnesis complaints of sudden chest pain, on the ECG examination there is ST elevation and an increase in cardiac markers, namely CKMB 56.1 U/L (7-25 U/L) Troponin T 1753 pg/mL.

The pathophysiology of thromboembolic events in PV patients includes several things such as increased hematocrit, blood hyperviscosity, platelet aggregation, and the presence of leukocytosis. In this patient, the cause of AMI is probably due to hyperviscosity. Hematocrit is a major determinant of blood viscosity, increased hematocrit levels are associated with decreased cerebral blood flow rate and contribute to the thrombotic tendency in PV (6).

The main purpose of the handling of polycythemia vera patients which prevent thrombosis, bleeding, minimize the risk of the development of PV toward acute leukemia and myelofibrosis (10). Prevention of acute coronary syndrome in polycythemia vera patients is the administration of low-dose aspirin to prevent bleeding. Cytoreductive therapy aims to reduce the risk of thrombosis. Phlebotomy to achieve an optimally controlled red blood cell count. In low-risk patients, only recommended therapy such as phlebotomy and prophylactic anti-thrombotic namely aspirin, while in high-risk patients, cytostatic therapy and other therapies are recommended (11).

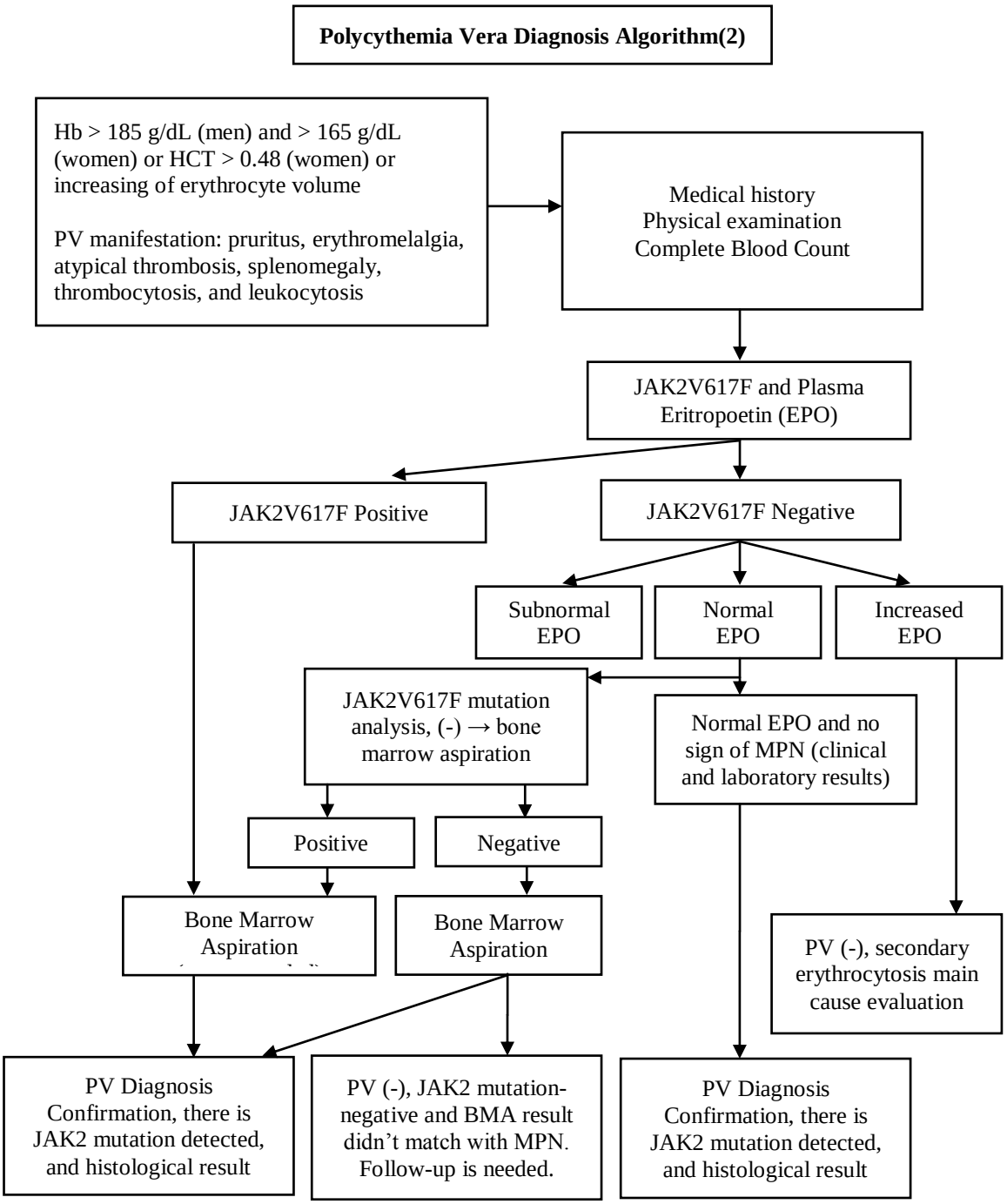

Fig 3. Polycythemia Vera Diagnosis Algorithm (2)

4. Conclusion

Polycythemia Vera (PV) is a risk factor for acute myocardial infarction. Good management of PV patients can reduce cardiovascular complications due to thrombosis which is a major cause of morbidity and mortality in PV patients.

Conflict of Interest

The authors declare no conflict of interest.

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