

Pulmonary Embolism and Splenic Infarction Caused by Polycythemia Vera

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Case report

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Abstract

Background: Pulmonary embolism and splenic infarction are rare in patients with embolism caused by polycythemia vera, which is easy to be neglected.

Case presentation: We presented a case who was diagnosed with pulmonary embolism and splenic infarction caused by polycythemia vera. The patient's main symptoms were chest tightness, cough and sputum expectoration. Anti-infection, bronchial relaxation and phlegm treatments did not release his symptoms. Pulmonary artery Computed Tomography Angiography showed pulmonary embolism and the abdomen CT showed multiple low-density changes in the spleen. Bone marrow aspiration cytology, biopsy and genetic testing confirmed polycythemia vera. Symptoms relieved after treatment with low molecular weight heparin, hydroxyurea, diuresis, vasodilation and oxygen inhalation.

Conclusions: This case emphasized that patients with polycythemia vera should be considered with the possibility of embolism, and we should give early interventions to minimize or delay the harm caused by its complications.

Introduction

Damages to the function or structure of vascular endothelial cells, changes in blood flow, and increased blood coagulation are the three major elements of thrombosis, which play a vital role in the process of thrombosis.^[1, 2] Polycythemia vera (PV) is mainly characterized by clonal erythrocytosis, and it can also have leukocytosis, elevated platelets, splenomegaly and thrombosis. Thrombosis is the most important factor of death in patients with PV. Cerebral artery embolism is most common, while splenic infarction, pulmonary artery and mesenteric artery embolism are less common.^[3] Therefore, we report a case of pulmonary embolism and splenic infarction caused by PV.

Case Presentation

20 days ago, the patient felt chest tightness, coughing, and sputum coughing discomfort after being cold. His symptoms did not be released significantly after resting. Then, He went to the Redcross Hospital of Qinghai Province and was diagnosed with "chronic bronchitis, emphysema, arrhythmia, splenomegaly". Half month later, the symptoms appeared, the patient had chest tightness, cough, and sputum symptoms worse than before, no chest pain and hemoptysis, no abdominal distension and abdominal pain. For further treatment, he went to the Qinghai University Affiliated Hospital.

Physical examination showed temperature 38°C, pulse rate 86 bpm, breathing rate 30 bpm and blood pressure 140/90mmHg. Consciousness, poor mental state, cyanotic lips, barrel chest, symmetrical voice tremor on palpation and blister sound and wheezing in both lungs. The heart rate was 86 bpm on auscultation, the rhythm is regular, and there were no abnormal murmurs in each valve area. In addition, the jugular vein was distended and the hepatic jugular vein reversing sign was positive. Abdominal tension and rebound pain were negative, the liver was untouchable under ribs, but the spleen under ribs

was touched (line I measured 36.7mm, line II measured 78mm, and line III measured 21mm). Moreover, both lower limbs were edema, and the lower left limb was more obvious.

White blood cells counts $21.37 \times 10^9/L$, neutrophil counts $18.52 \times 10^9/L$, red blood cell counts $6.90 \times 10^{12}/L$, hemoglobin 173g/L, hematocrit 51.30%, platelet counts $704 \times 10^9 /L$, lactate dehydrogenase 695U/L, uric acid 506umol/L, D-dimer 19.5mg/L, fibrinogen content 4.100g/L, C-reactive protein 67.70mg/L, procalcitonin 0.45 ng/mL, TnI 0.240ng/mL, N-terminal pro-brain natriuretic peptide 10900 ng/L. Echocardiography: The left and right atriums were enlarged, the tricuspid valve has a small amount of regurgitation, and the pulmonary valve has a small amount of regurgitation. There were no obvious abnormalities in the deep veins of the lower extremities. Pulmonary artery Computed Tomography Angiography (CTA) showed segmental visualization of the remote pulmonary artery of posterior right upper lobe. Bilateral pleural effusion, more obvious on the left, pulmonary hypertension, and the diameter of the main pulmonary artery is about 38.0 mm (Fig. 1). A plain CT scan of the abdomen showed fluid in the abdominal cavity; splenomegaly, multiple low-density changes in the spleen; portal hypertension (Fig. 3). The patient refused to undergo further enhanced CT examination of the abdomen. Therefore, he was given low-molecular-weight heparin 6000AxalU (once every 12 hours), cefoperazone sodium and sulbactam sodium 3.0g intravenously (once every 8 hours), blood vessel expansion, diuresis and nasal cannula oxygen therapy, and the symptoms was released.

The bone marrow aspiration and biopsy were performed. The results of bone biopsy showed the possibility of Myeloproliferative Neoplasms (MPN). Then, he was recommended to complete the relevant examination to exclude MPN. BCR-ABL fusion gene qualitative test was negative. Bone marrow tissue pathology diagnosis report showed that hematopoietic tissue was obviously active, granulocytes, erythroid and megakaryocytes were all proliferating, and macronuclei and multi-megakaryocytes were seen, and the gene test showed JAK2 V617F positive. He was treated with 100 mg aspirin per day and 0.25 g hydroxyurea per day. After he discharged from the hospital, rivaroxaban was added to 10 mg oral anticoagulant therapy per day.

One month later, his chest tightness, cough, and sputum expectoration released significantly, re-examination of the pulmonary artery CTA showed the disappear of segmental visualization of the remote pulmonary artery of posterior right upper lobe, and there were no filling defects in the two pulmonary arteries. At the same time, the pulmonary hypertension reduced compared with the front, with the diameter of the main pulmonary artery about 32.5 mm, and the left pleural effusion was significantly reduced (Fig. 2). White blood cells $10.60 \times 10^9/L$, neutrophil count $8.45 \times 10^9/L$, neutrophil percentage 79.7%, red blood cell count $5.24 \times 10^{12}/L$, hemoglobin 157g/L, hematocrit 49.2%, platelet count $233 \times 10^9/L$, he still refused to complete the enhanced abdominal CT examination. The rivaroxaban, hydroxyurea and allopurinol tablets were given outside the hospital.

Discussion And Conclusions

The destruction of the vascular endothelial structure, the changes of blood flow and the hypercoagulable state of the blood are the three major risk factors for thrombosis.^[1, 2] And studies have found that the risk of arterial and venous thrombosis in MPN is significantly increased^[4], especially in patients with PV for JAK2 V617F gene positive.^[5] The possible mechanisms of thrombosis are as follows.

At present, a large number of studies have shown that circulating endothelial cells are a reliable sign of endothelial injury.^[6-8] Studies have found that the circulating endothelial cells in the blood of patients with PV are significantly higher than those in the normal control group, and their levels may also represent the degree of endothelial cell damages and disease progression.^[8, 9] Therefore, the vascular endothelial cells of patients with PV are damaged. Healthy endothelial cells can inhibit the activation of platelets, and when endothelial cells are damaged, it can promote the thrombosis.

The hematocrit level is high in patients were diagnosed with PV, which increases the viscosity of the blood and causes blood flow stasis, and the higher the hematocrit, the greater the accumulation of platelets near the blood vessel wall, leading to further contact with von Willebrand factor.^[10] In addition, the study also found that the adhesion between the red blood cells and endothelial cells in patients with PV is 3.7 times higher than those normal red blood cells. However, patients with secondary polycythemia do not have this phenomenon, which indicates that adhesion is not related to the number of red blood cells but the unique manifestation of PV, which may be related to the increased expression of LU/BCAM in the red blood cells, leading to increased phosphorylation of LU/BCAM, increasing the adhesion of red blood cells firstly and promoting the thrombosis.^[11]

In patients with PV, the level of procoagulant microparticles (MPS) deriving from red blood cells, platelets and endothelial cells increases, which further increases exposure to phosphatidylserine (PS) of the outer membrane of platelets and red blood cells, and it is a co-factor in the coagulation process, which can promote the activation of factor X and the production of thrombin, leading to the thrombosis.^[12] At the same time, the antifibrinolytic activity (thrombomodulin, plasmin- α 2-antiplasmin complex, plasminogen activator inhibitor-1, thrombin - activated fibrinolytic inhibitor) increases in patients with PV, which inhibits the dissolution of fibrin and promotes the thrombosis.^[13]

Because embolism is the main reason of death in patients with PV, hydroxyurea and antiplatelet therapy should be given as soon as possible after the diagnosis of PV to prevent thrombosis and the conversion to myelofibrosis and leukemia, and improve patient's health condition and prognosis.^[14] For patients with existing pulmonary embolism, anticoagulants should be given in time, and studies have shown that direct oral anticoagulants (DOAC) are better than vitamin K antagonists in preventing the recurrence of thrombosis in patients with PV without increasing risks of bleeding.^[15]

In conclusion, pulmonary embolism and splenic infarction are less common in patients with PV. However, patients with PV should be considered the possibility of embolism, we should give early interventions to minimize or delay the harm caused by disease complications.

Abbreviations

PV: polycythemia vera

CTA: Computed Tomography Angiography

MPN: Myeloproliferative Neoplasms

MPS: procoagulant microparticles

PS: phosphatidylserine

DOAC: direct oral anticoagulants

Declarations

Ethical Approval and Consent to participate

The report design was approved by an ethics review board.

Consent for publication

Consent was obtained from the patient.

Availability of supporting data

Supporting data is not applicable to this article.

Competing interests

All authors do not have any possible conflicts of interest

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Authors' contributions

Both authors contributed to writing this manuscript and approved the final version.

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Figures

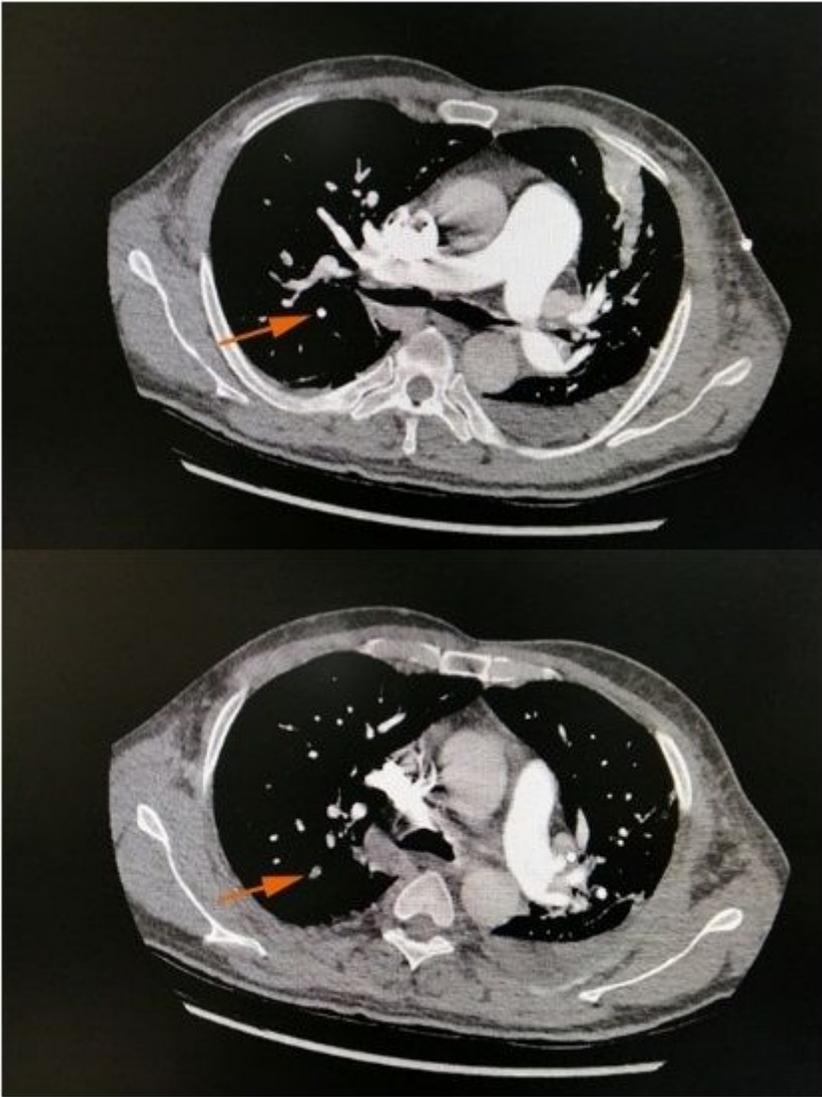


Figure 1

Pulmonary artery CTA in the beginning. It is showed that segmental visualization of the remote pulmonary artery of posterior right upper lobe (The blood vessels we pointed in both upper and lower picture are identical. The orange arrow, showing that the distal angiography is not obvious), bilateral pleural effusion, The left side is more obvious, with thickening and effusion of the bilateral interlobular pleura, pulmonary hypertension, and the diameter of the main pulmonary artery is about 38.0 mm.

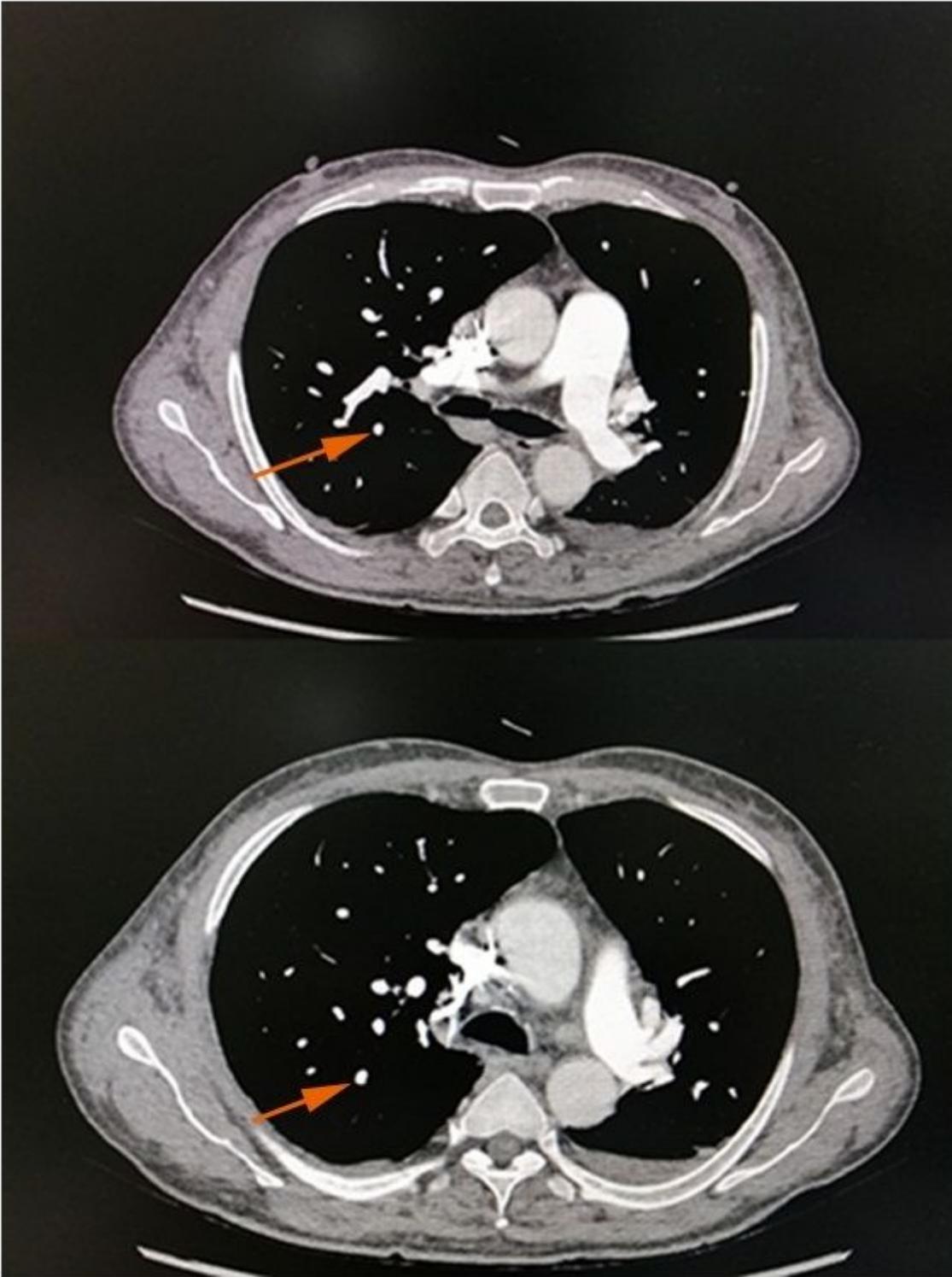


Figure 2

Pulmonary artery CTA One month later. It is showed that the disappear of segmental visualization of the remote pulmonary artery of posterior right upper lobe, and there were no filling defects in both pulmonary arteries (compared with the lower image of Figure 1, the lower image of Figure 2 showed that the distal angiography agent is filled without filling Defect). The left pleural effusion was significantly reduced, and pulmonary hypertension is released, with the diameter of the main pulmonary artery about 32.5 mm.

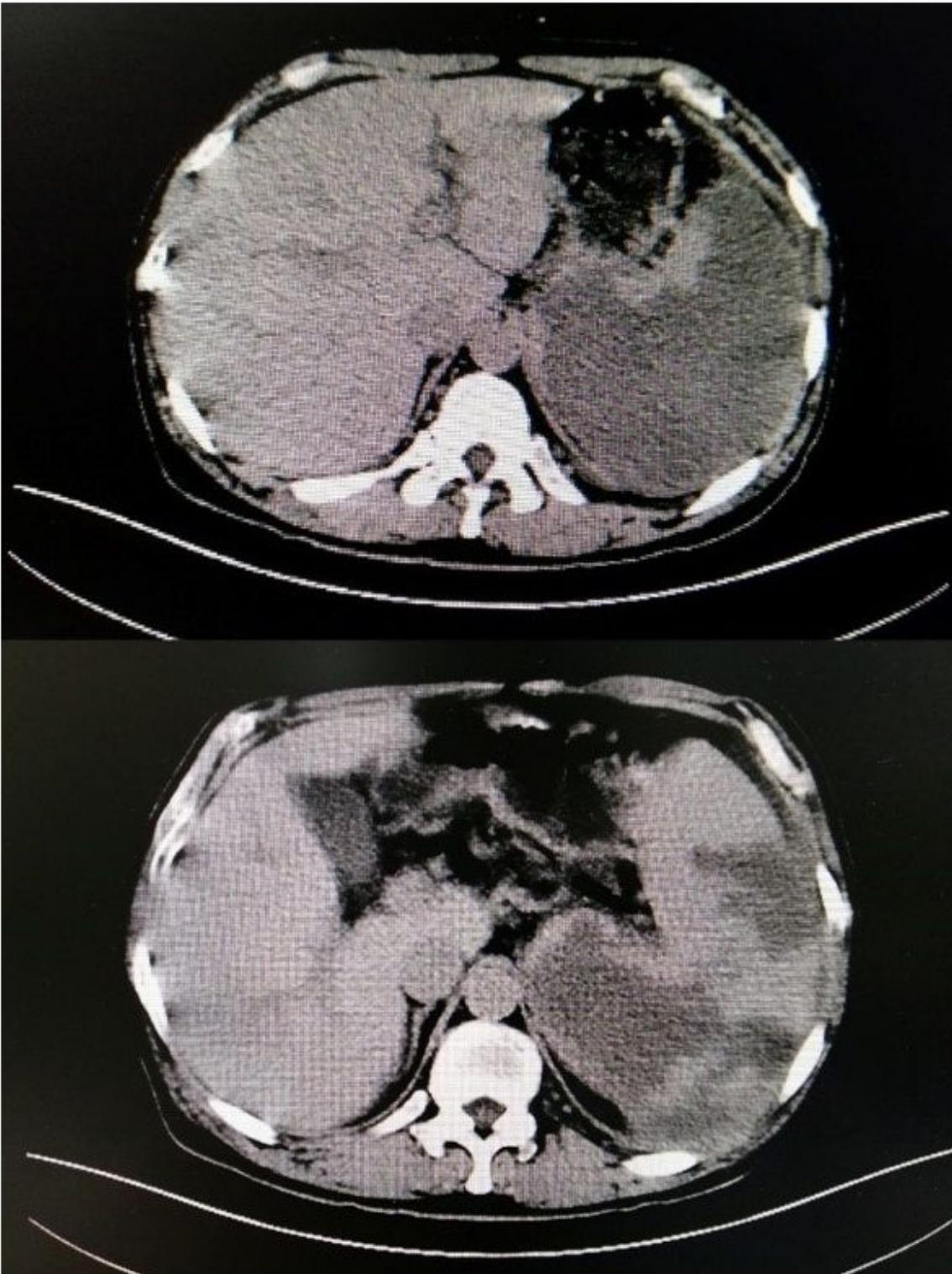


Figure 3

A plain CT scan of the abdomen. It is showed that the spleen was significantly enlarged, and there were multiple low-density changes in the spleen, which was considered the possibility of splenic infarction.