Case Report

Acute Myocardial Infarction in A 19-Year-Old Splenectomized Man

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Myocardial infarction is rare and catastrophic thrombosis in splenectomized thalassemia patient. The authors report a young thalassemia patient who underwent splenectomy for 3 years suffered cardiac arrest with no bystander cardiopulmonary resuscitation. He was diagnosed with acute ST-segment elevation myocardial infarction and cardiogenic shock. Primary percutaneous coronary intervention was performed successfully. Over the following days, the patient continued to deteriorate with septic shock and died. Arterial thrombosis can happen in thalassemia patient. Possible thrombotic mechanism and prevention of thrombosis in such patients are discussed.

Keywords: Myocardial infarction, Thalassemia, Splenectomy

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Thalassemia remains a major hereditary anemia in Thailand. Thalassemia disease also increases the risk of thrombosis. The incidence of thrombosis in thalassemia major and thalassemia intermedia were 0.9 to 4% and 3.9 to 29%, respectively[1,2]. Abnormalities in red blood cells, platelets, endothelial cells, coagulation factors as well as individual risk factors contribute to the pathogenesis of thrombosis in thalassemia[1]. Interestingly, myocardial infarction have rarely been reported in patients with thalassemia or any other hemolytic disorders after splenectomy. Herein authors describe such a case in the following report.

Case Report

A 19-year-old man was transferred to our institution from a regional hospital after suffering cardiac arrest. He had a medical history of hemoglobin H disease. He was transfusion-dependent and was splenectomized for 3 years ago. He also had portal vein thrombosis with subsequent aspirin and folate intake. Thrombophilia profiles were negative. He does not smoke or have family history of coronary artery disease.

The patient was initially reported collapse after a few minutes of playing football. He was not resuscitated promptly. Upon arrival of emergency medical services, he was found to be in ventricular fibrillation. Seven times of 200 J asynchronous shock were delivered, after which he developed pulseless electrical activity. Return of spontaneous circulation was achieved after a total of 27 minutes of cardiopulmonary resuscitation. An electrocardiogram was obtained and suggested an extensive anterior wall acute myocardial infarction (Figure 1). His hemoglobin was 9 g/dl, total white blood cell count was 45,100 per cubic millimeter with 78% of neutrophils, and the platelet count was 451,000 per cubic millimeter. An activated partial thromboplastin time (aPTT) was prolonged (41.4 seconds, reference interval 21.6 to 30.4 seconds) and prothrombin time was also prolonged (18.7 seconds, reference interval 9.6 to 12.2 seconds). Blood chemistry tests were abnormal as following; Troponin I level of 494.1 ng/L, blood urea nitrogen (BUN) of 17 mg/dL, creatinine of 1.47 mg/dL, potassium of 4.3 mEq/L and the bicarbonate of 14 mEq/L with wide anion gap metabolic acidosis. Lipid panel showed total cholesterol of 127 mg/dL, low density lipoprotein (LDL) cholesterol of 85.6 mg/dL,

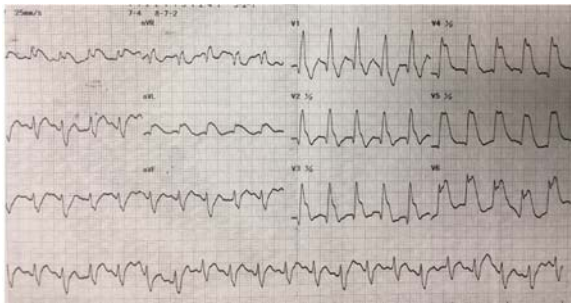

Figure 1. ECG showed sinus rhythm, right bundle branch block (RBBB) and ST-segment elevation in V_1 to V_6, leads I and aVL consistent with extensive anterior wall myocardial infarction.

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high density lipoprotein (HDL) cholesterol of 30 mg/dL, and triglyceride of 57 mg/dL, Bedside echocardiogram revealed an ejection fraction of 0.35 with hypokinesia of the anteroseptal and lateral wall, and no pericardial effusion.

The patient was transferred to the cardiac catheterization laboratory after six-hour of cardiac arrest. He was sedated and intubated with 96% of oxygen saturation. The Glasgow Coma Scale was $E_2M_3V_T$. His blood pressure was 133/78 mmHg and heart rate was regular at 140 beats per minute while being on two inotropic agents. Coronary angiogram of the left coronary artery from a right anterior oblique view with caudal angulation was shown as Figure 2. There was a total occlusion in the proximal segment of the left anterior descending artery (LAD). Coronary angiogram of the right coronary artery revealed normal. A 6 French XB3.5 guide catheter was engaged into the left coronary ostium. The LAD was crossed with Rinato wire (Asahi Intecc, Japan) and aspiration thrombectomy was performed. A 3.5 to 23 mm Xience Pro stent (Abbott Laboratories, USA) was deployed in the proximal LAD with the pressure of 24 atmospheres. Angiography revealed no residual stenosis with Thrombolysis in Myocardial Infarction (TIMI) grade III flow (Figure 2).

His initial temperature was 38 degrees Celsius, and then he received ceftriaxone for empiric antibiotic. His initial blood culture was negative. The patient remained sedated and intubated. He was treated with dual antiplatelet therapy, atorvastatin, cooling to 36.0°C, vasopressors, broadened antibiotic therapy. The course of antibiotics was as follows: ceftriaxone as monotherapy for 4 days, then switched to piperacillin/tazobactam, ertapenem, vancomycin, and colistin accordingly. The following blood culture showed extended spectrum beta-lactamases *Escherichia coli* on day 4 of hospitalization, methicillin-resistant *Staphylococcus epidermidis* and multidrug resistant *Acinetobacter baumannii* on day 9 of hospitalization. The patient had worsening hypotension in spite of vasopressor support. His bloodwork showed elevated creatinine level, lactic acidosis, and multi-organ dysfunction. His clinical conditions were further deterioration, the patient's family decided to pursue palliative care.

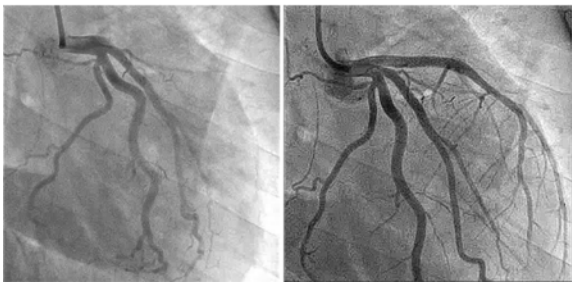

Figure 2. Coronary angiogram of the left coronary artery from a right anterior oblique view with caudal angulation revealed total occlusion in the proximal segment of left anterior descending artery (left), no residual stenosis after stenting with TIMI III flow (right).

Discussion

The spleen is an important component in the modulation of immunity, thrombosis, and inflammation. Accumulation of data has shown that splenectomy has been associated with an increased incidence of arterial as well as venous thrombosis, while the risk of overwhelming post-splenectomy infection has been reduced considerably but not eliminated since the vigilant use of pneumococcal, *Hemophilus influenzae* and meningococcal vaccinations. The physician must recognize the complexity of sepsis in splenectomized patients and should take appropriate steps to aggressively and systematically implement early appropriate antibiotic therapy.

Patients with thalassemia have been reported to be at risk of arterial thrombosis after splenectomy, mainly ischemic stroke, even in the young[3-5], but the incidence of arterial thrombosis appeared to be less than venous thrombosis or pulmonary arterial hypertension. In the largest series of thrombotic complications in thalassemia reviewing 8,860 patients, arterial thrombosis (mostly stroke) was more common in the thalassemia major population (17 patients) compared with thalassemia intermedia (7 patients, $p = 0.005$) with the most of patients in each group having previously had splenectomy. The 52% of thalassemia intermedia patients who were receiving aspirin after splenectomy had a lower recurrence of stroke, deep vein thrombosis, pulmonary embolism and portal vein thrombosis compared with those who were not receiving aspirin, although these differences were not statistically significant[2]. Very few cases of myocardial infarction were reported with post-splenectomy thrombocytosis. It occurred mainly in patients with essential thrombocytosis[6,7]. A literature review of myocardial infarction in thalassemia yielded two reports of β-thalassemia major and intermedia patients[8,9]. Splenectomized thalassemia intermedia patients who developed thromboembolism were characterized by high nucleated erythrocytes and platelet counts, and were more likely to be transfusion naive[10].

This current young patient was illustrated a rare and serious thrombotic complication found in a splenectomized thalassemia patient. He was definitely diagnosed with myocardial infarction despite aspirin treatment for portal vein thrombosis. He had no any atherosclerotic risk factors. His blood count showed no nucleated erythrocytes and mild thrombocytosis with platelet of 451,000 per cubic millimeter. The hypercoagulable state after splenectomy is likely to be due to a qualitative defect rather than a quantitative effect of the platelet. Compelling evidence in thalassemia suggested the presence of a hypercoagulable state greatly exacerbated by splenectomy, which is the result of platelet activation[11-13], reduced levels of the natural anticoagulants protein C and protein S[11], and enhanced red blood cell adherence to the endothelium[14]. These may further contribute to hemostasis and vascular occlusion. Alterations

in the phospholipid composition of red blood cell membrane provide a procoagulant surface for increased thrombin formation in thalassemia[11,15]. Furthermore, procoagulant cell-derived microparticles have also been increased after splenectomy for hematologic disorders, suggesting that the spleen appears to play a critical role in clearing them from the circulation[16-18].

Splenectomy was previously widely undertaken in patients with erythrocyte disorders with hemolysis, in order to reduce the extravascular hemolysis. However, the long-term thromboembolic risk was higher. A more conservative approach has been advocated in the settings of hereditary spherocytosis[19], thalassemia intermedia[20] and thalassemia major. The current indication for splenectomy in thalassemia major remains a progressive increase in transfusion requirement due to hypersplenism and difficulty in controlling iron overload[21,22]. However, a more conservative approach is presently suggested and a large spleen alone should not be an indication for splenectomy. In thalassemia intermedia, splenectomy is even more sparingly undertaken[21,22]. Transfusion therapy, which is not usually recommended in current practice, may be worthwhile to reduce the risk of thromboembolic events[22]. Patients with thalassemia intermedia who undergo a major surgery (for instance, cholecystectomy) should receive perioperative antithrombotic prophylaxis with heparin, even if they are young. In patients at high risk because they are splenectomized, long-term antithrombotic prophylaxis may be considered. This prophylaxis includes the inhibition of platelet aggregation with aspirin and control of platelet counts to below 400,000 per cubic millimeter with hydroxyurea[22].

Conclusion

Myocardial infarction is very rare in the patients with thalassemia after splenectomy and may become another important complication encountered by those who care for patients with thalassemia. Arterial thrombosis can emerge in the younger thalassemia patients with no other athero-thrombosis risks. Awareness of the increased risk and prevention for catastrophic thrombotic complications should be considered.

What is already known on this topic?

Patients with thalassemia have been reported to be at risk of arterial thrombosis after splenectomy, mainly ischemic stroke, even in the young. The incidence appeared to be less than those with venous thrombosis. Myocardial infarction have rarely been reported in thalassemia or any other hemolytic disorders after splenectomy.

What this study adds?

Arterial thrombosis can emerge in the younger thalassemia patient with no other atherothrombosis risks. Awareness of the increased risk and prevention for this catastrophic thrombotic complications should be considered.

Potential conflicts of interest

The authors declare no conflict of interest.

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