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CASE REPORT / OLGU SUNUMU

Fatal hyperacute left main thrombosis after aortic root surgery

Aort kökü cerrahisi sonrası ölümcül hiperakut sol ana tromboz

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ABSTRACT

Acute aortic root thrombosis is a potentially lethal condition due to the possibility of thrombosis into the ascending aorta branches, resulting in various clinical manifestations. A 29-year-old male patient was admitted to our center with hyperacute left main thrombosis after elective Bentall procedure. Due to massive left ventricular infarction, the patient was supported by extracorporeal membrane oxygenation, but without success to recovery. The patient's blood analyses revealed a high level of the Factor VIII. In conclusion, Factor VIII levels in the blood are elevated by genetic abnormalities, infectious diseases such as severe acute respiratory syndrome-coronavirus 2 infection, and vascular inflammation. This pathological condition may be a reason for hyperacute thrombosis.

Keywords: Factor VIII, hyperacute, myocardial infarction, SARS-CoV-2.

ÖZ

Akut aort kökü trombozu, çeşitli klinik bulgulara yol açarak çıkan aort dallarında tromboz olasılığına bağlı muhtemel ölümcül bir tablodur. Yirmi dokuz yaşında erkek hasta elektif Bentall prosedürü sonrası hiperakut sol ana tromboz ile merkezimize başvurdu. Masif sol ventrikül enfarktı nedeniyle hasta ekstrakorporeal membran oksijenasyonu ile desteklendi; ancak iyileşme sağlanamadı. Hastanın kan tahlillerinde Faktör VIII düzeylerinde artış görüldü. Sonuç olarak, kandaki Faktör VIII düzeyleri genetik anormallikler, şiddetli akut solunum sendromu-koronavirüs 2 enfeksiyonu gibi enfeksiyon hastalıkları ve vasküler enflamasyon ile artış gösterebilir. Bu patolojik durum, hiperakut trombozun bir nedeni olabilir.

Anahtar sözcükler: Faktör VIII, hiperakut, miyokart enfarktüsü, SARS-CoV-2.

Early acute aortic root thrombosis following the implantation of an aortic valve prosthesis is a highly uncommon and serious disease. Embolization into the ascending aorta branches determines the clinical presentation. The most frequent adverse outcome of aortic root thrombosis is brain infarction. Coronary artery embolism is a rare, and most cases of coronary embolism involve the left coronary artery due to preferential flow related to the aortic valve morphology.[1-3] The mechanical prosthesis is the most thrombogenic than biological one. The risk of artificial valve thrombosis increases with hypercoagulable diseases.[4]

In this article, we present a case of a high level of Factor VIII who experienced hyperacute left main thrombosis following replacement of the aortic root.

CASE REPORT

A 29-year-old male patient was hospitalized for elective ascending aortic surgery. Palpitation, dyspnea and fatigue were present in his medical history. No one in the family had any hematological, cardiovascular, or other disorders. One year prior, the patient had pneumonia due to severe acute respiratory syndrome-coronavirus 2 (SARS-CoV-2) infection. The last dose of the immunization was given 20 days

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before surgery using the Sinopharm® (China National Pharmaceutical Group, China) vaccine. Transthoracic echocardiography revealed a bicuspid aortic valve that was calcified, with an area of 1.1 cm^2, a mean pressure gradient of 32 mmHg, and significant regurgitation (Grade ≥3). The aortic root and ascending aorta were each dilated by 46 and 58 mm, respectively. The aortic wall did not have any noticeable calcification. Ejection fraction was 55%; left ventricular (LV) hypertrophy was present, but there were no abnormal segmental movements. Coronary angiography did not reveal coronary artery disease.

The median sternotomy was used to perform a surgical procedure. Extracorporeal circulation was established after systemic heparinization using ascending aorta and right atrial appendage cannulation. When the activation clotting time (ACT) exceeded 480 sec, cardiopulmonary bypass (CPB) was initiated. To replace the aortic root due to calcification of the aortic leaflets, we used the Carbomedics™ (CarboMedics Inc., Austin, TX, USA) prosthesis 27 mm for the Bentall de Bono procedure. The weaning from a heart-lung machine was smooth.

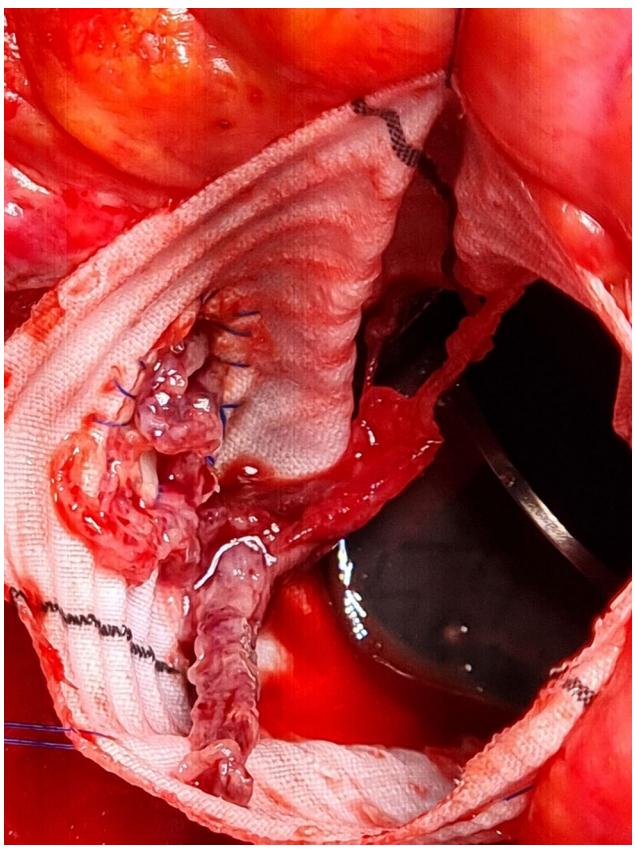

Figure 1. Surgical view of the transected Dacron® graft. The ostial left main was totally covered by thrombi.

After decannulation, heparin was neutralized by protamine sulfate on a standard fashion. The controlled ACT after protamine administration was 120 sec.

The patient was gradually awakened 2 h following surgery, with no sensory or motor impairment. At 6 h following the procedure, additional postoperative left-sided hemiparesis was observed and confirmed by neurological examination. The carotid artery color Duplex scan revealed no dissection or obstruction. The presence of an aortic arch dissection was ruled out by echocardiography. The mechanical prosthesis functioned properly. Ventricular tachycardia and ventricular fibrillation were soon detected. Rhythm abnormalities were resistant to cardioversion and antiarrhythmic treatment. The patient was immediately transferred into the operating room. After the direct heart massage and defibrillation failed, we decided to resume the CPB. The heart was stopped using a cardioplegic solution, and the Dacron® graft was opened 2 cm above the right coronary button. During the examination, surgeons discovered a full obstruction of the left main ostium by a new thrombotic mass (Figure 1). The mechanical prosthesis functioned normally and was free of thrombosis. A complete thrombectomy was done (Figure 2). Following surgery, transesophageal echocardiography showed akinesis of the anterolateral and septal wall of the LV, as well as a significant decrease in the LV ejection fraction to 20%. Weaning from CPB failed, despite the administration of large doses of inotropes and vasopressors. We decided to put the patient on the

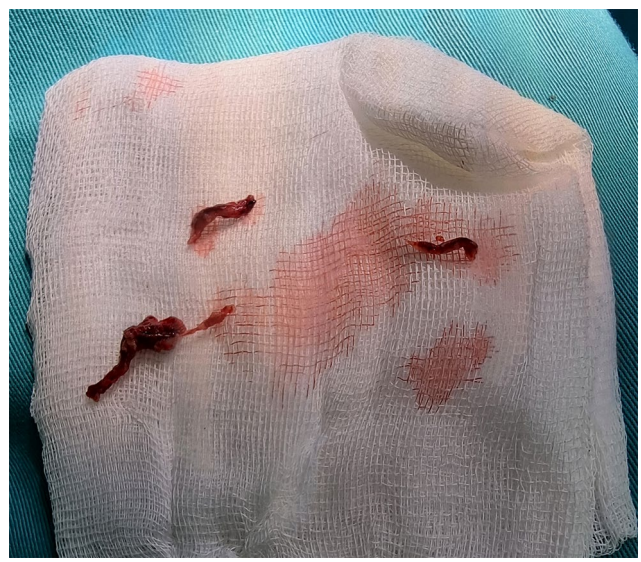

Figure 2. Extirpated thrombus mass. Thrombus was completely extirpated.

open form of extracorporeal membrane oxygenation. The perioperative level of high sensitivity troponin was 256,689 pg/mL (normal range: 19 pg/mL). Anterolateral and septal akinesis was identified using transthoracic echocardiography.

Coagulation testing showed a high level of Factor VIII of 245.5% (normal range: 50 to 150%). The recovery of the heart failed throughout the postoperative phase. Unfortunately, the patient died on Day 10 postoperatively due to multiorgan failure.

DISCUSSION

It is widely accepted that any foreign entities inserted into the circulatory system increase the risk of thrombosis and thromboembolic complications. Mechanical valve thrombosis occurs at a rate ranging from 0.1 to 5.7% per year. The annual rate of thromboembolic incidents is 2.5 to 3.7%.[4] Pradegan et al.[1] reported a patient with acute aortic root thrombosis involving the coronary ostia in the early period after aortic valve replacement. Although it is well accepted that artificial valves increase the risk of thrombosis after aortic root replacement, hyperacute thrombosis of the coronary artery following this procedure is extremely uncommon. In the present case, the reason for the left main thrombosis without thrombosis of the mechanical prothesis still remains unclear. The suture line of the coronary button or Dacron® prothesis could be a potential trigger for this condition.

Hypercoagulable states increase the risk of thrombosis and embolic events. Factor VIII in our patient was twice as high as the reference value. Factor VIII is essential for the endogenous coagulation pathway, and high levels in the circulation may cause venous and arterial thrombosis. A high level of Factor VIII may indicate a genetic hypercoagulable disease.[5] The next concern is how to identify these individuals prior to heart surgery. Routine screening for hypercoagulable conditions is not recommended. On the other hand, the literature described the effect of novel coronavirus disease-2019 (COVID-19) on thrombosis and thromboembolic events in individuals with elevated Factor VIII levels. The major causes of increased blood levels of Factor VIII include vascular inflammation and endothelial damage induced by COVID-19.[6] One year before to the operation, our patient was infected with SARS-CoV-2. Inflammation caused by surgery is another cause for concern. CPB may result in an increase in the value of Factor VIII causing endothelial cells inflammation and damage.[7] A blood sample for the analyses was taken from our patient after postoperative cardiac fibrillation before the second CPB.

In conclusion, Factor VIII is a procoagulant factor that increases the risk of thrombosis. The primary concern is how to recognize hypercoagulable patients who undergo cardiac surgery procedures, particularly in the coronavirus disease-2019 era.

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REFERENCES

1. Pradegan N, Basso C, Della Barbera M, Thiene G, Tarantini G, Gerosa G, et al. Cardiac arrest due to acute massive aortic root thrombosis after pericardial bioprosthetic aortic valve replacement. Cardiovasc Pathol 2019;41:8-10. doi: 10.1016/j.carpath.2019.03.003.
2. Alajaji W, Hornick JM, Malek E, Klein AL. The characteristics and outcomes of native aortic valve thrombosis: A systematic review. J Am Coll Cardiol 2021;78:811-24. doi: 10.1016/j.jacc.2021.06.023.
3. Koo H, Lee H, Anh T, Kang JW, Yang D, Song J, et al. Postoperative complications after surgical aortic valve replacement. Cardiovasc Imaging Asia 2017;1:222. doi: 10.22468/cvia.2017.00115.
4. Dangas GD, Weitz JI, Giustino G, Makkar R, Mehran R. Prosthetic heart valve thrombosis. J Am Coll Cardiol 2016;68:2670-89. doi: 10.1016/j.jacc.2016.09.958.
5. Basaric D, Saracevic M, Bosnic V, Vlatkovic A, Tomic B, Kovac M. Factor VIII activity in relation to the type of thrombosis and patient's risk factors for thrombosis, age, and comorbidity. Eurasian J Med 2023;55:9-13. doi: 10.5152/eurasianjmed.2023.22072.
6. Teimury A, Khameneh MT, Khaledi EM. Major coagulation disorders and parameters in COVID-19 patients. Eur J Med Res 2022;27:25. doi: 10.1186/s40001-022-00655-6.
7. Jones DK, Luddington R, Higenbottam TW, Scott J, Cavarocchi N, Reardon D, et al. Changes in factor VIII proteins after cardiopulmonary bypass in man suggest endothelial damage. Thromb Haemost 1988;60:199-204.