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Case Report / Olgu Sunumu

Hemodynamic stability following incidental cardiac perforation on extracorporeal life support

Ekstrakorporeal yaşam desteğinde rastlantısal kardiyak perforasyon sonrası hemodinamik stabilite

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ABSTRACT

A 60-year-old male patient arrived at emergency department due to cardiac arrest. As the patient had acute myocardial infarction and hemopericardium, we performed extracorporeal life support by percutaneous femoral cannulation. His cardiac function was recovered and stabilized hemodynamically. Soon after identifying post-infarction left ventricle rupture, we found that the venous cannula was protruded out right ventricle after pericardiotomy. We repaired the both ventricles and left anterior descending artery was bypassed. The patient was discharged without complication.

Keywords: Complication; extracorporeal life support; myocardial infarction.

ÖZ

Altmış yaşında erkek hasta, kardiyak arrest nedeniyle acil servise getirildi. Akut miyokard enfarktüsü ve hemoperikardiyum izlenen hastaya perkütan femoral kanülasyon ile ekstrakorporeal yaşam desteği uygulandı. Hastanın kalp fonksiyonları iyileşti ve hemodinamik açıdan stabilize oldu. Enfarktüs sonrası sol ventrikül rüptürü tespit edilen hastada venöz kanülün perikardiyotomi sonrasında sağ ventriküle doğru çıkıntı yaptığı izlendi. Her iki ventrikül onarıldı ve sol ön inen artere baypas uygulandı. Hasta herhangi bir komplikasyon olmaksızın taburcu edildi.

Anahtar sözcükler: Komplikasyon; ekstrakorporeal yaşam desteği; miyokard enfarktüsü.

Extracorporeal life support may improve cardiac output in cardiogenic shock patients with a reversible etiology and increase survival in patients undergoing early implantation without any end-organ damage.[1]

Extracorporeal cardiopulmonary resuscitation improve prognosis and may be beneficial in special circumstances of hospital cardiac arrest; however, there are many complications associated with cannulation, such as bleeding, limb ischemia, vascular injury, and aberrant placement of the cannula. About 10 to 20% of patients with extracorporeal life support for cardiac and respiratory failure experience complication due to cannulation which may even lead to life-threatening complications. Using imaging studies during all phases of cannulation, if applicable, including vascular access, guiding wire insertion, and cannula placement is recommended to avoid these complications.[2]

Herein, we report a case of incidental right ventricle perforation during extracorporeal life support application for cardiac tamponade which resulted in hemodynamic stability.

CASE REPORT

A 60-year-old male patient was admitted to our emergency department with cardiac arrest. At presentation, ventricular fibrillation was confirmed. Cardioversion was done by paramedics. Initial rhythm on arrival at hospital was sinus tachycardia. His systolic blood pressure was less than 70 mmHg. Transthoracic echocardiography revealed a large amount of hemopericardium and decreased wall motion of the anterior wall of the left ventricle. Electrocardiography showed elevated V1-3 ST segments. We suspected aortic dissection with coronary malperfusion. Chest

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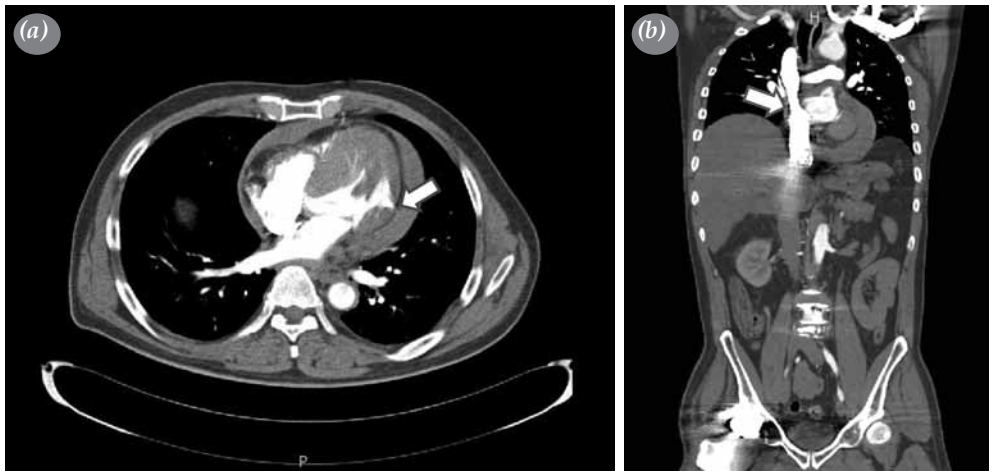

Figure 1. A computed tomography image showing **(a)** defect of left ventricle wall (arrow), hemopericardium and **(b)** collapse of right atrium with dilatation of inferior vena cava (arrow).

computed tomography revealed left ventricle rupture and cardiac tamponade was diagnosed (Figure 1). He developed frequent ventricular fibrillation without being converted to normal sinus rhythm by cardioversion. Therefore, extracorporeal cardiopulmonary resuscitation was initiated. The right common femoral artery and vein were cannulated percutaneously. We used a 21-French venous cannula with multi-holes (Bio-medicus™ Medtronic, Minneapolis, Minnesota) for venous drain. After extracorporeal circulation, cardiac function was recovered. His blood flow by extracorporeal circulation was able to be kept up to 3.5 L/min. Post-infarction rupture of the left ventricle was suspected and emergency coronary angiography was proceeded. During examination, malposition of the venous cannula was detected and left main coronary artery disease was confirmed (Figure 2). Emergency operation was followed. Following pericardiotomy, only small amount of blood gushed. Venous cannula was found to protrude out the right ventricle. Following the repair of the ruptured right ventricle, primary closure of left ventricle and coronary artery bypass grafting of the left anterior descending artery with the greater saphenous vein were done on a beating heart. The left internal mammary artery was injured during cardiopulmonary resuscitation which we were unable to use for the graft conduit. Therapeutic hypothermia was kept for 24 h. The patient was conscious on Day 2 after the operation. Extracorporeal life support was weaned on Day 3. On postoperative cardiac

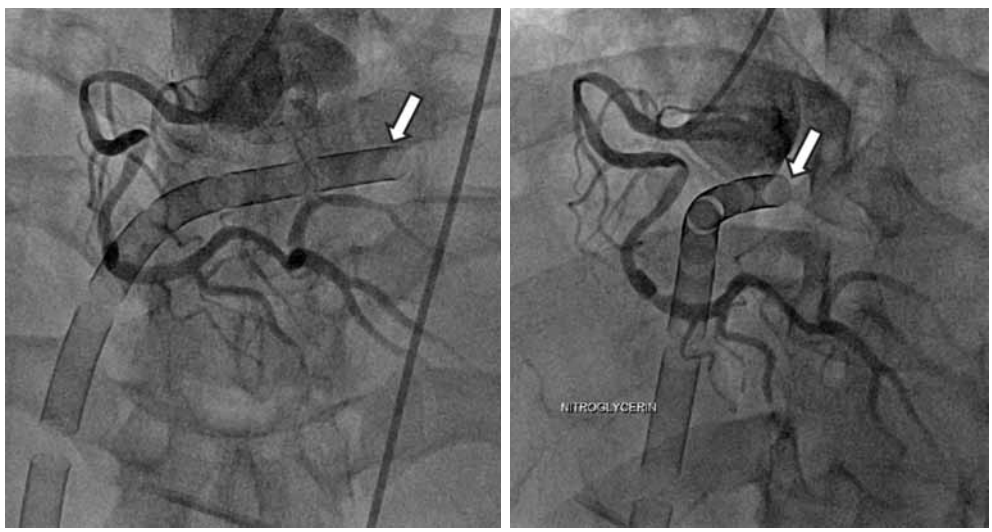

Figure 2. Malposition of venous cannula as shown by coronary angiography (arrows).

Figure 3. A computed tomography image after the operation showing patent saphenous vein graft (white arrow) and repaired left ventricle wall (black arrow).

computed tomography, the saphenous vein was patent. No abnormal finding was detected (Figure 3). The patient was discharged without any complication on Day 15 following the operation.

DISCUSSION

There is no gold standard method for the cannulation on extracorporeal life support. However, percutaneous peripheral cannulation is usually performed, as it has many advantages. The optimal position of venous cannula on venoarterial extracorporeal life support has not been defined; however, venous drain from superior vena cava has been recommended.[3] The correct position of the cannula tip is in the right atrium. Malposition of venous cannula will result in poor venous drainage and it can cause mechanical complications.[4]

Under cardiopulmonary resuscitation situation, femoral vessels are usually available during chest compression. These vessels are preferred for cannulation for extracorporeal circulation. All percutaneous cannulation has been accomplished using the Seldinger's technique.[5] A long guidewire is usually introduced into the proper vessel and forwarded to optimal position under the guidance of echocardiography or fluoroscopy, where applicable. The access can be widened with dilators. Appropriate cannula can be inserted along the guidewire. The position of venous cannula is very important for extracorporeal life support. Malposition of cannula causes inadequate venous drain and poor oxygenation with the potential of leading to life threatening complications, as described in this report. We might have difficulty in advancing the guidewire for venous cannulation into the inferior vena cava or the guidewire might have run across the tricuspid valve and entered inside the right ventricle. Malposition of venous cannula may result in the presence of a large Eustachian valve in the right atrium which prevents the guidewire from passing in to the right atrium.[6] In patients with cardiac tamponade, the right atrium is usually collapsed due to pericardial hematoma, thereby, causing mechanical obstruction from inferior vena cava to the right atrium. In case of ventricular premature complex as assessed by electrocardiography, malposition of guidewire should be suspected and the surgeon should retrieve the guidewire backward. If the migration of guidewire into right ventricle is not detected, it can lead to the right ventricle rupture by guidewire or cannula. On extensive acute myocardial infarction, myocardium is very friable and cannulation into cardiac chamber must be done carefully. Anticoagulation for extracorporeal circulation might worsen bleeding on extracorporeal cardiopulmonary resuscitation, and the patient with cardiac tamponade might be worsened hemodynamically. Prompt drain of pericardial blood should be performed percutaneously or surgically.[7] In the present case, drainage of venous blood was sufficient and blood pressure was kept above 90 mmHg without any drain or transfusion. On pericardiotomy, there was only a small amount of blood in the pericardium. Therefore, the blood from ruptured right ventricle was drained into venous cannula. Fortunately, we were able to keep the patient stable, until we performed the surgical procedure.

In conclusion, venous cannulation should be applied, if possible, under the guidance of echocardiography or fluoroscopy for percutaneous extracorporeal life support to obtain the optimal position of the venous cannula. In addition, more caution is needed for patients with a collapsed cardiac chamber such cardiac tamponade.

Declaration of conflicting interests

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