

Right Ventricular Failure Following Acute Type A Aortic Dissection Successfully Treated with ECMO: Report of Two Cases

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Abstract

Patients with acute aortic dissection report often the typical sharp, abrupt chest pain. In some cases, when the disease leads to the coronary malperfusion, the symptoms of acute coronary syndrome may be reported. Low cardiac output as the result of the accompanying coronary flow disturbances can require the mechanical cardiopulmonary support. In some selected cases extracorporeal membrane oxygenation can be successfully used as a bridge to recovery or bridge to decision. The additional advantage of this therapeutic option is the possibility of choice of the cannulation strategy: veno-venous, veno-arterial, veno-pulmonal, central/peripheral. Oxygen delivery can be easily regulated on oxygenator. We present two patients with acute type A aortic dissection and acute coronary syndrome, who recovered thanks to such therapy.

Keywords: Aortic dissection; ECMO; Heart failure; Right coronary artery

Case Report

A 36-year-old man presented with acute inferior ST-elevation myocardial infarction (STEMI) and aneurysm of the ascending aorta was admitted to our hospital with suspicion of an acute aortic dissection. The diagnosis was confirmed with the computed tomography (Figure 1). The coronary angiography (Figure 2) showed proximal closure of the right coronary artery (RCA). The modified Bentall operation using the mechanical valve conduit was performed under cardiopulmonary bypass (CPB) and mild hypothermia (32°C). Intraoperative detach of the right coronary artery orifice from the Valsalva sinus was

demonstrated. This vessel was ligated and bypassed with a saphenous vein graft.

Postoperative the patient needed the NO-ventilation and inotropic agents to maintain the function of the right ventricle. 14 hours after leaving the operating room the veno-venous extracorporeal membrane oxygenation (ECMO) pump implantation was carried out because of hypoxia ($\text{PaO}_2/\text{FiO}_2=45$) despite the FiO_2 of 100% on respirator. Under gas flow of 2.5 L/min and FiO_2 of 100% on ECMO we achieved an immediate improvement of the arterial oxygenation with PO_2 of 197 mmHg. The central venous pressure dropped rapidly from 26 mmHg to 8 mmHg.

The patient underwent bronchoscopy and some bronchial secretion was removed. The echo examination revealed the dilated, poor-functioning right ventricle. On the 12th postoperative day the percutaneous tracheostomy was performed and the patient was successfully weaned from ECMO on the day 18th after the operation. The series of repeated echo examinations showed a distinct improvement of the right ventricular function. Our patient was mobilized and without neurological deficits discharged to internal medicine unit on the 27th postoperative day.

A 64-year-old man with the coronary heart disease, who was diagnosed with acute myocardial infarction without ST-elevation (NSTEMI), underwent the echo examination that showed the dissection of the ascending aorta. The patient was admitted to our institution and the modified Bentall operation was carried out under CPB and moderate hypothermia (27°C). The dissection entry was located on the both coronary sinuses, involving the coronary orifices and coming onto the RCA. The left coronary artery (LCA) was anastomosed to the aortic prosthesis with short saphenous vein graft (SVG). The RCA was bypassed with SVG. Because of the right

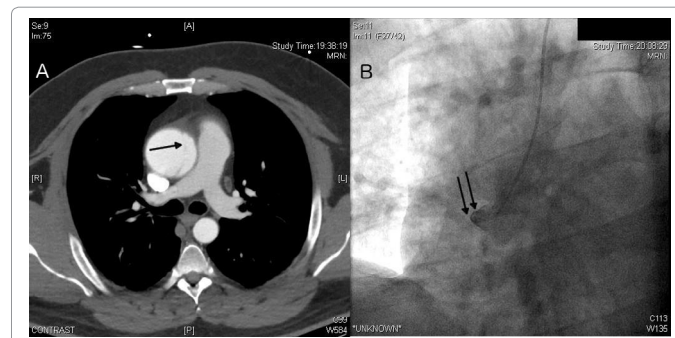


Figure 1: a) Preoperative CT-scan shows the dissection membrane in the ascending aorta (arrow). b) preoperative angiography with proximal closure of the right coronary artery (double arrow).

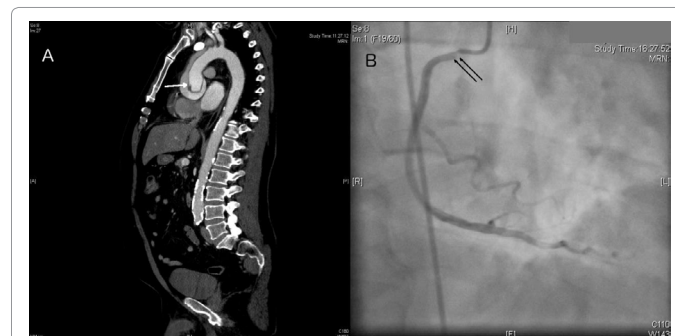


Figure 2: a) Computed tomography revealing the dissection of the ascending aorta involving the aortic root (arrow). b) angiogram of the dissected right coronary artery. The dissection flap obliterates partially the coronary orifice (double arrow).

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ventricular low output, we decided to use the veno-pulmonary ECMO. Under NO ventilation and therapy with inotropic agents (Dobutamin 1.5 µg/kg/min, Noradrenalin 0.1 µg/kg/min) the CPB was turned off and the chest was closed. With gas flow of 1.5 l/min and FiO₂ of 60% at the oxygenator and FiO₂ of 55% on bilevel positive airway pressure (BIPAP) ventilation we initially reached the arterial PO₂ at the level of 120 mmHg with adequate cardiac output measured with the oxygen extraction.

The right ventricular function gradually improved and the patient was successfully weaned from the ECMO on the 8th postoperative day. The next day we discharged him from the intensive care unit.

Coronary artery involvement in type A aortic dissection often results in myocardial ischemia, which is a negative prognostic factor. The right coronary artery is more frequently affected than the left one and in these patients postoperative right ventricular function impairment can occur. Early coronary revascularization may be necessary to reduce the area of the heart muscle necrosis and to minimize the risk of low-output syndrome.

Veno-pulmonary ECMO seems to be a good therapeutic method for the postoperative right ventricular failure associated with oxygenation disturbances. The advantage of this solution is the possibility to regulate the oxygen supply. It can be also used only as right ventricular assist device (RVAD) and the oxygenator can be excluded from the circuit, when not needed [1,2]. The risk of bleeding is increased and the operation time becomes longer when RVAD implantation is performed, however in particular cases, such as in our two patients, good outcome is not possible without this support.

Not only the use of mechanical circulatory support but also development of the intensive care visibly improved the survival in this group of patients in the last time. The great emphasis must be placed on careful use of positive end expiratory pressure. Pharmacological therapy with inotropes and pulmonary vasodilators are in most cases necessary. [3]

In selected patients who suffer from postoperative hypoxia, veno-venous ECMO can be also useful. This variant of circuit does not require re sternotomy since the peripheral access is preferred, however it does not provide right ventricular support. The right ventricular function can be managed in these cases pharmacological and with respirator settings.

ECMO is a good therapeutic option for patients with postoperative oxygenation disturbances or right heart failure. It can be successfully used in cases of acute aortic dissection with affected coronary arteries, when the heart assist device and improvement of blood oxygenation are necessary [4].

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