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Case Report

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Myocardial revascularization in a patient with acute myocardial infarction, refractory shock and arrest supported by ECMO-VA

Abstract

Extracorporeal membrane oxygenation is an extracorporeal life support modality that allows temporary support for pulmonary and/or cardiac function failure, refractory to conventional clinical treatment. Its indications include in-hospital cardiac arrest, refractory cardiogenic shock, and acute respiratory distress syndrome. Objective: This study will present the case of a 54-year-old patient with acute myocardial infarction plus diabetes, hypertension and heart failure with an ejection fraction of 31. This patient presented triarterial coronary lesions of over 80% of obstruction in three epicardial arteries. The patient was submitted to revascularization, who evolved with refractory cardiogenic shock due to important left ventricular dysfunction and opted for the installation of circulatory support with extracorporeal membrane oxygenation during cardiorespiratory arrest, as a bridge to the surgical approach. In the present case, arterial extracorporeal membrane oxygenation fulfilled its role as a bridge to definitive surgery, however, due to the negative direct contribution of other factors, the patient did not present a desired outcome.

Keywords: ECMO-VA, Revascularization, Cardiac Arrest, Refractory schock, Acute Myocardial Infarction

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Abbreviations: ECG, Electrocardiogram; ECMO-VA, Veno-Arterial Extracorporeal Membrane Oxygenation; ICU, Intensive Care Unit

Case report

WBS, male, 54 years old, with a previous history of non-insulin-dependent diabetes mellitus and smoking, presented on January 9, 2021 a single episode of so-called syncope and again on January 11, 2021, he presented two new episodes now associated with sweating, chills and chest pain. He sought medical attention and performed electrocardiogram (ECG) with evolved anterior wall supra (V2-V4, T wave inversion V5-V6 and lower) and positive myocardial necrosis markers.

Admitted on January 14, 2021 at one of the greatest tertiary hospitals in São Paulo for cardiac catheterization that showed coronary lesion with triarterial pattern with right coronary artery occluded in the middle third, anterior descending coronary artery occluded in the middle third, diagonal coronary artery of great importance with a 70% lesion in the ostium and second left marginal branch of great importance with an 80% lesion in the middle third. Transthoracic Doppler cardiogram performed on January 15 showed moderate systolic dysfunction of the left ventricle at the expense of akinesia of the middle segment of the septal and anterior walls and apical akinesia of all walls, ejection fraction (Simpson) of 31% and grade 1 diastolic dysfunction. He did not present moderate/important valvulopathies or signs of pulmonary hypertension. The case was discussed with a clinical cardiology team and surgical team and we opted for surgical treatment of severe coronary insufficiency. On the same day, in an Intensive Care Unit (ICU) bed in the emergency room around 1:00 p.m., he developed sudden malaise followed by cardiorespiratory arrest and return to spontaneous circulation after resuscitation maneuvers. He returned hypotensive with the need for clinical and hemodynamic stabilization with vasoactive drugs (dobutamine and norepinephrine) and ECG maintained a pattern of supraevolved anterior wall, but two hours later presented a new episode of cardiorespiratory arrest in electrical activity without pulse with 8 minutes of duration with return to spontaneous circulation after maneuvers and opted for orotracheal intubation. We chose to perform a new catheterization for restudy after cardiorespiratory arrest and clinical decompensation. During the procedure, no change in arterial pattern was observed and the right coronary artery was not studied. The patient evolved with a new cardiorespiratory arrest at the end of the reversed procedure after 2 cycles of resuscitation and adrenaline maneuvers. Intra-aortic balloon implantation (mode 1:1) was chosen in the right femoral artery. Referred to the ICU for continuous monitoring and intensive care in intubated and coupled to mechanical ventilation.

In the same day night, he evolved with a new cardiorespiratory arrest, with return to circulation after resuscitation and defibrillation maneuvers. Discussed with surgical and clinical team and we opted for installation of extracorporeal assistance circuit (ECMO-VA).[1-6] ECMO entry at 11:50 p.m. on January 15 through arterial cannulation (21 RF) in the left femoral artery by dissection and direct visualization with reperfusion of the left lower limb with double lumen catheter 7 Fr and venous cannulation (23Fr) in the right femoral vein through puncture. Procedure performed without complications and confirmed location of cannulas by chest x-ray.

On January 17, 2021, sedation was switched off to assess the neurological level after cardiorespiratory arrest, and the patient opened his eyes to the call and answered simple commands. The patient evolved with worsening of the right lower limb perfusion with non-fixed cytosis and decreased temperature. Intra-aortic balloon was

removed on January 17 and requested evaluation of vascular surgery that guided maintaining anticoagulation and right lower limb warm-up. The patient also developed infectious worsening, fever and increased cardiorespiratory arrest, opting for culture collection and initiation of antibiotic therapy with piperacycline and tazobactan + vancomycin adjusted for renal function and vancocinemia. She was monitored with nephrology and due to worsening renal function (Creatinine of admission of 0.99 and 2.1 at the time of the first evaluation by the Nephrology team), maintained for now conservative treatment.

Discussed with clinical team and surgery and chosen to perform surgical approach of coronary lesions, procedure then myocardial revascularization with cardiopulmonary bypass performed on January 22, 2021 with 3 bridges, being mamaria bridge of free left breast graft in right coronary artery and sequential mamher bridge of right mammary artery in anterior descending coronary (lateral-lateral) and diagonal (terminolateral), extracorporeal circulation times of 110 minutes and tweezers 68 minutes. At the end of the surgery around 6:00 p.m., the patient returned to the ICU while still in ECMO and evolved with hemodynamic instability using norepinephrine, dobutamine and vasopressin, difficulty maintaining adequate flow in ECMO and hypovolemic shock. Presenting mediastinal drain output of 4700 ml. He received beriplex, haemocompletan, eight units of platelets, eight packed red blood cells. An exploratory thoracotomy was performed around 11:00 pm on January 22, with revision of the cavity and rigorous review of hemostasis. Patient maintained with minimal sedo-analgesia with fentanyl and precedex for comfort. Maintained in orotracheal intubation and weaning progression of ventilatory parameters and daily evaluation of awakening.

On January 24, the patient was clinically stable and hemodynamically, with low flow in ECMO and with criteria for withdrawal of assistance, an ECMO-VA clamping test was performed, maintaining good hemodynamic tolerance with dobutamine 12 mcg/kg and norepinephrine 0.25 mcg/kg/min. Discussed with a team and opted for decannulation and reconstruction of the left femoral artery (01/24/2021 at 6:00 p.m.). It evolved to extubation on January 25, performed without complications.

On January 26, he was reevaluated by infectology due to persistent fever and oriented to keep meropenem + vancomycin adjusted for antibiotics and wait for new cultures, but on January 27 the patient evolved with infectious worsening, fever and tachycardia, sepsis with no other likely focus other than right lower limb. Urgent evaluation of vascular surgery was requested and amputation of the right lower limb was indicated due to significant ischemia with extensive necrosis up to the middle third of the thigh and already mummified toes. Amputation procedure at the level of the right thigh performed on the same day around 6:00 p.m., without complications. It evolved with worsening of perfusion in the left lower limb, maintaining follow-up with vascular surgery.

Patient still under close follow-up with nephrology, indicated initiation of renal replacement therapy on January 29 due to refractory hypernatremia and hypercatabolic state. He then maintained daily reassessment and renal replacement therapy on demand.

On January 30, he presented the need for closed pleural drainage to the right due to voluminous pleural effusion on the right with respiratory repercussion and respiratory distress, performed without complications.

The patient evolved on February 4 with an increase in vasoactive drugs and cardiac tamponade confirmed by transthoracic Doppler echocardiogram performed as a bedside emergency. Conversationed with surgical team and indicated pericardial drainage. Procedure performed without complications in the operating room, on the same day, marfan technique, with output of 300 ml of hematic fluid. Return to ICU in orotracheal intubation, post-anesthetic narcosis, hemodynamically stable using dobutamine 5.5 mcg/kg/min and norepinephrine 0.3 mcg/kg/min. Extubation was performed in the immediate postoperative period.

The patient presented two febrile peaks on February 5 and the need for increased norepinephrine. Discussed with infectious disease team and expanded antibiotic therapy for polymyxin B, amicacin and maintained meropenem and vancomycin. On February 9, schilley catheter removal was requested due to partial culture result and catheter tip was sent for culture, a definitive positive result for Staphylococcus haemolyticus, antibiotic therapy with poly B + amicacin + mere and changed vancomycin to linezolid. Punctured new schilley catheter in a new site for maintenance of renal replacement therapy.

On February 11, he developed new orotracheal intubation due to tachydyspnea, respiratory distress and desaturation, refractory to measurements.

Patient maintained severe condition, refractory to treatments proposed so far, difficult weaning from mechanical ventilation, vasoactive drugs in high doses, evolving with hemodynamic worsening. Requested family reunion on February 16 to talk about reserved patient prognosis (**Figures 1-3**).

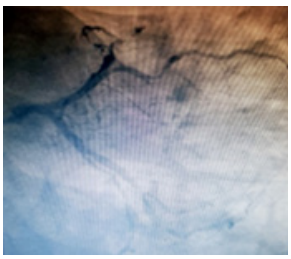

Figure 1 Circumflex artery and second left marginal branch, of great importance, diffusely atheromatous, with segmental lesion of 80% in the middle third.

Figure 2 Anterior Descending Artery exceeds the tip of the heart, is occluded in the middle third and first diagonal branch, of great importance, presents with a 70% lesion in the ostium, followed by a segmental lesion of 70% in the middle third.

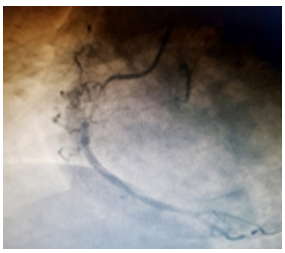

Figure 3 Dominant right coronary artery, irrigates part of the posterior wall of the left ventricle, is occluded in the middle third and posterior descending artery, of little importance, presents with a lesion of 70% in the middle third.

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On February 17, he evolved with hypotension and bradycardia, hemodynamic instability during hemodialysis, requiring interruption of renal replacement therapy. Started vasopressin at maximum dose and increased doses of vasoactive and inotropic drugs. The patient evolved with three cardiorespiratory arrests and pulseless electrical activity, the first with return to spontaneous circulation in 6 minutes and the second with return in 12 minutes. In the third cardiorespiratory arrest, the patient did not respond to the resuscitation maneuvers, performed from 6:30 p.m. to 7:05 p.m., and declared death.

Discussion

There are small studies in the literature demonstrating significant benefit of the use of ECMO during cardiorespiratory arrest, showing significant improvement in the neurological function of these patients in the long term. The use of ECMO during cardiac arrest improves tissue perfusion and oxygenation by decreasing hypoxemia time and determining better outcomes.

In summary, a patient hospitalized with acute myocardial infarction with evolved non-thrombolyzed anterior wall ST-segment supraleveling on January 11, 2021, referred for elective catheterization that demonstrated severe triarterial pattern with indication of myocardial revascularization. He evolved with cardiogenic shock due to important and refractory ventricular dysfunction, and circulatory support was chosen in veno-arterial extracorporeal oxygenation therapy as a bridge for revascularization, which was performed on January 22, without complications. The patient evolved with circulatory support removal on the 24th and extubation on day 25, but evolved during hospitalization with multiple infectious and vascular complications, requiring amputation of the right lower limb at thigh level. Even with all support and optimized therapy, the patient was never able to effectively wean vasoactive and inotropic drugs, maintaining severe ventricular dysfunction. In addition to infectious, vascular complications, cardiac tamponade, pleural effusion, respiratory failure requiring orotracheal intubation, renal failure requiring renal replacement therapy, hematological dysfunction with anemia and persistent thrombocytopenia requiring multiple transfusions during hospitalization. Despite all therapy and optimized support, the patient evolved with multiple organic dysfunction and refractoriness to the proposed treatment and death on February 17, 2021.

Conclusion

In this case of myocardial revascularization, in spite of the ECMO procedure having been successful, of the deleterious effects of all the other comprehended factors and the serious complications in the ICU the patient did not survive.

Acknowledgments

None.

Conflicts of interest

No conflict of interest.

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