CASE REPORT

Veno-arterial extracorporeal membrane oxygenation as a bridge for enabling surgery in a patient under cardiogenic shock due to acute mitral prosthesis dysfunction

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A 52-year-old male patient, who underwent mitral replacement with a mechanical prosthesis as a child, sustained a cardiac arrest which was successfully resuscitated. Further investigation showed prosthesis malfunction with significant regurgitation in the context of multi-organ failure. In such a life-threatening condition, veno-arterial extracorporeal membrane oxygenation was considered as a rescue procedure to achieve optimisation of clinical status to allow definitive surgical treatment. An unusual complete fracture of the prosthesis was subsequently identified as the cause of acute dysfunction.

Keywords: VA-ECMO, Mitral, Prosthesis, Dysfunction, Cardiogenic shock

Introduction

We report the case of a patient submitted to a mitral valve replacement during childhood, who presented a sudden cardiac arrest. After successful resuscitation, a severe mitral prosthesis dysfunction was detected. Emergency surgery became mandatory, however, the extreme instability of the patient, in addition to the distance to the operating room, made it non-viable to transfer the patient to the operating room.

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Besides, surgical adhesions due to reoperation would delay an immediate access to the heart. In such a life-threatening condition, a veno-arterial extracorporeal membrane oxygenation (VA-ECMO) life support system was proposed as a way to stabilise the patient, enable surgery, and to expedite postoperative management. An unexpected complete mitral prosthesis rupture was found to be the cause of cardiogenic shock.

The patient, a 52-year-old man, was subjected in 1972 to cardiac surgery for an atrial septal defect closure and a mitral valve replacement using a Björk-Shiley Delrin valve. After more than four decades of uneventful follow-up, he presented with an acute onset of dyspnoea, followed by syncope and cardiopulmonary arrest. He was initially resuscitated and transferred to the hospital under congestive heart failure. No abnormalities were detected on electrocardiogram, but chest radiography showed white lungs and pulmonary oedema. Blood gases showed deep hypoxemia, and he was immediately connected to mechanical ventilation because of acute respiratory failure. High doses of inotropic and vasopressor drugs were required due to refractory hypotension to keep the patient alive. A transoesophageal echocardiography was ordered which showed severe dysfunction of mechanical mitral valve prosthesis (Fig. 1A). The real cause of prosthesis dysfunction was not clear, but massive mitral prosthesis regurgitation was remarkable. In spite of continuous respiratory support, deep hypoxemia remained because of the extreme severity of the pulmonary oedema which made the correct oxygenation of the patient impossible. Multi-organ failure was rapidly established. In such a complicated situation, emergency surgery was indicated. However, rapid access to the heart and correction of mitral prosthesis dysfunction were not viable. The associated risks included transferring the patient to the operating room which was located far away from and on a different floor than the intensive care unit, the time needed to prepare basic anaesthesia and surgery, and the complex and time-consuming process of removing adhesions from the previous surgery which would irremediably delay access to the heart and would risk the patient's life. These conditions were sufficient reasons to consider stabilization of the patient mandatory before surgery. First, an intra-aortic balloon pump was placed through the right femoral artery; however, the patient's condition did not improve. Thus, to rescue the patient and as a bridge to surgery, VA-ECMO life system support was implanted through the left femoral vessels. After 2 hours, oxygenation was partially improved, and kidneys started to function, which made the patient stable enough to be transferred to the operating room. During the surgery, VA-ECMO therapy was replaced by conventional femoral extracorporeal circulation support. Through medium re-esternotomy, surgical adhesions were released. The left atrium was accessed and complete fracture of the tilting disc of mitral Björk-Shiley Delrin valve was found (Fig. 1B). The prosthesis was explanted and replaced with mechanical 25–33 On-X Conform prosthesis. After surgery, the patient was transferred to the postoperative intensive care unit under the VA-ECMO support. Resolution of the

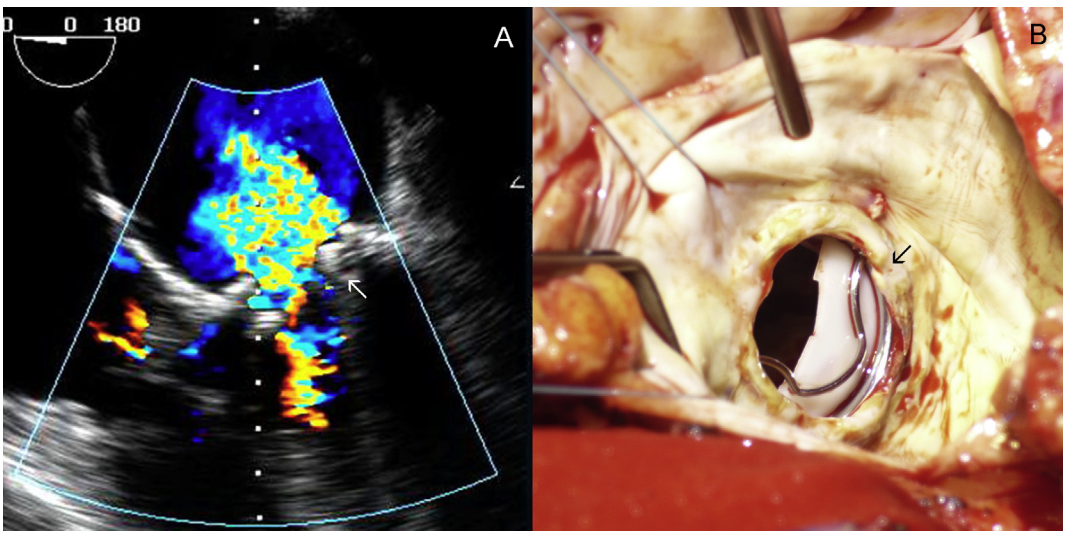

Figure 1. (A) Transoesophageal echocardiography showing mitral valve prosthesis dysfunction causing massive mitral valve regurgitation; (B) Intraoperative image of complete fracture of Björk-Shiley Delrin prosthesis.

pulmonary oedema was evident, and multi-organ failure regressed allowing ECMO explantation on the 5th postoperative day. The patient recovered gradually and was discharged home after a long postoperative stay.

Discussion

Approximately, 1% of patients undergoing routine cardiac surgical procedures can suffer severe postoperative cardiac function decompensation, leading to postoperative cardiogenic shock. Nowadays, VA-ECMO is an acknowledged treatment for refractory postoperative cardiogenic shock, and favourable long-term outcomes confirm its utility in this context [1,2]. VA-ECMO provides sufficient temporary cardiac and respiratory support to enable postoperative recovery and reversible myocardial injury. That explains why, in the event of cardio respiratory failure after cardiac surgery, an early use of VA-ECMO may be beneficial [1–3].

Abrupt mitral prosthesis rupture causing sudden mitral valve dysfunction with cardiopulmonary arrest and refractory respiratory distress is a rare and dramatic condition. Prosthesis rupture drives circulatory, pulmonary, and renal failure leading finally to the undesired multi-organ failure. Management of such a desperate condition can be challenging and may evolve to an inoperable state. Medical therapy prior to surgery is not always successful and may not be enough to stabilise the patient. In such a life-threatening situation, the surgical approach has proved to be superior to medical therapy and considered as the gold standard.

However, several conditions can make emergency surgery not always possible. Extreme haemodynamic instability of the patient, the time necessary to transfer the patient to the operating room, and anaesthesia preparation or removal of surgical adhesions in cases of reoperations which can delay a rapid access to the heart [1,2,4,5]. In those cases, preoperative implantation of a VA-ECMO life support system can be justified [1,3–5]. Beyond its known and previously reported ability to provide biventricular support for postoperative cardiogenic shock, the use of VA-ECMO is herein presented as a valuable strategy for support of patients under preoperative cardiogenic shock, who would otherwise not survive and would die. A VA-ECMO implant can stabilise gas exchange and provide haemodynamic support to enable surgery. It can also expedite management and postoperative support, allowing recovery from the preoperative and postoperative myocardial injury. Owing to its relative simplicity and low cost, it is an attractive and acceptable technique for this aim [1–5]. Its use must be decided on an individual risk profile basis because of high morbidity and mortality rates. In conclusion, it can be justified as a rescue therapy, used as a bridge to emergent valvular heart surgery, in those situations or conditions which may lead to a delay in surgery, or those situations or conditions in which the risk of death is considered unacceptable.

Conflict of interest

None.

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