



A Hybrid Intervention for Post-infarction Papillary Muscle Rupture with Severe Mitral Regurgitation: A Case Report

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Papillary muscle rupture with severe acute mitral regurgitation is a rare complication of acute myocardial infarction (AMI) that causes pulmonary congestion and cardiogenic shock. Moreover, it has a poor prognosis. Surgical intervention, including revascularization, is indicated; however, surgical mortality remains high. We report the case of an 85-year-old woman with cardiogenic shock from severe acute mitral regurgitation, in whom a hybrid intervention, combining percutaneous coronary intervention with mitral valve replacement via minithoracotomy, was performed after post-infarction papillary muscle rupture. She was discharged in a favorable clinical condition. We describe a novel hybrid intervention for treating a rare complication of AMI, which could minimize surgical invasion in elderly patients, prevent disuse syndrome after the intervention, and improve prognosis. However, mitral valve surgery via minithoracotomy for emergency cases requires technical proficiency, as well as collaboration with other healthcare professionals, and the choice to perform this procedure requires careful consideration.

Keywords: Acute mitral regurgitation, Papillary muscle rupture, Mitral valve replacement, Minimally invasive cardiac surgery, Hybrid intervention, Case report

Case report

Acute mitral regurgitation (AMR) with papillary muscle rupture (PMR) is a rare and potentially fatal complication of acute myocardial infarction (AMI) [1,2]. It causes pulmonary congestion and cardiogenic shock, and is associated with a poor prognosis. Surgical intervention with revascularization is traditionally considered to be the standard therapy; however, it is highly invasive, and the mortality rate remains high [3]. We report the successful case of a hybrid intervention that combined percutaneous coronary intervention (PCI) with mitral valve replacement (MVR) via minithoracotomy (minimally invasive cardiac surgery, MICS-MVR), for treating severe AMR with PMR as a complication of AMI.

An 85-year-old woman with a 3-day history of chest pain presented to our emergency room with dyspnea. She had a history of hypertension and dyslipidemia. Her troponin T level was elevated, and electrocardiography showed ST depression in V2–5. Chest radiographic findings showed pulmonary congestion (Fig. 1A), and transthoracic echocar-

diography (TTE) showed severe mitral regurgitation (MR) with P2 prolapse (Fig. 1B). Coronary artery angiography demonstrated 99% stenosis of the mid-portion of the left circumflex artery (LCx) (Fig. 1C). Intra-aortic balloon pumping (IABP) was initiated, and the patient was intubated in the intensive care unit (ICU). Transesophageal echocardiography demonstrated the presence of PMR; thus, severe AMR with PMR as a complication of AMI was diagnosed (Fig. 1D). Our cardiac team discussed the surgical indication, and we selected a hybrid intervention combining PCI with MICS-MVR, considering the patient's age and frailty. She developed cardiogenic shock and her hemodynamics were managed with IABP and inotrope support. Emergency PCI for LCx stenosis was performed, followed by MICS-MVR.

Cardiopulmonary bypass (CPB) was established with right femoral arterial cannulation and right femoral and jugular venous drainage. We used a 3-dimensional surgical endoscope (Karl Storz Endoskope, Tuttlingen, Germany). Cardiac arrest was achieved with antegrade cardioplegia. We approached the mitral valve (MV) through left atrioto-



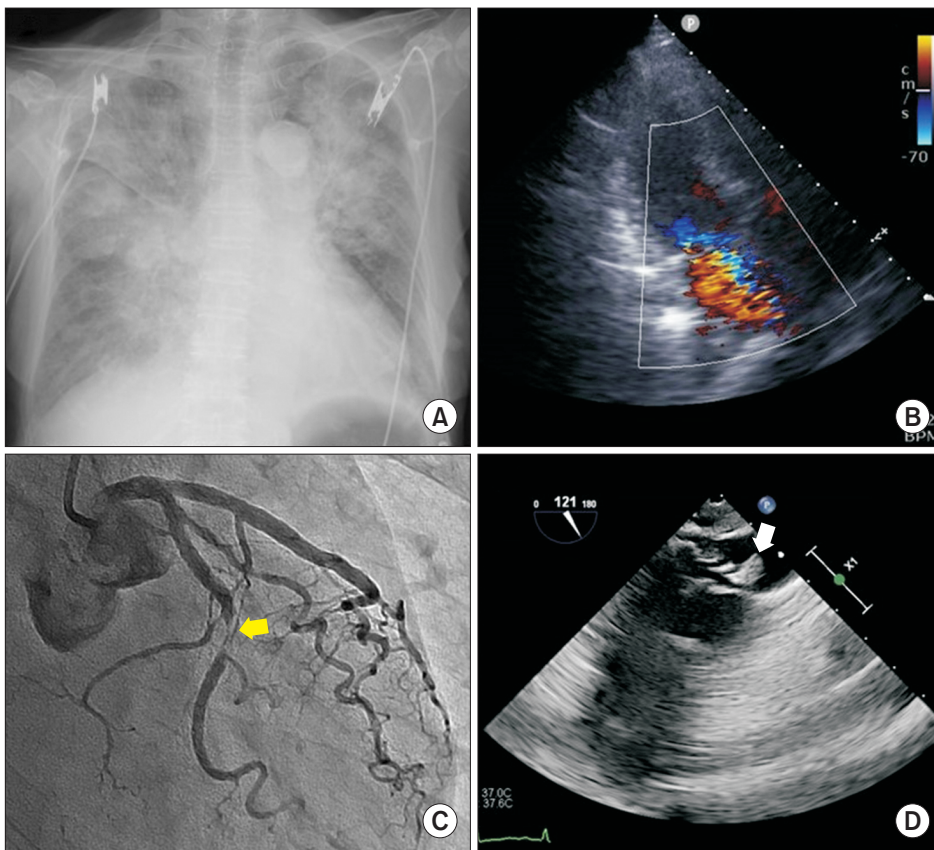


Fig. 1. Preoperative chest radiographic findings show pulmonary congestion (A). (B) Transthoracic echocardiography (TTE) shows severe mitral regurgitation (MR). (C) Coronary artery angiography demonstrates 99% stenosis of the mid-portion of the left circumflex artery (LCx) (yellow arrow). (D) Transesophageal echocardiography demonstrates P2 prolapse with papillary muscle rupture (white arrow).

my. Partial anterolateral PMR was observed (Fig. 2A) and MVR was performed using a 29-mm Epic mitral stented tissue valve (Abbott Laboratories, Chicago, IL, USA) with a good frontal view of the MV using a 3-dimensional surgical endoscope (Fig. 2B). The patient was smoothly weaned from CPB with minimal inotrope support. The operative, CPB, and cross-clamping times were 314 minutes, 221 minutes, and 118 minutes, respectively.

Postoperatively, the patient's hemodynamic status stabilized, IABP was discontinued the day after the procedure, and she was extubated 2 days postoperatively. She developed sepsis 4 days postoperatively, and the source of infection was likely a rectal ulcer. However, after antibacterial treatment, her condition improved quickly, and she was discharged from the ICU 6 days postoperatively. Postoperative TTE showed normal cardiac and bioprosthetic valve function. On discharge, the patient could walk 200 m independently, and she was transferred to another hospital for further rehabilitation.

The patient provided written informed consent for publication of the clinical details and images.

Discussion

While it is important to intervene as early as possible in the treatment of AMR to improve patients' prognosis [4], for MR and for revascularization [5], the treatment of this disease in elderly patients should be as minimally invasive as possible to avoid developing postoperative disuse syndrome. Although increasingly many reports in the literature advocate for transcatheter mitral valve repair (TMVr) as an alternative treatment option for inoperable or high-surgical-risk patients, TMVr is not routinely performed in acute settings [4]. Thus, it is sometimes performed late or only when other treatment options have failed. Moreover, conservative treatment in the late phase leads to prolonged ventilation with mechanical or inotrope support, causing disuse syndrome and respiratory complications, especially in elderly patients.

A hybrid intervention with PCI and MICS-MVR is a novel and suitable treatment strategy for elderly patients with AMR due to PMR. According to Modi et al. [6], MICS is associated with lower morbidity, less likelihood of reoperation for bleeding, less pain, and a faster return to preoperative function levels with shorter in-hospital stays than con-

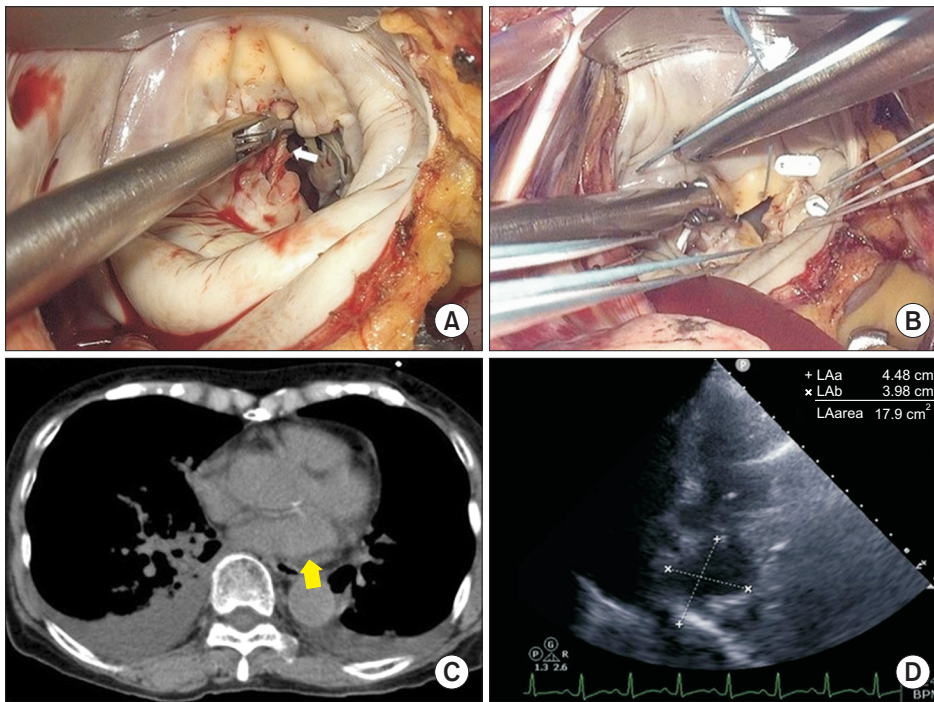


Fig. 2. Intraoperative endoscopic images show P2 prolapse with papillary muscle rupture (A, white arrow). (B) A good field of view is obtained using an endoscope via right-side minithoracotomy. (C, D) Preoperative computed tomography (yellow arrow) and transthoracic echocardiography show a small left atrium.

ventional sternotomy, with no difference in mortality rates despite longer CPB and aortic cross-clamping times. The incidence of wound complications is also significantly lower in elderly patients [7].

In most cases of AMR, the left atrium is not enlarged compared to cases of chronic MR (in this case, the preoperative data showed a left atrium diameter of 17 mm and a left atrium area of 17.9 cm²) (Fig. 2C, D), and it is difficult to identify the MV by median sternotomy, especially on the anterior side. A major advantage of the MICS approach, especially with an endoscope, is that a good frontal view of the MV is easily obtained (Fig. 2A, B), which facilitates the procedure.

In hybrid intervention for AMR, reperfusion for ischemia prior to surgery is important for reliable intraoperative cardioplegia and patients' postoperative prognosis. Conversely, it is also important to perform an early-stage surgical intervention for AMR to improve heart failure and hemodynamics. However, an acute loading of anti-platelet therapy is needed to perform PCI with a drug-eluting stent, but this could cause postoperative bleeding. In our case, we did not utilize an acute loading dose of clopidogrel pre-PCI to avoid postoperative bleeding, and we subsequently transferred the patient to the operating room soon after PCI. We then performed the operation, carried out systemic heparinization, and established CPB to avoid sub-acute stent thrombosis. After the operation, anti-platelet and an-

ti-coagulant therapy was initiated as early as possible.

Ensuring a proper indication requires careful consideration of anatomical limitations of blood access and the risk of vascular complications such as dissection. Moreover, proficient surgical skills and collaboration with other healthcare professionals, such as nurses, perfusionists, and anesthesiologists, are necessary to perform the procedure successfully and reproducibly with minimal CPB and aortic cross-clamping times.

In conclusion, to the best of our knowledge, this is the first reported case of a hybrid intervention for severe AMR with PMR following AMI. This strategy is especially beneficial for elderly patients and may improve their prognosis. However, MICS for emergency cases requires technical proficiency, and the choice to perform this procedure requires careful consideration.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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