Masters of Cardiothoracic Surgery

Managing and repairing ventricular free-wall rupture: the triple-patch technique

Roberto Lorusso[1,2], Daniele Ronco[1], Giulio Massimi[1], Michele Di Mauro[1], Federica Jiritano[1], Matteo Matteucci[1]

[1]Cardio-Thoracic Surgery Department, Heart and Vascular Centre, Maastricht University Medical Centre, Maastricht, The Netherlands; [2]Cardiovascular Research Institute Maastricht, Maastricht, The Netherlands

Correspondence to: Roberto Lorusso, MD, PhD. Full Professor of Cardiac Surgery and Extracorporeal Life Support, Cardio-Thoracic Surgery Department, Heart and Vascular Centre, Maastricht University Medical Centre, Cardiovascular Research Institute Maastricht, P. Debyelaan 25, 6202 AZ Maastricht, The Netherlands. Email: roberto.lorussobs@gmail.com.

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Clinical vignette

A sixty-five-year-old male patient was admitted to a peripheral hospital with chest pain of several hours' duration. This followed a previous episode, which occurred three days earlier. At admittance, the patient was in hemodynamic compromise, blood pressure of 90/55 mmHg, cold extremities and sweating. The ECG showed signs of infero-posterolateral acute myocardial infarction (AMI), confirmed by high blood troponin levels. The echocardiography showed pericardial effusion, with blood and clots in the pericardium. Furthermore, akinesia and reduced infero-posterolateral wall thickness and likely contained left ventricular (LV) free-wall rupture (LVFWR) were also detected.

The patient was transferred immediately to our tertiary care hospital for emergency LVFWR repair.

Preparation

The patient was brought directly to the operating room, and transthoracic echo (TTE) confirmed the previous diagnosis. Based on the clinical status and echocardiographic findings, the plan was for peripheral cannulation to establish extracorporeal circulation (ECC) with local anesthesia, followed by intubation to avoid further potential hemodynamic deterioration or cardiac arrest during sedation and intubation, and subsequent surgical correction.

Surgical technique

Whilst awake and prior to intubation, the patient was positioned on the operating table and draped. After adequate local anesthesia, the left venous and arterial femoral vessels (previous aorto-femoral bypass on the right femoral vessel) were surgically exposed. After partial heparinization, femoral vessel cannulation with pseudo-percutaneous Seldinger technique was performed with transthoracic monitoring to assess correct positioning of both cannulas. ECC was commenced to properly empty the heart and reduce the systolic ejection, and the patient was then sedated and intubated. Transesophageal echocardiography (TEE) was then performed, confirming the cardiac tamponade and the suspected contained LVFWR at the infero-posterolateral cardiac area. Median sternotomy was performed. The pericardial sac was slightly opened to allow controlled blood and clot drainage. Cardiac tamponade was clearly evident due to presence of blood under tension in the pericardium. The subsequent epicardial inspection was performed, following heart lifting, showing an evident AMI area and lesion in the middle of the injured myocardium at the infero-posterolateral area, with a contained rupture. Ventricular fibrillation was quickly induced to avoid any further danger of frank rupture and to allow LVFWR repair avoiding aortic-clamp related myocardial ischemia.

A triple-patch (bovine pericardium-Teflon felt-bovine pericardium) was then trimmed to adequately cover the

AMI area, keeping the contained rupture in the middle of the patch. BioGlue was first applied at the epicardial surface and then, between the patch layers. A few interrupted stitches were sewn at the perimetry of the wide patch lying on the epicardium in order to maintain the correct position. After spontaneous defibrillation following interruption of heart lifting, the pericardial patch was then kept in place with another compression. An intra-aortic balloon pump (IABP) was implanted prior to ECC weaning with a sheathless technique through the right femoral artery vascular prosthesis (open approach), while checking the correct position with TEE. The ECC weaning occurred without any major problem while on IABP support.

The patient's extubation was purposely performed after three days of controlled mechanical ventilation, adopting a smooth awakening process; taking strict care during the extubation phase and thereafter, to avoid hypertensive crisis or prolonged high blood pressure periods. The IABP was removed on postop day seven, again maintained for such a prolonged time to favor persisting reduced intra-LV chamber tension. The patient was finally discharge at postoperative day fourteen with overall preserved left and right ventricular function, and with adequate medical therapy to control arterial blood pressure. At six months post-operation, no signs of aneurysm or pseudo-aneurysm formation were present and, preserved bi-ventricular function was evident.

Comments

LVFWR affects 0.01% of patients affected either by ST elevation or non-ST elevation AMI, with an in-hospital mortality rate of around 40% (1). Oozing-type represents almost 50% of the operated cases, as shown by the recently published multi-centre CAUTION study, which confirmed the in-hospital mortality rate shown in the American investigations (2-4). Although a suture-based repair was performed in more than 60% of the cases in the CAUTION study, the use of sutureless technique in the oozing-LVFWR type has been shown to be safe with regards to low rates of re-rupture-related events, either at early or medium-term (3,5). The hereby presented technique represents a compromise between a sutureless- and a suture-based repair, and accounts for several other technical peculiarities. The "pseudo-sutureless" technique includes the use of a wide and rather stiff patch, to address the subsequent interplay between the patch and the inferior (epicardium), as well as superior (native pericardium) surfaces. Indeed, such a large triple-patch construction/repair provides several potential advantages, including: landing zone distant from the injured myocardial area, a smooth surface at the epicardial or native pericardial levels so as to reduce the inflammatory and fibrotic reaction which might lead to calcification, and finally, several anchoring stiches and BioGlue to maintain either the triple-patch layers together as well its position over the selected and targeted cardiac zone. As mentioned, the presence of Teflon fabric in the middle of the triple-patch provides robustness and a solid barrier to prevent recurrent rupture. In the several cases treated with such a technique, we had no re-rupture events, no intra- or perioperative unfavorable outcome, and absence of subsequent pseudoaneurysm formation. Furthermore, the use of a few peripheral anchoring stitches avoids large iatrogenic AMI, usually induced by continuous suture to fix the patch on the epicardium.

The concomitant use of intra-operative IABP, if not already preoperatively implanted, is also, in our opinion, of paramount importance for the first six to seven postoperative days following the surgical repair, to reduce the LV end-diastolic and end-systolic pressures thereby, reducing the negative tension applied over the ruptured myocardial zone (3,5).

Obviously, our technique has some limitations in the blow-out LVFWR, where repair of the frank wall rupture may require direct suturing to repair the AMI-related hole and may therefore, not be the most appropriate technical strategy (5). This triple-patch technique, however, may still find a place even in the blow-out circumstances in combination with the "suture repair" by providing a larger "containment area" which is usually present around the LVFWR.

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Footnote

Conflicts of Interest: RL is a consultant for Medtronic, Getinge and LivaNova, and Member of the advisory board of Eurosets and Fresenius/Xenios. The other authors have no conflicts of interest to declare.

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