

## Research Article

# Posterior Pericardial Effusion Affecting Hemodynamics Occurred Late after Cardiac Surgery: Left Mini-Thoracotomy as an Alternative Surgical Approach to Redo Sternotomy. Three Case Reports

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**Abstract**

Although sternotomy represents the main surgical access for most cardiac interventions, there are some cases in which alternative surgical approaches may be safer. A re-sternotomy may determine, in patients affected by posterior or very lateral pericardial effusion or mass and in redo-surgery procedures, an increased risk of injury to cardiac structures or previously placed bypass grafts. Moreover concern can arise about sternal wound dehiscences, late recovery from ICU, nosocomial pneumonia and prolonged hospital stay. A different surgical approach should be taken into account, whenever feasible, in order to reduce those risks and improve the outcomes. Below are reported three successful surgical treatments of hemodynamically compromising pericardial effusion occurred as a late complication of cardiac surgery through a lateral pericardial window via a left mini-thoracotomy. This approach was found to be as reliable as effective and definitive. The expected post procedural pain was well controlled with common pain killers and all the three patients could benefit from a short hospital stay.

**INTRODUCTION**

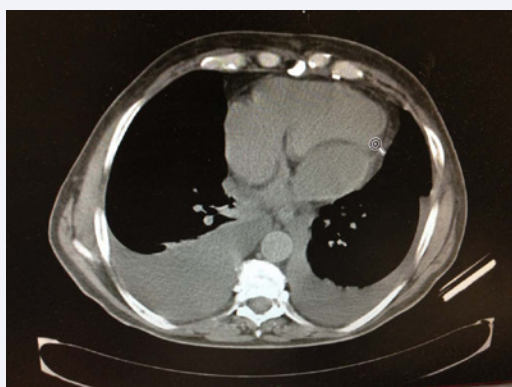
Pericardial effusion (PE) is a common complication following open heart surgery, generally occurring with few and not specific symptoms, with an incidence reported as high as 85 % while pericardial effusion conditioning cardiac tamponade (CT) is an infrequent and potentially lethal complication requiring immediate drainage, with an incidence ranging from 0.1% to 6% [1]. Most of cardiac tamponades develop in the early post operative period as one of life-threatening complications. Late cardiac tamponades instead, (those occurring at least after 72 h from operation) are reported up to 6 months determining a delay of therapeutic treatment because of their late and atypical appearance [2]. Several pre-operative and post-operative variables have been proposed as risk factors for postoperative PE/CT such as: female gender, pre and postoperative use of anticoagulants, larger body surface area, pulmonary

thromboembolism, hypertension, immunosuppression, renal failure, urgency of operation, cardiac operation other than coronary artery bypass grafting and prolonged cardiopulmonary bypass [3]. The kind of operation is one of the major well-known independent risks with special regard to aortic aneurysm surgery which accounts for a reported incidence of post-operative PE and CT up to 35% and 15% respectively. Mediastinal clot retention with osmotic fluid accumulation and serous “weeping” have been advocated as possible explanations [4]. Although CT following CABG operation is a very rare presentation, this is the situation where great attention in avoiding injuring an underlying patent ITA graft, during drainage maneuver, must be paid. This case can be easily and safely approached performing a pericardial window through a left lateral mini-thoracotomy.

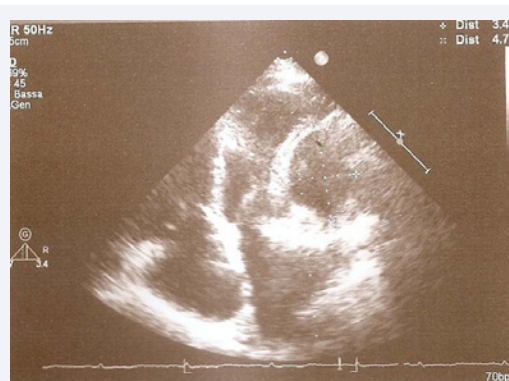
**PATIENTS AND METHODS**

We report three successful surgical drainages of late CT

occurred from 1 to 24 months after CABG operation or AVR, via a left lateral mini-thoracotomy. The patients were a 70 (A) and 79 (B) year-old men, who had undergone a 3 bypass operation (1 LIMA and 2 GSV grafts) 1 year before and a 2 bypass operation (1 LIMA and 1 GSV graft) 2 years before respectively, and a 50 (C) year-old man who had his native aortic valve replaced with a mechanical prosthesis just one month before. The first two patients (A and B) were admitted to our Department with symptoms of congestive heart failure: dyspnea and leg oedema while C had always remained in stable conditions being the diagnosis of severe PE an incidental finding during his stay in rehab. B was suffering from severe and recurrent CT. An entry ECG from A demonstrated a 65 bpm sinus rhythm with a clockwise rotation of the heart while a chest X Ray revealed a moderate to severe bilateral pleural effusion. A Chest CT scan (Figure 1) showed a capsulated mostly fluid mass with dimensions of 7.6 x 6.8 x 5 cm, localized behind the left ventricle close to the inferior pulmonary veins determining some compressing effects over the cardiac chamber towards the ventricular septum. LIMA graft appeared very close to the sternum, making the prospect of a redo sternotomy troublesome. A transthoracic echocardiography (Figure 2) showed a heterogeneous mass localized on back to lateral wall of the left ventricle with some compressing effect; a systolic Pulmonary Artery Pressure of 35 mmHg and an increased diameter of IVC. Severe cardiac tamponade was excluded. A pleural thoracentesis was performed with a discharge of about 3000 cc of serum-like fluid. Chemical and bacterial examinations of that fluid were negative for tumoral or infectious disease. As soon as the procedure was terminated, the patient showed a great relief of his initial symptoms. Follow-up echocardiographic controls showed a partial dislocation of the mass with persistent constrictive effect over the left ventricle. A transthoracic echocardiography from B instead showed a posterior pericardial cavity expansion mostly occupied by fluid, chronically affecting left ventricle kinetics. Similarly the ultrasound imaging from C showed a maximal PE width of more than 3 cm along the lateral walls determining a partial collapse of the left side chambers apparently not due to the anticoagulant medication. Although the patient was still benefiting from a good hemodynamic compensation, an emergency treatment of liquid evacuation was planned in order to prevent abrupt clinical destabilization. A



**Figure 1** Pre-operative CT scan showing a pericardial mass partially collapsing left ventricle.

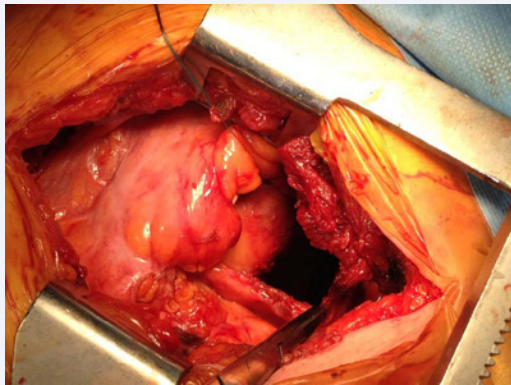


**Figure 2** Pre-operative echocardiographic image showing a heterogeneous mass localized on back to lateral wall of left ventricle.



**Figure 3** Exposure of left thoracic cavity through a left mini-thoracotomy.

surgical treatment through a left thoracotomy was planned for all of them as an alternative strategy to redo sternotomy in order to avoid injury to the LIMA. After the induction of general anesthesia, a central pressure monitoring and a double-lumen intubation, the patients were positioned in a right lateral decubitus with hips turned out to have an available access to femoral vessels. The indwelling arterial catheter was inserted into the right radial artery in order to alert the clinician on potential brachial plexus compression and consequently on need of repositioning the axillary roll. External defibrillator pads were also placed in case of life threatening cardiac arrhythmias. A left 12 cm incision was performed into the 5<sup>th</sup> intercostal space, beginning from the mid-clavicular line to just below the left nipple in order to get an adequate mobilization of the inferior pulmonary ligament and allowing a full exposure of the left ventricular apex and back-lateral wall [5]. All the underlying muscular planes were incised and the left chest cavity was exposed (Figure 3). LIMA and venous grafts were safe and far enough from the surgical field. An accurate excision of all the pleural-pericardial adhesences was done. We could explore in A a whitish-grey 4 x 7 cm conical shaped and organized mass (Figure 4) with an elastic consistence to the touch, very close to the ventricle in its back-lateral side and quite distinct from the anastomosis site of coronary grafts. The pericardium was incised in its longitudinal diameter (5-6 cm). About 150 cc, 400 cc and 160 cc of dark deoxygenated blood was drained from A, B, and C respectively, via a 5 x 5 cm window and



**Figure 4** Intraoperative finding: the pericardial mass strictly adherent to the left lateral and posterior wall incised in its longitudinal diameter.

a 28F or 32F thoracotomy tube was inserted into the pericardial space. For A the mass cavity was accurately washed with saline solution leaving the fibrotic capsule in place. The manipulation of the heart was minimal and hemodynamically well tolerated. Nonetheless, a cardiopulmonary bypass standby was setup in all cases as a potential solution since hemodynamic instability could have occurred any time [6]. Left thoracotomy was closed in a routine fashion.

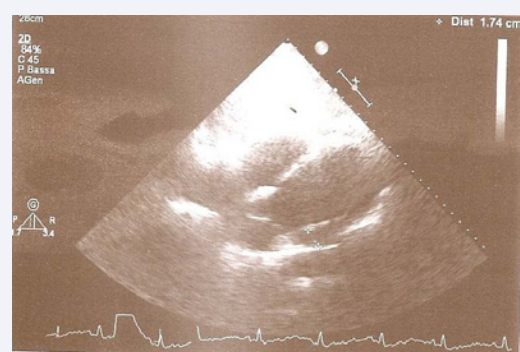
## RESULTS

The post operative course was uneventful. All the three patients were extubated after 3 to 4 hours. For the first post-operative 12 hours the intercostal pain was kept under control through i.v. paracetamol infusion or low dose of morphine, and then switched to oral. Temperature higher than 38°C were not registered. There was no need for antibiotic cover and the thoracotomy incision did not affect an early mobilization. The patients completely improved both clinically and through imaging evidence. For A, the ECG turned normal, a post procedural echocardiogram (Figure 5) confirmed a great reduction of the mass (2 x 2 cm) without any compressive effect on the cardiac chambers resulting in an expansion of the left ventricle, and a 7 day CT scan control, after discharge, showed a volume reduction of the pericardial mass and a left ventricle re-expansion (Figure 6). Patients were discharged in good health within 3 days of hospital stay. The 2 and 6 week follow up showed a trivial if not any recurrence of the effusion.

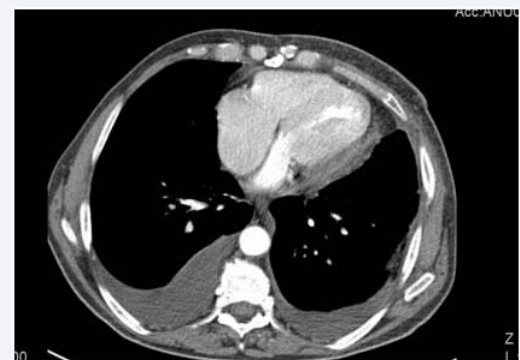
## Comment

Late and "Early" CT following cardiac surgery are two quite distinct entities. Early CT is usually caused by surgical bleeding or coagulopathy due to long heart-lung machine times while late CT has been found to be related to excessive postoperative mediastinal drainage and postpericardiotomy syndrome. Expanding hematoma was first described by Reid et al. [7]. as a lesion that persists and increases in size from more than 1 month after the initial hemorrhage. An inflammatory cause is proposed by some experimental evidences so that the inflammation deriving from the post pericardiotomy syndrome could lead to persistent bleeding. This enhances the inflammatory response, giving rise to a cycle that allows the development of an

expanding hematoma over a period from 1 month onwards after heart surgery. In the first two cases (A and B), symptoms were completely correlated to the hematoma position and got better as soon as the obstructive effect of the mass was removed. The management of such hematoma should be a complete surgical resection at an early stage before cardiac and mediastinal compression occur [8]. Echocardiography allows for a quick and accurate detection of PE and its related hemodynamic effects. In case of CT, an immediate decompression is crucial. Currently the most common treatment approaches are surgical (redo sternotomy, subxiphoid drainage or transthoracic pericardial window technique) or percutaneous (echocardiography or guided CT) drainage techniques. Percutaneous techniques are safe, simple and effective when performed pre-operatively. Mediastinal gas, surgical scars, pericardial hematoma and clot formation make this procedure not feasible in post-operative patients. Subxiphoid pericardial drainage is the most frequently used surgical technique to manage late CT after cardiac surgery. It is simple and often life-saving but not feasible for patients having a posterior or laterally located pericardial effusion or hematoma. In these cases a redo sternotomy or a thoracotomy need to be taken into account. This is the case of our treated patients. We chose left thoracotomy as surgical approach instead of a redo option with the aim of easily getting close to the posterior pericardial cavity thus avoiding possible and inadvertent entry or injury to a patent midline LIMA graft. It was found to be a



**Figure 5** Post-operative echocardiographic image showing a reduction in each dimension of the pericardial mass.



**Figure 6** Post-operative CT scan showing a volume reduction of the pericardial mass and re expansion of left ventricle.



quick and safe procedure with minimal risk or complications. Moreover thoracotomy showed the advantage of preventing the development of cardiac tamponade caused by recurrent effusion. In such cases, fluid can fill up the pleural space rather than pericardial space and offer the possibility of a percutaneous evacuation [9]. No specific cases of post surgical posterior pericardial effusion drained through a left minithoracotomy have been reported so far being this approach mostly used for non cardiac, mainly cancer, patients [10] with recurrent pericardial effusion. Commonly a traditional pericardial window or in some cases the echocardiography-guided pericardiocentesis are used for the treatment of pericardial effusions after cardiac procedures regardless of the precise localization of the fluid. We believe that for posterior effusions the thoracotomy approach can be a direct and safe solution effectively decreasing the rate of recurrence of the effusion itself.

## CONCLUSION

Left thoracotomy provides in some cases a safe alternative to the hazard of a redo sternotomy with good results in terms of surgical therapy and hospital stay. We recommend it as a feasible and effective surgical approach for pericardial drainage when a patent graft (including IMA graft) located beneath the sternum needs to be preserved and in case of localized posternolateral effusions. A better cosmetic result and a reduction of hospital stay are detectable advantages. Nonetheless several problems, such as: limited surgical exposure, potential risks in case of defibrillation, and post-thoracotomy pain syndrome, can potentially affect the outcome.

Further possible application for this strategy are reasonable for patients who have suffered from previous sternal wound complication, mediastinitis or pericarditis, mediastinal or anterior thoracic radiation therapy and in case of heavy adhesions between right heart and inferior mediastinal structures.

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### Cite this article

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