Injury Extra 42 (2011) 171–172

Contents lists available at ScienceDirect

Injury Extra

journal homepage: www.elsevier.com/locate/inext

Case report

# Massive pulmonary embolism and cardiac arrest complicating a stab wound to the heart

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ARTICLE INFO

*Article history:*
Accepted 9 May 2011

## 1. Introduction

Patients with cardiac injuries surviving cardiorrhaphy must be monitored for delayed sequelae. One possible complication, mural thrombus, has been described in the literature following blunt chest trauma, but it is very rare following penetrating trauma [1–3].

We present the case of a cardiac thrombus and massive acute pulmonary embolism with cardiac arrest following cardiorrhaphy to repair a right ventricular penetrating injury.

## 2. Case report

A 45-year-old man was admitted to the emergency department at a community hospital with a single epigastric stab wound. Initial assessment revealed a systolic blood pressure of 130 mm Hg, heart rate 85 bpm, respiratory rate of 20/min and oxygen saturation 98%.

After initial evaluation, a median laparothomy was decided that showed a laceration of the right diaphragm underlying the pericardial sac, and hemopericardium. Then, an anterior thoracothomy on the left fourth intercostal space was done on the following minutes. The pericardium was opened showing two injuries to the right ventricle. Myocardiorrhaphy was performed by interrupted sutures with Dacron reinforcement. At this time the patient arrested and immediately received internal cardiac massage and intravenous epinephrine returning him to a perfusing rhythm.

As regards to other injuries, these were confined to the left lobe of the liver.

After surgery, the patient was admitted to the intensive care unit, where received support with noradrenaline, mechanical ventilation and moderate hypothermia to prevent neurological injury. On the following days, his haemodynamia improved and mechanical ventilation was removed. At this time, he was conscious and neurologically normal. A transaesophageal two-dimensional echocardiogram was accomplished showing normal left and right ventricular size, good ventricular wall function, and normal valves and septum.

On postoperative day 9 he began with dyspnoea, tachypnoea and tachycardia. A new echocardiogram did not show changes, but a contrast-enhanced CT (Computered Tomography) was performed detecting emboli in the right segmental pulmonary arteries. Treatment with a direct thrombin inhibitor (lepirudin) instead of heparin was decided because the patient presented a severe thrombocytopenia ($48 \times 10^3$ platelets/ml).

On postoperative day 12, he suddenly had dyspnoea again, hypoxemia, hypotension, sweating, and epigastric pain. A 12 leads ECG showed transitory ST-segment elevation on inferior leads. On following minutes, ventricular fibrillation developed requiring an immediate 200 J shock, after it sinus rhythm returned. Mechanical ventilation and noradrenaline infusion were instituted again. A new contrast-enhanced CT (Fig. 1) was performed detecting new thrombi in main and segmental right pulmonary arteries. At this time, echocardiogram detected a great right intraventricular thrombus (Fig. 2), pulmonary hypertension and light dilated right ventricle. In view of lepirudin could not prevent recurrent pulmonary embolism, the anticoagulant therapy was changed: enoxaparin was started (1 mg/kg/12 h) and eventually the evolution was good: vasopressor therapy and mechanical ventilation were withdrawn, and the patient was discharged from ICU on day 32, with acenocumarol therapy.

## 3. Discussion

Some challenges may be considered: the best therapy for massive pulmonary embolism with cardiac arrest after heart surgery, and the combined cardiac and abdominal injuries initial management at a community hospital.

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doi:10.1016/j.injury.2011.05.006

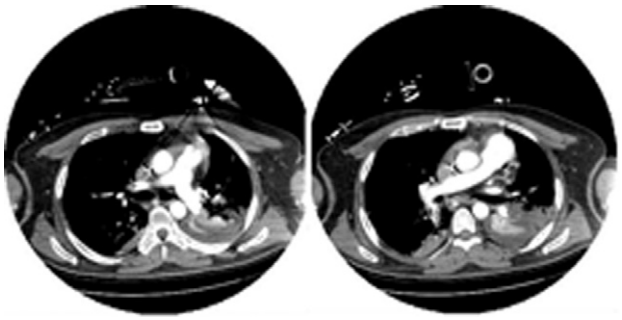

**Fig. 1.** Contrast-enhanced CT showing thrombus in main and segmental right pulmonary arteries.

Cardiac thrombus is very uncommon following penetrating trauma. Cardiac contusions often have an associated dysfunctional portion of myocardium that allows thrombus forms, but with penetrating injury to the heart, cardiac function is usually kept intact preventing this event [3]. In our patient a thrombus behind the myocardium repaired, was responsible for subsequent evolution of the patient, conditioning pulmonary embolism, right ventricle overload, ischaemia and cardiac arrest. In non-massive acute pulmonary embolism, the use of low-molecular-weight heparin is recommended [4]. An alternative with a direct thrombin inhibitor (lepirudin) could be considered for heparin-induced thrombocytopenia with thrombosis [5]. Our patient was initially treated with enoxaparin to prevent venous thrombosis, but his platelets were progressively impairing to $48 \times 10^3$ platelets/ml on postoperative day 9, and we could not be ruled out heparin-induced thrombocytopenia so replace enoxaparin with lepirudin that was started with 0.2 mg/kg as bolus dose, and 0.05 (mg/kg/h) as maintenance dose, monitoring by aPTT 1.5–2.5× baseline. Despite gradually increasing doses, we failed to maintain a level of APTT acceptable, and the patient had a recurrence with cardiac arrest, 3 days after. A new change of anticoagulant therapy for enoxaparin was decided (1 mg/kg/12 h subcutaneous) despite count platelets, with progressive improvement of the patient without bleeding complications or new recurrences. On the following days the thrombus had disappeared in the echocardiography.

In this case the embolism recurrence probably caused right ventricle ischemia and ventricular fibrillation. It was reversed with a 200 J biphasic shock on the first minute, with return of sinus rhythm, although his haemodynamia became pressor-dependent after. Two therapies might be considered in this context: the most widely accepted indication for thrombolysis is proven pulmonary embolism with cardiogenic shock, however, the recent major surgery strongly discouraged it. We have not found literature to support the thrombolysis in this case. In other cases, for instances, in perioperative strokes after heart surgery, it had been used without clinically significant bleeding complications [6]. Surgery is sometimes considered when there are right heart thrombi, but no data from randomized trials are available to support this approach; thrombolysis is more common. In our case, the high risk of surgery and the spontaneous improvement of the patient were the reasons for rejecting that option. A third option, the percutaneous mechanical thrombectomy via a right heart catheter [7], presents the high risk of the ventricular sutures, the need of experienced team, and the patient translate to a reference hospital.

In patients with penetrating cardiac and abdominal injuries, failure to diagnose initially one or other component of the injury is common. Usually the need for an exploratory laparothomy is obvious, whereas the cardiac injury is often missed. A single high epigastric stab wound must always arouse the suspicion of

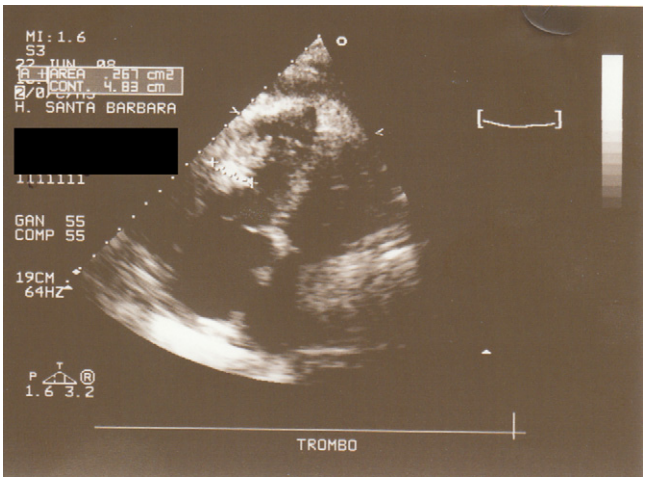


**Fig. 2.** Transthoracic echocardiogram showing a right intraventricular thrombus.

combined injuries. In a review of patients with combined trauma, a diagnostic transdiaphragmatic pericardiothomy was performed selectively in patients in whom the laparothomy was the first intervention, like our patient [8,9]. Ultrasonography could have been an important diagnostic tool in the emergency department for the assessment of abdominal injury and the diagnosis of haemopericardium, in the presence of which, an anterior thoracothomy must take priority [10,8,11].

## 4. Conclusions

Cardiac thrombus and pulmonary embolism following right ventricle penetrating trauma are possible complications.

There is no therapy recommended for massive pulmonary embolism in this context. In our experience, lepirudin did not prevent embolism recurrence.

Ultrasound is an important tool before surgery in combined injuries where an anterior thoracothomy must be priority.

## Conflict of interest statement

None declared.

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