Case Report

Suspicion of Penetrating Cardiac Injury: Curing or Caring?

Abstract

Identifying penetrating cardiac injury in hemodynamically stable patients can be challenging especially when the patient has no signs of cardiac tamponade and no pericardial effusion identified on transthoracic echocardiography. In this case report, we discuss both penetrating cardiac injuries diagnosis algorithm and treatment strategies. At present, it is difficult to refer to general guidelines transposable from one center to another. We report the paramount importance of multidisciplinary management with experienced teams to face any possible pitfalls in traumatology especially in the context of penetrating cardiac injury.

Keywords: *Cardiac trauma, chest computed tomography, focused assessment with sonography for trauma, penetrating cardiac injury*

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Introduction

Despite advances in traumatic care, penetrating cardiac injuries (PCI) remain highly lethal, particularly if surgical intervention is delayed due to diagnostic complexity. For a hemodynamically unstable patient, an immediate curing strategy with cardiac surgery and sternotomy is nondisputable.[1] Identifying PCI in hemodynamically stable patients can be challenging, especially when the patient has no signs of cardiac tamponade and no pericardial effusion identified on transthoracic echocardiography (TTE). In this context, we discuss optimal PCI diagnosis algorithm and treatment strategies.

Case History

We report the case of a 29-year-old man (non-English-speaking) who was admitted to our trauma center after multiple stab wounds. The most worrying wound was situated in the chest wall in the fourth left intercostal space, 1 cm from the sternum. Upon arrival in the triage zone, hemodynamic status was reassuring: HR = 85 BPM − NIBPS/D: 142/85 mmHg − no clinical signs of tamponade. Chest X-ray was unremarkable. Electrocardiogram revealed some repolarization abnormalities with submillimeter ST-segment elevation (V2 and V3 precordium – [Figure 1]) and incomplete right bundle branch block. Focused assessment with sonography for trauma (FAST) ultrasound protocol showed no pericardial effusion. Chest computed tomography (CT) scan revealed a pre-sternal hematoma (9 mm thickness) and a 1.5 cm^3 false aneurysm facing the right ventricle (RV) free wall without hemopericardium [Figure 2 - Panel a].

At that stage, it was decided not to perform cardiac surgery but to care for the patient instead, because of the hemodynamic stability and the absence of pericardial effusion. The patient was referred to the perioperative surgery ICU for close monitoring. In the ICU, a TTE was performed by the cardiologist to assess the false aneurysm. It showed a communication exiting from and entering in the RV in contact with the false aneurysm sac with no hemopericardium [Figure 2 - Panel b].

With this new element suggesting active bleeding inside a false aneurysm sac, it was decided to stop caring and to cure the patient with cardiac surgery. Dissection revealed a severely reshaped, fibrotic, thick pericardium. Opening the fibrotic "pericardial sac" revealed active bleeding originating from an injured right coronary artery (RCA) branch situated just above a transfixing wound of the RV wall. The surgeon sutured the RCA branch and the RV free wall (a 1-cm wound). The patient was extubated after the end of surgery and

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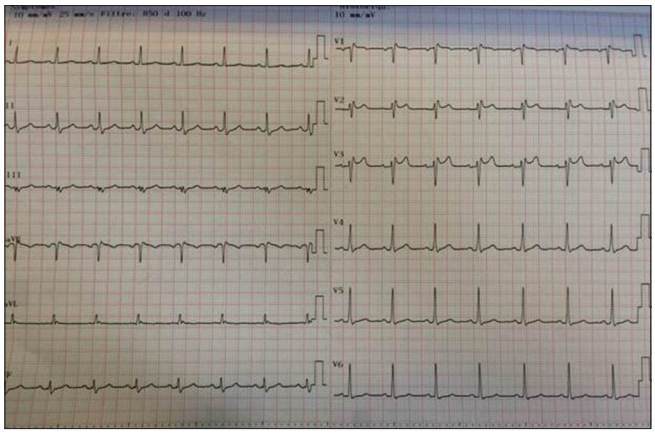

Figure 1: Electrocardiogram

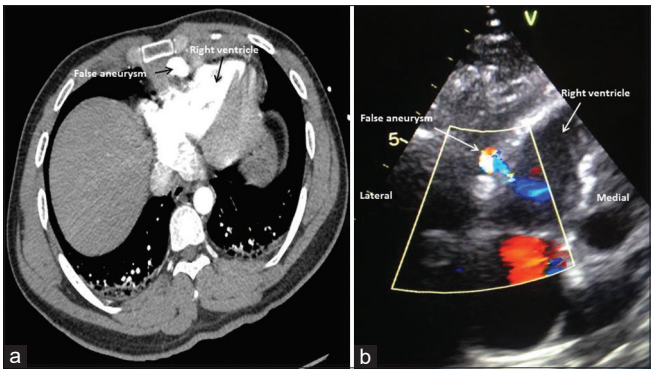

Figure 2: Panel a: Chest CT – scan: It reveals a 2-cm diameter encapsulated false aneurysm, which seemed to be in continuity with the free wall of the right ventricle. Panel b: Transthoracic ultrasonography image demonstrating flow into the false aneurysm from right ventricle – Right ventricle in diastole

recovered completely. After the surgery, English-speaking close relatives revealed that the patient had been hospitalized 5 years before for a tuberculosis constrictive pericarditis, treated during 4 months, but had refused further medical follow-up.

Discussion

This case report highlights several points regarding PCI diagnosis, and raises interesting questions regarding therapeutic options.

The first diagnosis point is related to FAST examination as an effective screening tool for penetrating cardiac trauma. FAST examination carries the advantage of being noninvasive and, with some caveats, is highly sensitive and specific. It can be performed rapidly, although it is limited by operator experience and identifies only the result of injury (fluid); furthermore, FAST does not allow the direct inspection of the heart or have the advantage of intervention to manage pericardial blood.[2]

Regarding the diagnosis of hemopericardium, the sensitivity and specificity of the test are variable, and there is concern about the number of false − negative reports, particularly in association with hemothorax.[3] In this case report, FAST failed detecting injuries, and it seemed to be concordant with the clinical feature. Based upon FAST, a surgical first-line treatment was not indicated. Slow bleeding may slowly lead to tamponade. Therefore, it may be necessary to repeat the imaging workup and clinical evaluation.[4] As RV injury is usually self-limited, proper treatment should have an echocardiographic follow-up.

The second point is related to CT scan identification of the false aneurysm aspect facing the RV free wall. The advent of multidetector computed tomography (MDCT) reduces motion artifacts due to respiratory and cardiac motions, and shows injury to the heart with accuracy.[5] MDCT detects more details including wound tracts, defects in the pericardium or myocardium, pneumopericardium, and herniation of the heart or a portion thereof through a pericardial tear. MDCT has high sensitivity and specificity in the diagnosis and characterization of cardiac effusion.[6,7] In this case, the false aneurysm with no hemopericardium was correctly diagnosed. The pericardium aspect seemed to be normal: thin (<2 mm), regular, and noncalcified with no argument to diagnose fibrotic pericardium related to the past history of tuberculosis. The MDCT correctly showed the circulating aneurysm and the absence of hemopericardium, but failed to diagnose the fibrotic hemopericardium. The latter could have been hypothesized from the false aneurysm contained in a fibrotic pericardium, whereas active bleeding would induce hemopericardium and tamponade. The right coronary branch wound was not seen on the MDCT images probably due to the lack of synchronization.

A positive MDCT (circulating aneurysm) points to a severe injury to be explored during cardiac surgery. However, at the end of the examination, we favored a noninvasive procedure. Indeed, because of the hemodynamic stability and the absence of pericardial effusion, a development of the false aneurysm at the expense of the RV could have progressed into a spontaneous thrombosis (low-pressure regime).

If the false aneurysm developed from the RCA wound, one could have considered a similar noninvasive strategy, or, in order to prove it, a percutaneous coronary intervention.

The nonspecific minor electrocardiogram abnormalities are of limited help to select the treatment. However, particular attention could be given in the case of suspicion of injuries on coronary angiography reconstruction during CT scan injection. This reconstruction might have shown the RCA exiting flow into the false aneurysm. A minimally invasive endovascular strategy could have been proposed. A right coronary covered stent placement might have been sufficient to exclude the false aneurysm if a diagnosis was made. To the author's best knowledge, this technique has been described for the other causes of coronary perforation such as revascularization or infarction, however not for trauma.[8,9]

Finally, we decided to secondarily cure the patient with cardiac surgery and sternotomy based upon a bundle of nonclinical arguments given by electrocardiogram, CT scan, and TTE strongly suggesting PCI. This raises the paramount importance of a multidisciplinary management with experienced teams to face any possible pitfalls in traumatology, especially in the context of PCI.

Retrospectively, we are not sure that a curative invasive urgent surgical treatment was needed.

For hemodynamically stable patients, it is difficult to refer to general guidelines, transposable from one center to another. Patients' critical management depends on local conditions. Recall that all the aforementioned data must be considered in combination with those from the clinical evaluation to achieve a comprehensive interpretation of the cardiovascular status, and to guide decision making.

Identifying PCI in hemodynamically stable patients can be challenging. This case emphasizes the limits of different diagnostic tools, and once again highlights the importance of clinical reasoning to guide decision making.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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