



Cardiac Tamponade: Look for Pulsus Paradoxus in the Arterial Line

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ABSTRACT

Cardiac tamponade is a life-threatening condition with a myriad of etiologies. The diagnosis is challenging and when left undiagnosed and untreated this results in a significant mortality. We present a case of a sixty-nine-year-old male with a history of stage IV breast cancer that was hospitalized with a recurrent right-side pleural effusion. A thoracocentesis was performed, and the drain removed five days after. As a complication he had extensive subcutaneous emphysema. On the day of the ICU admission, he became obtunded, with worsening of hypoxemia, hypotensive and anuric. High flow nasal cannula and norepinephrine were started. A right-side chest drain was inserted. Despite the slight improvement in oxygenation, the patient remained in shock. The arterial line showed pulsus paradoxus leading to the suspicion of cardiac tamponade. The exuberant emphysema made the acoustic window very poor but a huge pericardial effusion with heart swing and collapse of right cavities confirmed the diagnosis. A pericardiocentesis was performed with the resolution of shock. This case highlights the importance of reading and interpreting the invasive arterial line curve in the differential diagnosis of shock patients, particularly in those with poor echocardiogram acoustic window.

Keywords: Cardiac tamponade; Pulsus paradoxus; Arterial line; ICU; Thoracocentesis; Pericardiocentesis

INTRODUCTION

Cardiac tamponade is a life-threatening condition that results from an accumulation of fluid in the pericardial space which leads to impairment of the diastolic filling of the ventricles with a reduction of cardiac output and obstructive shock [1]. The main causes of cardiac tamponade are malignancies, infectious/inflammatory, trauma, iatrogenic and post-myocardial infarction and aortic dissection [2]. Clinical presentation depends on the rate of fluid accumulation relative to pericardial compliance. The classic clinical signs are Beck's triad, namely hypotension, distended jugular veins, and muffled heart sounds. However, this triad is present in a minority of cases. Other findings that can lead us to this diagnosis are the presence of pulsus paradoxus and electrocardiogram with low voltage QRS

and electrical alternans. Pulsus paradoxus was first described by Kussmaul in 1873 in patients with cardiac tamponade and despite the fact that it may be associated with different aetiologies, this remains one major to consider. Although cardiac tamponade is a clinical diagnosis, the echocardiography plays an important role in evaluation and guided treatment [3]. If left undiagnosed or untreated this condition is associated with significant mortality.

CASE PRESENTATION

We present a case of a 69 years old male patient that was admitted to the Intensive Care Unit (ICU) in shock. He had a previous history of stage IV breast cancer with pleural and bone metastasis, ischemic cardiomyopathy with reduced ejection

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fraction and complete AV block with a pacemaker dual chamber. He was hospitalized 7 days previous to the admission in the ICU with worsening of dyspnea, ortopnea and cough. A diagnosis of a recurrent right side pleural effusion was made and a thoracocentesis was performed removing 920 mL of a malignant exudate. The drain was removed 5 days after. As a complication he had an extensive subcutaneous emphysema in the trunk, face and upper limbs with a controlled chest X-ray revealing hydropneumothorax. On the day of the ICU admission, he became obtunded, with worsening of hypoxemia, hypotensive, with poor skin perfusion signs and anuric. Arterial blood gas with non-rebreather mask revealed pH 7.24, $p\text{CO}_2$ 23.1 mmHg, $p\text{O}_2$ 70.2 mm Hg, HCO_3^- 9.6 mmol/L, lactate 6.03 mmol/L. The patient went to the CT-scan and was admitted to the ICU (Figure 1). He started high flow nasal cannula and norepinephrine at a maximum dose of 0.63 mcg/kg/min. A right side chest drain was inserted. Despite the slight improvement in oxygenation, the patient remained in shock. The arterial line showed pulsus paradoxus has exhibited in Figure 2 leading to the suspicion of cardiac tamponade. The exuberant emphysema made the acoustic window very poor but a huge pericardial effusion with heart swing and collapse of right cavities confirmed the diagnosis (Figure 3). A pericardiocentesis was performed, draining 850 ml of serous hematic fluid, with the resolution of shock.

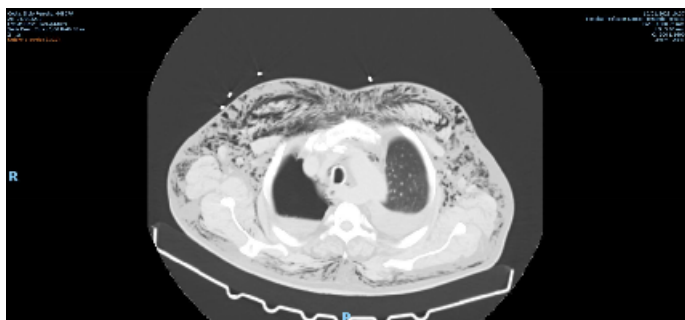


Figure 1: CT-scan showing extensive subcutaneous emphysema and right hydropneumothorax.



Figure 2: The arterial line showing pulsus paradoxus with blood pressure drop during inspiration.

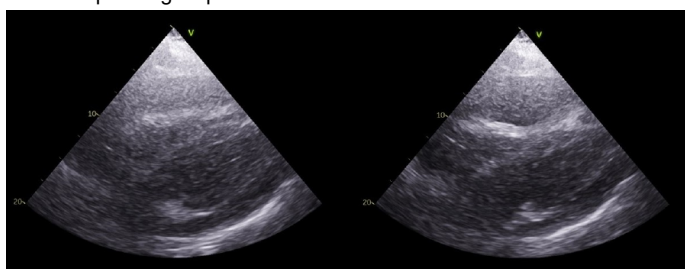


Figure 3: Transthoracic echocardiogram showing pericardial effusion with collapse of right cavities.

RESULTS AND DISCUSSION

We present a case of a patient with clinical signs of shock and a pneumothorax as an identified cause of obstructive shock. Although the pneumothorax was drained, the patient remained in shock suggesting another underlying cause. The arterial line analysis revealed the presence of pulsus paradoxus. Pulsus paradoxus in the arterial line curve can be identified as a fall of systolic blood pressure of more than 10 mm Hg during inspiratory phase, as demonstrated in Figure 2, with simultaneously representation of the respiratory curve from pulse oximetry [4,5]. In this particular case, the patient presented a limitation for the echocardiography evaluation with extensive subcutaneous emphysema, highlighting the value of the arterial line interpretation in such cases.

Several mechanisms explain the pathophysiology leading to pulsus paradoxus in cardiac tamponade. One of most importance is ventricular interdependence. The right ventricular wall becomes unable to fill with blood during inspiration restricted by increased pericardial pressure and so exerting pressure in interventricular wall. As the pericardial space is a noncompliant space in order to the right ventricle to expand more in inspiration, the left ventricle has to fill less resulting in a lower stroke volume and a lower systolic pressure [5]. Another important mechanism is the variation in left ventricular pressure with ventilation acknowledging the negative intrathoracic pressure during inspiration.

It is also important to emphasize that pulsus paradoxus may be present in pericardial and non-pericardial aetiologies, as in our patient (cardiac tamponade and pneumothorax). One should consider the pericardial disease when the drop is mainly in systolic pressure with a narrower pulse pressure, in contrary to non-pericardial disease, where there is a drop in both systolic and diastolic pressures.

CONCLUSION

This case has a teaching message and aims to stress the importance of reading and interpreting the invasive arterial line curve in the differential diagnosis of shock patients, particularly in those with poor echocardiogram acoustic window.

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CONFLICT OF INTEREST

The author declares there is no conflict of interest in publishing this article.

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