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CASE REPORT

Dyspnoea with normal B-type natriuretic peptide level: don't miss cardiac tamponade! A case report

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Abstract A 78-year-old female patient with a medical history of severe aortic stenosis and metastatic ovarian cancer with liver and right iliac bone metastases was admitted for dyspnoea that started during the same day. Six months ago, she was diagnosed with acute heart failure with a B-type natriuretic peptide (BNP) level at 682 pg/mL. Upon presentation, she was hypotensive (85/55 mmHg) and tachycardic (114 b.p.m.). Her BNP level was 278 pg/mL. A bedside echocardiogram showed a large pericardial effusion that was successfully drained. Ten days later, BNP was repeated and was 1147 pg/mL. The pseudonormalization of BNP level was due to the impaired ventricular stretching caused by the chronic cardiac tamponade.

Keywords B-type natriuretic peptide • Heart failure • Tamponade • Case report

Learning points

- A normal or pseudonormal B-type natriuretic peptide level should not exclude a cardiac cause of dyspnoea in a patient with heart failure.
- In the urgent care setting, cardiac tamponade is a serious cause of heart failure with normal or pseudo-normal BNP level and should not be missed.

Introduction

B-type natriuretic peptide (BNP) has been widely used in helping to establish the diagnosis of heart failure (HF) in the urgent care setting in a patient in whom diagnosis is uncertain and presenting with symptoms that can be similar to those found in HF.[1,2] Many known conditions can falsely increase BNP level.[1,2] However, very few are the causes of lower-than-expected or normal BNP.[3–5] We herein report the case of a 78-year-old female patient with severe aortic stenosis and end-stage ovarian cancer presenting with dyspnoea and found to have normal BNP in the setting of cardiac tamponade.

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Timeline

Eight months prior to presentation	Medical history significant for severe aortic stenosis.
	Recently diagnosed with Stage IV epithelial ovarian carcinoma with liver and bone metastases, but refused chemotherapy.
Six months prior to presentation	Dyspnoea, acute HF, BNP level 682 pg/mL.
	Bisoprolol 2.5 mg orally daily then increased to 2.5 mg orally twice daily, furosemide 40 mg orally daily and ramipril 5 mg orally daily.
Upon presentation to the emergency room	Hypotension and tachycardia, severe dyspnoea, lungs clear to auscultation. BNP level 278 pg/mL.
	Echocardiogram showed large pericardial effusion.
	Urgent pericardiocentesis drained haematic neoplastic fluid.
	Non-contrast computed tomography (CT) chest did not show consolidation or pulmonary metastases.
After 10 days	The patient was clinically stable.
	A new BNP level was 1147 pg/mL.
	Workup excluded idiopathic, autoimmune, infectious, traumatic and cardiac causes of tamponade.
	She was discharged on Day 11 of HF therapy with follow-up for a scheduled chemotherapy regimen.

Table 1 Laboratory values measured at baseline and during the recent admission

Normal reference values	Six months prior to presentation	Upon admission	10 days later
WBC (4000–11 000/μL)	9300, 58% Leucocytes	8400, 54% Leucocytes	9200, 56% Leucocytes
Hb (female: 12–16 g/dL)	9.5	8.9	9.3
Hct (36–48%)	29	27	28
TSH (0.5–5 μU/mL)	1.4	1.6	NA
FT_4 (0.8–2.3 ng/dL)	1.9	2.1	NA
BUN (7–18 mg/dL)	67	96	81
Creatinine (0.6–1.2 mg/dL)	0.9	1.9	1.1
Troponin I (<0.08 ng/mL)	0.02	0.07	NA
ALT (0–20 U/L)	72	83	79
ANA (<1:40 dilution)	NA	Requested	<1:40
RF (<1:16 dilution)	NA	Requested	<1:16
BNP (<100 pg/mL)	628	278	1147

WBC, white blood cell count; Hb, haemoglobin; Hct, haematocrit; TSH, thyroid-stimulating hormone; FT_4, free tetraiodothyronine; BUN, blood urea nitrogen; ALT, alanine aminotransferase; ANA, antinuclear antibody; RF, rheumatoid factor; BNP, B-type natriuretic peptide; NA, not available.

Case report

A 78-year-old female patient with a medical history significant for severe aortic stenosis and Stage IV epithelial ovarian carcinoma with liver and right iliac bone metastases diagnosed 8 months ago but not treated was admitted to the emergency department because of severe dyspnoea at rest of same day duration. Upon arrival, she was tachypneic, respiratory rate was estimated at 24 breaths/min, blood pressure was 85/55 mmHg, and pulse rate was paradoxical 114 b.p.m. General examination was significant for a pale and cachectic woman in acute distress. Physical examination revealed distended jugular veins and hepatojugular reflux. Cardiac auscultation was remarkable for an aortic systolic murmur Grade 4/6, best heard at the second right intercostal space with a significant decrease in S2. The lungs were clear to auscultation. An electrocardiogram showed sinus tachycardia with low-voltage QRS complexes. Laboratory workup was normal, except for a haemoglobin level of 8.9 g/dL, haematocrit of 27%, blood urea nitrogen of 96 mg/dL, creatinine level of 1.9 mg/dL, and mildly elevated liver enzymes. Troponin I level was 0.07 ng/mL (cut-off value 0.08) (*Table 1*).

Six months ago, she presented with dyspnoea and she was diagnosed with acute HF. Her baseline BNP level was 682 pg/mL (congestive HF unlikely if BNP < 100 pg/mL and very likely if BNP > 400 pg/mL). Her medications included furosemide 40 mg orally once daily, bisoprolol 2.5 mg orally twice daily, and ramipril 5 mg orally once daily. A new BNP level to rule out decompensated HF was 278 pg/mL. A chest radiograph showed cardiomegaly with clear lungs (*Figure 1*). A bedside transthoracic echocardiography showed cardiac tamponade (*Figure 2*), in addition to severe aortic stenosis (aortic valve area 0.8 cm^2, mean gradient 46 mmHg, and peak jet velocity 4.7 m/s) and left ventricular hypertrophy. The ejection fraction was calculated at 50–55%. An urgent ultrasound-guided pericardiocentesis drained

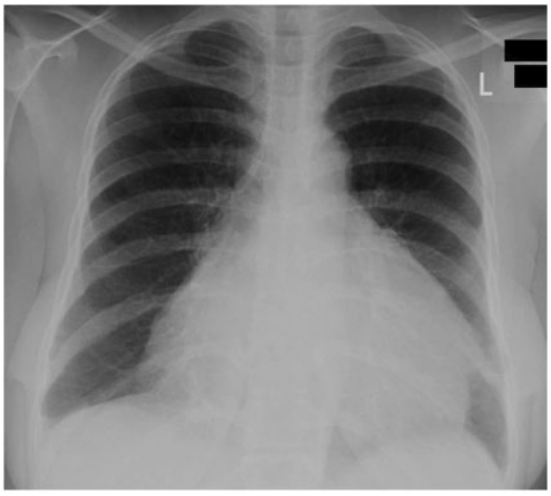

Figure 1 Water bottle sign on chest X-ray consistent with pericardial effusion.

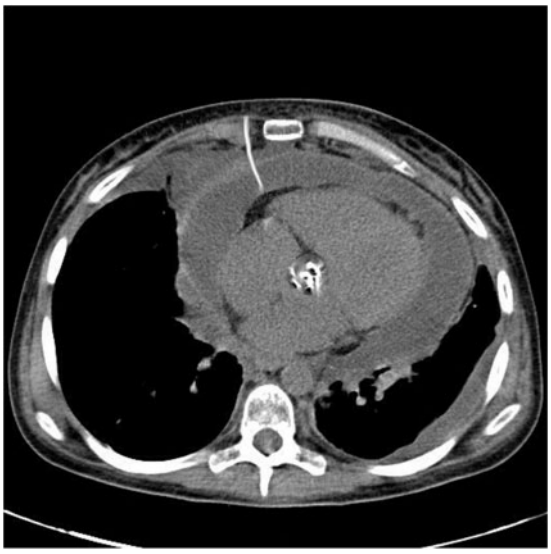

Figure 3 Non-contrast computed tomography scan of the chest showing resolving tamponade after insertion of a pericardial drain.

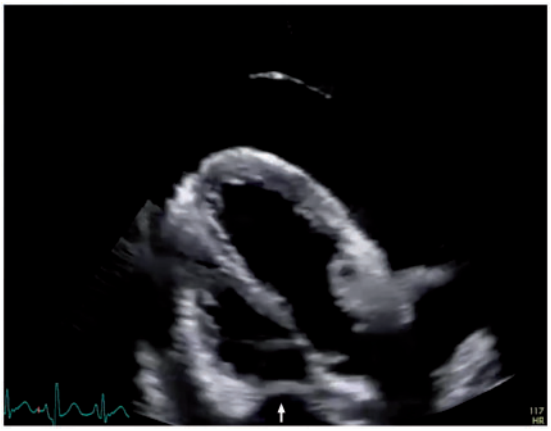

Figure 2 Transthoracic echocardiogram showing a large pericardial effusion with right atrial collapse (arrow) consistent with a cardiac tamponade.

830 mL of haematic fluid, leading to significant clinical improvement without any complications. Cytological examination of the pericardial fluid did not show any malignant cell. However, analysis of a fluid sample revealed a haematocrit level of 11%, white cell count of 2805/mL with 64% lymphocytes and 12% monocytes, lactate dehydrogenase of 372 U/dL, and glucose level of 67 mg/dL. CA125 was significantly elevated with 121 U/mL (normal < 35 U/mL). A purified protein derivative skin test was negative. Gram stain and three culture bottles were also negative. A CT scan of the chest did not show pulmonary metastases or consolidation (*Figure 3*).

The patient was admitted to the coronary care unit and, 10 days later, transthoracic echocardiography was repeated showing a normal pericardium with a residual minimal effusion. A new BNP level was therefore ordered revealing a significant increase to 1147 pg/mL. The patient was clinically stable, and her vital signs were within normal limits. Serum antinuclear antibody and rheumatoid factor came out normal. All laboratory values are shown in *Table 1*. She was discharged the next day with a scheduled 1 week appointment in the clinic for optimization of her medical treatment and discussion of the potential benefits of chemotherapy protocols but was lost to follow-up.

This case report was approved by the ethics committee of Clemenceau Medical Center.

Discussion

BNP has diuretic, natriuretic, and vasodilator properties. Nevertheless, BNP may reduce blood pressure, which is not its main physiological effect. Additionally, BNP is mainly released by the ventricular myocardium in response to elevations of end-diastolic pressure and volume, whereas other natriuretic peptides can be produced by the atria.[6]

Few conditions are associated with elevated BNP other than congestive HF and include acute myocardial infarction, atrial fibrillation, acute coronary syndrome, cardioversion, valvular heart disease, and myocarditis.[1,2] Other non-cardiac causes include acute kidney injury, chronic kidney disease, hypertension, and pulmonary diseases such as pulmonary hypertension, severe chronic obstructive pulmonary disease, pneumonia, pulmonary embolism, adult respiratory distress syndrome, and older age.[1,2]

Obesity is associated with lower BNP levels in healthy individuals and patients with chronic HF. Conditions associated with lower-than-expected BNP are female gender, liver cirrhosis, hyperthyroidism, sepsis, chemotherapy, flash pulmonary oedema, and constrictive pericarditis.[3–5]

In case of pericardial constriction, the ventricular wall stretch is limited by the thickened stiff pericardium. These physiological differences suggest that the elevation in plasma BNP levels in constrictive

pericarditis is modest and is expected to be much less than the levels measured in case of restrictive cardiomyopathy.[7]

In our case, the BNP level was expected to be significantly high because of the acute kidney injury and the patient's cancer and HF history. However, it was found to be normal for her age. Based on the laboratory values, the progressive accumulation of bloody fluid in the pericardium was thought to be of malignant origin, despite the absence of malignant cells. Vaitkus *et al.*[8] showed that cytological examination of pericardial fluid was positive for malignancy in only 65–85% of cancer patients who underwent pericardiocentesis.

Chronic tamponade resulted in a constrictive physiology leading to impaired ventricular stretching and a subsequent lower-than-expected BNP level. When tamponade resolved, BNP level was sufficiently high to explain the symptoms of HF of the patient. A study conducted by Minai *et al.*[9] validated the importance of our observation. Patients with cardiac tamponade had a pseudonormal BNP level. When pericardiocentesis was performed, BNP level was significantly high. To our knowledge, other causes that can decrease BNP level were not present in our case (e.g. sepsis, chemotherapy, or other conditions mentioned earlier).

Conclusion

In the urgent care setting, patients admitted with dyspnoea and suspected to have HF despite a normal or pseudonormal BNP level should have an urgent echocardiogram to exclude any pericardial disease, especially a chronic tamponade. The clinician's role is crucial, because a lower-than-expected BNP level can mask an underlying life-threatening condition and if diagnosed it can be lifesaving.

Consent

Informed consent was obtained from this patient for publication of this case history and associated images in line with COPE recommendations.

Conflict of interest: none declared.

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