

## CASE REPORT

## Cardiac Tamponade Presenting as Refractory Asthma

以顽固性哮喘为表征的心脏压塞

Taponamiento cardíaco que se presenta como asma resistente al tratamiento

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## ABSTRACT

Asthma has numerous etiologies, and successful treatment requires a proper diagnosis. Changes in weather and exposure to dust can make treatment of asthma difficult. This case exemplifies a diagnostic dilemma associated with bronchospasm; bronchospasm can have an occult cardiac etiology. Diagnosis can be particularly challenging in rural sub-Saharan Africa during the *Harmattan*, when winds are blowing sands from the Sahara into nearby villages, especially when radiographs are not available. This case is that of a 40-year-old female Ghanaian woman with a lifelong history of asthma. Although she has often had exacerbations of bronchospasm during the dusty *Harmattan* season, her bronchospasm was now refractory to usual treatments. X-rays were not available at the clinic in the rural city of Tamale, Ghana, and bedside ultrasound was utilized. She was found to have cardiac tamponade with secondary “cardiac asthma.” After 750 cc of fluid was aspirated during a bedside pericardiocentesis, her bronchospasm immediately resolved. The cardiac effusion was due to previously unknown renal failure from hypertension. The patient was referred for dialysis and 1 year later was well without any recurrence of significant cardiac effusions. Healthcare providers should be wary of atypical non-pulmonary etiologies of bronchospasm, especially in cases where there is an inadequate response to usual treatment. Bedside ultrasound has great utility for the diagnosis of cardiac tamponade.

## 背景

引发哮喘的病因有很多种，若要成功治疗，必须进行适当诊断。天气变化和接触粉尘可能会使哮喘的治疗难以进行。此病例例示了与支气管痉挛相关的诊断困境；而支气管痉挛可能拥有一个隐匿性的心脏病因。在撒哈拉沙漠以南的非洲农村地区的哈麦丹风期间，风会将撒哈拉沙漠的沙子吹入附近的村落中，诊断非常难以进行，尤其是在无 X 光照相设备可用之时。此病例中的患者是一名拥有终身哮喘病史的 40 岁加纳女性。尽管在充满沙尘的哈麦丹风季节里，她的支气管痉挛经常恶化，但目前的正常疗法已很难治愈她的支气管痉挛。在加纳塔马利这个农村型城市的诊所里，并没有 X 光照相设备，医生采用的是床旁超声技术。她被诊断患有心脏压塞，并伴有继发性“心脏哮喘”。床旁心包穿刺术期间，在医生吸出 750 cc 液体后，她的支气管痉挛立即得到了解决。心包积液是由先前未知的高血压致肾衰竭造成的。患者转而接受透析，并于 1 年后痊愈，且并未再次出现任何明显的心包积液。医疗护理提供者应提防支气管痉挛的非典型非肺部病因，尤其是在那些对正常疗法未做出充分响应的病例中。床旁超声在心脏压塞诊断方面起着非常重要的作用。

## SINOPSIS

El asma tiene diversas etiologías y el éxito del tratamiento exige un diagnóstico correcto. Los cambios en las condiciones atmosféricas y la exposición al polvo pueden dificultar su tratamiento. Este caso ejemplifica un dilema diagnóstico asociado con el broncoespasmo, que puede ser de etiología cardíaca oculta. El diagnóstico puede ser especialmente difícil en el África subsahariana rural durante el período del *harmatán*, cuando el viento sopla llevando arena del desierto del Sáhara a los pueblos cercanos y, especialmente, cuando no es posible realizar radiografías. Este caso es de una mujer ghanesa de 40 años con antecedentes de asma durante toda su vida. Aunque solía sufrir reagudizaciones de broncoespasmo durante la época del *harmatán*, ahora el trastorno se había vuelto resistente a los tratamientos habituales. En la clínica de la ciudad rural de Tamale (Ghana) no había posibilidad de obtener una radiografía y se utilizó un ultrasonido de cabecera. Se halló que presentaba taponamiento cardíaco con «asma cardíaco» secundario. Tras aspirar 750 cc de líquido mediante una pericardiocentesis en la cabecera, su broncoespasmo desapareció de inmediato. El derrame cardíaco se debió a una insuficiencia renal anteriormente desconocida derivada de la hipertensión. Se remitió la paciente para que recibiera diálisis y, 1 año más tarde, se encontraba bien y sin recurrencia de derrames cardíacos de importancia. Los profesionales sanitarios deben sospechar etiologías atípicas no pulmonares del broncoespasmo, especialmente en aquellos casos en los que se produce una respuesta inadecuada al tratamiento habitual. El ultrasonido de cabecera del paciente resulta de gran utilidad para el diagnóstico de un taponamiento cardíaco.

## INTRODUCTION

Successful treatment of bronchospasm requires a proper diagnosis of its etiology. Non-pulmonary causes should be considered especially if symptoms are persistent and refractory to typical treatment regimens. Evaluation can be particularly challenging in rural communities that have no access to radiographs. This article presents a case of asthma that was refractory to all treatments in the rural city of Tamale, Ghana.

This 40-year-old woman had asthma since childhood. She typically experienced an increase in symptoms and refractoriness to treatment during the dusty season, when the *Harmattan*, winds carrying Sahara sands, envelops Northern Ghana. This year the patient's bronchospasm worsened during the *Harmattan* but, unlike in prior years, was unresponsive to her routine medications plus prednisone. She had a blood pressure of 106/70, heart rate of 98, and respiratory rate of 22. No blood tests or x-rays were available in this community. A donated portable bedside ultrasound revealed cardiac tamponade. Emergency pericardiocentesis was performed, and the patient's wheezing immediately resolved. Her blood pressure post-procedure was 180/100. The patient was diagnosed with renal failure due to hypertensive nephropathy. She received dialysis and 1 year later had no recurrence of cardiac tamponade but still required medication for asthma.

This case is important in that it reminds clinicians that bronchospasm is not always of pulmonary origin and can be due to "cardiac asthma." Additionally, it adds to a growing body of literature illustrating how bedside portable ultrasonography is a useful diagnostic tool, especially in areas without access to more expensive modalities such as x-rays. This case serves as a reminder that a normal blood pressure reading can occur with cardiac tamponade if the patient has baseline hypertension. It also highlights the importance of the systems aspect to medical care, noting the interrelation of physical and social environments.

## CASE PRESENTATION

A 40-year-old Ghanaian female farmer presented to her internist with an exacerbation of asthma. She has lived all of her life in Tamale, Ghana, and she and her physician were accustomed to asthmatics having increased symptoms at this time, during the dry season when the *Harmattan*, dry desert winds carrying sand off of the Sahara, blanket northern Ghana.<sup>1</sup> Her baseline medication was only an albuterol inhaler, which was used rarely on an as-needed basis. In prior years, she would increase her albuterol to two puffs four times a day, and that would typically control her bronchospasm. For the previous 5 weeks, her medications were albuterol inhaler two puffs four times a day, budesonide 400 µg two puffs two times a day, montelukast 10 mg per day, and fluticasone 250 µg/salmeterol 50 µg one puff two times a day. Her respiratory symptoms did not abate, so she was put on two courses of prednisone 20 mg per day for 5 days, the last course ending 2 weeks previously, without relief.

She presented to an outpatient medical clinic in Tamale, a city with limited access to x-rays or blood tests. The patient complained of mild shortness of breath at rest but severe dyspnea on exertion for 1 month that had increased over the past 2 weeks despite the additional medications ordered by her internist. She denied experiencing orthopnea, chest pain, cough, fever, chills, abdominal pain, heartburn, dyspepsia, leg trauma, or swelling. The symptoms did not alter at any time of the day. She had a history of hypertension diagnosed many years ago but never took antihypertensive medication due to financial constraints. She also has had many episodes of malaria, with the last episode 5 months earlier, which was treated with artemether/lumefantrine. Her family history is significant for a mother who has had asthma since she was a teenager. The patient is poor, lives in Tamale, has never had a chest x-ray, and has had no blood tests for 15 years. Controlling her asthma is crucial as she is a farmer who works in the field 7 days a week performing manual labor.

The patient is a thin, muscular woman who appeared with mild dyspnea at rest. She was able to speak in full sentences without distress but had a mild increase in shortness of breath when asked to climb onto the exam table. She had a blood pressure of 106/70, heart rate of 98, respiratory rate of 22, and temperature of 37°C (98.6°F). Examination of the nose and throat were normal. Auscultation of the lungs was remarkable for bilateral wheezing in mid-late expiration in all lung fields with prolonged expiration and 1+ bibasilar inspiratory crackles. There were no areas of dullness to percussion. Cardiac exam revealed a regular rate and rhythm without murmurs, and heart sounds were not muffled. Neck veins were unable to be visualized. Abdominal exam revealed a scaphoid abdomen with normal bowel sounds, no masses or organomegaly, and no tenderness. There was no calf tenderness and no lower-extremity edema. She had 2+ carotid, dorsalis pedis, femoral, and radial pulses bilaterally.

The clinic did not have radiographic capabilities. However, a physician from the United States was visiting and teaching ultrasonography to the Ghanaian clinicians. He used a portable bedside ultrasound that had been previously donated to evaluate the patient. Subcostal and 4-chamber apical views revealed a swinging heart<sup>2</sup> within a large pericardial effusion with diastolic collapse of the right ventricle.<sup>3</sup> A diagnosis of pericardial tamponade<sup>4</sup> was made, and an emergency pericardiocentesis was performed via a parasternal approach in the left third intercostal space. After 100 cc of straw-colored fluid were removed, the patient was significantly improved. A total of 750 cc was aspirated, and a repeat ultrasound now revealed a trivial effusion with normal ventricular function. The patient then stated that her breathing was normal. Post-procedure, the patient had clear lungs, a blood pressure of 180/100, a heart rate of 72, and a respiratory rate of 12. She was referred to Accra, the capital of Ghana, for blood tests that were performed 10 days later. Her creatinine was

8.2 and blood urea nitrogen (BUN) was 92. She had a normal chest x-ray and after an extensive evaluation by a nephrology consultant was diagnosed with renal failure due to hypertensive nephropathy. She received dialysis and 1 year later had no recurrence of cardiac tamponade but still required albuterol inhaler as needed that was increased to every 6 hours during the *Harmattan* to control her bronchospasm.

## DISCUSSION

Pericardial tamponade is an unusual non-pulmonary etiology of bronchospasm. There is increasing compression of all cardiac chambers as fluid fills the pericardial sac with equalization of intracardiac chamber pressures. Venous return to the heart diminishes as the low-pressure venous system cannot overcome the increase in intrapericardial pressure. Less blood enters the ventricles, and increasing intrapericardial pressure compresses the heart, forcing the intraventricular septum to bow into the left ventricle.<sup>5</sup> This intraventricular dependence leads to decreased filling of the left ventricle and decreased ejection fraction. With acute decompensation, the pulmonary-capillary membrane may succumb to increased pressure, with shearing of the capillary and release of fluid, protein, and occasionally red blood cells into the alveoli.<sup>6</sup> Pulmonary edema from left ventricular failure can cause bronchiolar compression and increased airway resistance with subsequent coughing or wheezing.<sup>7</sup> This “cardiac asthma” is a clinical syndrome induced by acute passive congestion and edema of the lungs that occurs when the left side of the heart suffers from a sudden disproportion between workload and work capacity.<sup>8</sup> The etiology of tamponade in this case was renal failure. Other potential etiologies for tamponade include infections, hypothyroidism, drugs, cancer, radiation, and collagen vascular disease.<sup>9</sup>

This case is relevant for several reasons. It illustrates that not all bronchospasm has a pulmonary etiology. This woman had asthma for many years but now also had “cardiac asthma” from cardiac tamponade due to her previously undiagnosed renal failure. She had inspiratory crackles, which can be seen in congestive heart failure and are not typical for asthma. Auscultation of crackles might be difficult as very prominent wheezing could obscure it. In fact, other physicians did not appreciate inspiratory crackles presumably for this reason. Although normotensive at presentation, this patient had a history of hypertension. In view of her possible relative hypotension and her findings of crackles, bronchospasm, and dyspnea, a bedside portable ultrasound was indicated,<sup>10</sup> and it revealed the definitive diagnosis.

Tamponade can cause hypotension due to decreased stroke volume, jugular-venous distension due to impaired venous return to the heart, and muffled heart tones due to fluid inside the pericardium.<sup>11</sup> The patient did not have visibly distended neck veins, illustrating that these findings, known as Beck’s triad,

are unreliable for the diagnosis of pericardial tamponade as it is seen only in a minority of patients.<sup>12</sup> Dyspnea is the most common presenting finding with cardiac tamponade.<sup>13</sup> Although this patient presented with normal blood pressure, it increased substantially to the patient’s baseline hypertensive state after pericardiocentesis. Pericardiocentesis with a parasternal approach using ultrasonographic guidance is the preferred technique.<sup>14</sup> Her blood pressure at presentation, while seemingly normal, was actually significantly lower than her baseline. Dialysis treatments prevented recurrences of cardiac tamponade.

In 2000, the American Medical Association passed Resolution 108 and reaffirmed Policy H-230.960, providing general acceptance of bedside ultrasound by non-radiology physicians and recognized that “ultrasound imaging is within the scope of practice of appropriately trained physicians” and not a specialty specific privilege.<sup>15</sup> This report also adds to the growing body of literature illustrating that bedside portable ultrasound is gaining utility as a useful diagnostic modality by non-radiologists<sup>16</sup> in areas without access to radiographs. Compared to other modalities such as x-rays, it is less costly, requires less training, and uses few consumable items,<sup>17</sup> making it ideal for use in areas with poor access to more advanced diagnostics.<sup>18</sup>

This case highlights the importance of the systems aspect of medical care, noting the interrelation of physical and social environments. The patient did have asthma that was worsened each year by environmental winds from the Sahara. Yet pericardial tamponade, rather than an environmentally related exacerbation of asthma, proved to be the etiology of her dyspnea. Because she was indigent, the patient could not afford to treat her hypertension with medication. She lived in an area without significant diagnostic medical capabilities and therefore did not have access to blood tests to diagnosis her chronic renal disease. Yet a portable ultrasound was available in this clinic and was crucial in diagnosing pericardial tamponade. Fortunately, the patient was able to procure funds to be cared for at the only dialysis facility in Ghana and was doing well without a recurrence of tamponade 1 year after pericardiocentesis.

## CONTEXT AND GOAL

This case is pertinent for multiple reasons. It illustrates that not all bronchospasm has a pulmonary etiology and that “cardiac asthma” should be considered, especially in cases of refractory bronchospasm. It also shows how diagnostic ultrasound can be used by non-radiologists in critically ill patients. Furthermore, this case is an example of how environmental changes, occupation, and finances all affect healthcare.

## CONCLUSION

The etiology of bronchospasm is not always of pulmonary origin, and non-cardiac etiologies such as pericardial tamponade should be pursued, particularly



when wheezing is refractory to treatment. Bedside ultrasonography can be used as a diagnostic modality for cardiopulmonary disease, especially in areas without access to x-rays.

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