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Case Report

Cor Pulmonale an Overlooked Complication of Pulmonary Tuberculosis: A Case Report

Okeke Chinelo Vivian [1], Antia Samuel Edem [2], Ogoke Victor Ikechukwu [3], Eze James Ejikeme [4], Antia Grace Amarachi [5], Okoro Kenneth Johnson [4]

[1]Consultant Pediatrician, National Obstetrics Fistula Center Abakaliki Ebonyi State Nigeria.
[2]Consultant Cardiologist, Alex Ekueme Federal University Teaching Hospital Abakaliki Ebonyi State Nigeria.
[3]Consultant Gynaecologist, Imo State University Teaching Hospital Orlu Ummuna Nigeria.
[4]Consultant Pediatrician, Alex Ekueme Federal University Teaching Hospital Abakaliki Ebonyi State Nigeria.
[5]Pediatric Resident, National Obstetrics Fistula Center Abakaliki Ebonyi State Nigeria.

*Corresponding Author: Okeke Chinelo Vivian; *chinelookekemail@gmail.com*

Abstract

Background: Cardiovascular complications are rare in tuberculosis. It causes severe morbidity and mortality. There is paucity of data on cor pulmonale as a complication of pulmonary tuberculosis in pediatric population in Nigeria. Physicians need to develop high index of suspicion in order to ensure early diagnosis and prompt treatment. ***Case Presentation:*** In this case report, a 16-year old female, presented with constitutional symptoms of three months duration with acute deterioration evidenced by tachycardia, tachypnoea and hypoxia. Chest radiograph documented widespread reticulonodular opacities involving both lungs with mildly dilated cardiac silhoette (cardiothoracic ratio of 50.8%). Sputum and stool gene xpert were positive for rifampicin non-resistant tuberculosis. Electrocardiography revealed sinus rhythm with AV block 1 while echocardiography showed dilated right ventricle with borderline systolic function and interventricular septal shift to the left. A diagnosis of disseminated tuberculosis (lungs and spine) complicated with cor pulmonale was made. Treatment initiated with anti-tuberculosis, oxygen, steroids, diuretics recorded near complete resolution of symptoms. ***Conclusion:*** We recommend cardiac workup in all pulmonary tuberculosis cases with disproportionate tachycardia.

Keywords: ***pulmonary tuberculosis, cardiac dysfunction, cor pulmonale.***

Background

Pulmonary tuberculosis accounts for more than 80% of tuberculosis [1]. Extra pulmonary tuberculosis most commonly involves the pleura and lymph nodes, other systems involved includes gastrointestinal, central nervous system, cardiovascular, genitourinary, and osteoarticular system. Cardiovascular tuberculosis accounts for 1% to 2% of all tuberculosis cases in immunocompetent cases [2]. Cor pulmonale is an overlooked cardiovascular complication of pulmonary tuberculosis especially in the pediatric age group in Nigeria or Africa. This is evident by paucity of data in published literature regarding its occurance in Sub Saharan Africa where the burden of pulmonary tuberculosis is enormous. Some reasons may be due to low index of suspicion by clinicians, programmatic nature of tuberculosis that allows treatment in specialized settings, cost of echocardiography etc. Cor pulmonale is a modification in the structure and function of the right ventricle (RV) of the heart caused by a primary disorder of the respiratory system. A common link between lung dysfunction and the heart in cor pulmonale is pulmonary hypertension. Cor pulmonale can also develop secondary to a wide variety of cardiopulmonary disease processes. Although cor pulmonale commonly has a chronic and slowly progressive course, acute onset or worsening cor pulmonale with life-threatening complications can occur [3].

The American Society of Cardiology project called NET-heart project "Neglected tropical diseases and other infectious diseases involving the heart" aims to create awareness concerning the cardiovascular complications due to tuberculosis, diagnostic modalities for better management and rationale treatment to decrease mortality and morbidity [4,5]. This case report aims to bring to fore this awareness in pediatrics tuberculosis management in Nigeria.

Case Presentation

16-year-old indigent female, primary six pupil, with history of contact with chronically coughing adult and poor immunization history with no addiction history. Normotensive, non-diabetic, referred from a peripheral hospital to our center on account of a three month history of cough, low grade fever, drenching night sweats, weight loss and a two month history of progressive breathlessness. Cough was said to be productive of whitish sputum, non-paroxysmal, non-whooping with history of contacts with chronically coughing person. This was associated with low grade intermittent

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fever temporarily relieved by anti-pyretic. Patient also admitted to drenching night sweat and weight loss evident by loose previously fitted clothing. Two months prior to presentation, she developed breathlessness with associated orthopnoea. Breathlessness progressively worsened to shortness of breath at rest about a month prior to presentation. She also complained of pleuritic retrosternal chest pain aggravated by coughing, temporarily relieved by analgesics.

On account of symptoms, she was given herbal concoction for 2 weeks with no improvement. She was taken to a peripheral hospital where intravenous drugs were given to no avail necessitating referral to our center.

Clinical examination revealed chronically wasted female adolescent (evident by prominent zygomatic bones, rib cage and over hanging skin folds in the axilla and gluteal region) in respiratory distress (evident by flaring of ala nasi, intercostal and subcostal recession, tachypnoeic), febrile (390C),pale, anicteric, cyanotic with finger clubbing grade three, no signs of dehydration, significant peripheral cervical lymphadenopathy (painless and firm) with bilateral pitting edema up to the mid leg.

Respiratory system examination was marked by severe respiratory distress with respiratory rate was 74 breaths per minute and widespread coarse crepitations. SPO2 60% in room air.

Central Nervous System was not remarkable.

Cardiovascular System: Pulse Rate 132 beats per minute, full volume regular. Blood pressure was 110/80mmHg with distended neck veins. The apex was at the 6th Left Intercostal space lateral to the mid clavicular line. First, second and third heart sounds were heard with left parasternal heave

Digestive System: Good oral hygiene was noted. Abdomen fully moved with respiration. No evidence of clinically demonstrable ascites. There was marked epigastric tenderness, tender hepatomegaly with normoactive bowels sounds.

Musculoskeletal system: Mild kyphosis with gibbus between first and second lumbar vertebrae. No psoas abscess noted.

Genito-urinary System: Normal female external genitalia, Urethral catheter in-situ, urine bag draining about 50mls of amber coloured clear urine.

Investigations

Sputum and stool gene xpert revealed micro bacterium tuberculosis with no rifampicin resistance.

Retroviral screening done was negative.

Her Packed cell volume was 26% with a white blood cell count of 14,000 cells per micro-litre of blood.

Erythrocyte sedimentation rate was 22mm in the first hour.

Her Serum electrolyte urea and creatinine done was essentially normal.

Malaria parasite done was positive.

Electrocardiography revealed sinus rhythm with AV block 1

Chest radiograph on presentation (**Figure 1**) showed widespread reticulo-nodular opacities involving both lungs, mildly dilated cardiac silhouette with cardiothoracic ratio of 50.8%. Aorta and hilar were unremarkable and both lung recesses were clear. An impression of pulmonary tuberculosis to rule out atypical pneumonia was made.

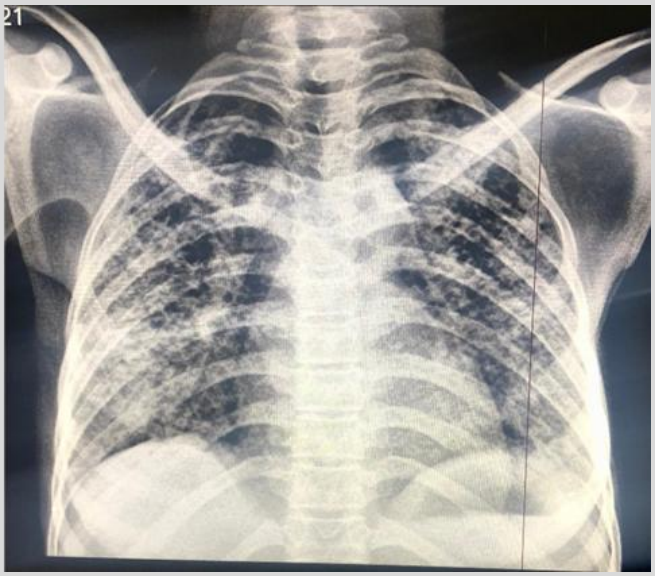

Figure 1: Showed widespread reticulo-nodular opacities involving both lungs, mildly dilated cardiac silhouette with cardiothoracic ratio of 50.8%.

A diagnosis of disseminated tuberculosis (Lungs, Spine) complicated by right heart failure was made.

Patient was admitted into the isolation ward, nursed in cardiac position and placed on intranasal oxygen, intravenous frusemide, intravenous antibiotics (ceftriaxone- sulbactam), anti-malarials, and zinc tablet. Azithromycin was also commenced pending gene xpert result. Weight based anti-Koch's combination (isoniazide, ethambutol, rifampicin and pyrazinamide) and pyridoxine was commenced for two months as recommended by WHO guidelines. Other supportive care was omeprazole tablets,astymin syrup and emphasis on adequate nutrition and nursing care.

One month into admission patient had improved remarkably evident by weight gain (from 30kg on admission to 35kg), regression of sputum production and resolution of fever and leg edema. Child was gradually weaned off oxygen despite initial fluctuations in oxygen saturation. Patient was also placed on prednisolone tablets due to the suspicion of Potts disease.

The observation of residual breathlessness and hepatomegaly despite resolution of leg swelling and cough prompted our team to request for echocardiography and cardiology review.

Echocardiogram (**Figure 2**) showed a dilated right heart chambers with spontaneous echocardiographic contrast in the right ventricle. There was slightly reduced right ventricular systolic function RVEF-48%), mild tricuspid regurgitation and slightly elevated pulmonary artery pressures by doppler estimation. There was an interventricular septal shift to the left. Reversed trans mitral flow noted. The great vessels and all heart valves were morphologically normal. The mitral valve anterior leaflet was elongated (normal variant). Minimal pericardial effusion was noted. Right atrial pressures by echocardiographic estimation was normal. An assessment of chronic cor pulmonale and pericarditis was made.

The cardiologist placed child on low dose sildenafil and apixaban as daily dosages.

Two weeks later, patient was noticed to have remarkably improved evident by significant improvement in oxygen saturation at room air, ambulated freely with minimal breathlessness and better affect.

Patient was placed on anti-Koch's continuation phase regimen for ten months after intensive phase and is currently on follow up with interval echocardiographic surveillance, pulmonary rehabilitation and surveillance for post TB lung disease [6,7].

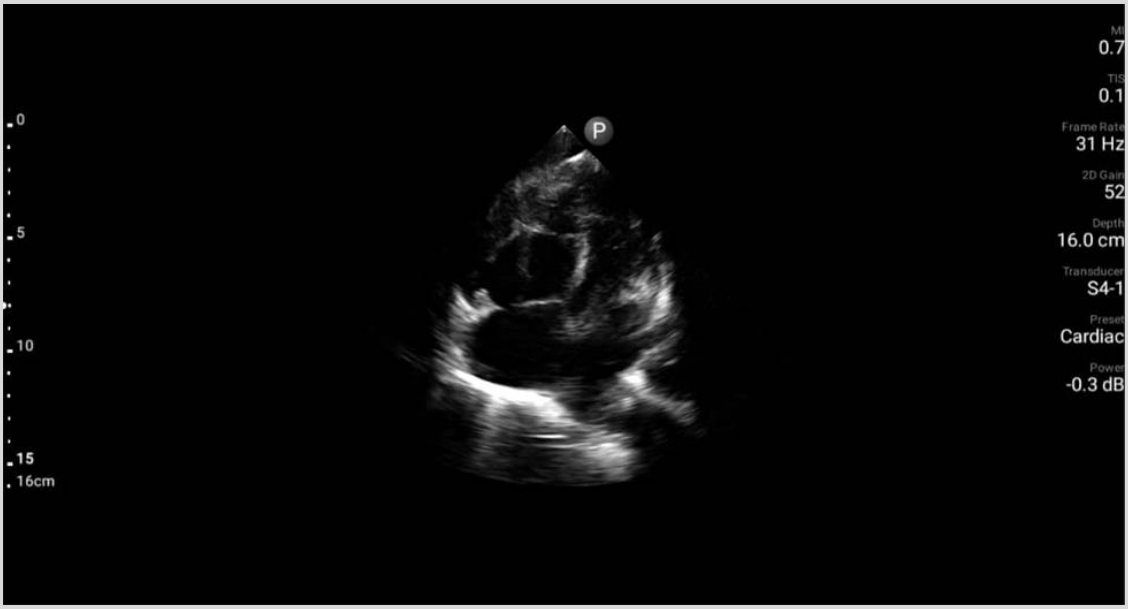

Figure 2: Showed dilated right ventricle with borderline systolic function and interventricular septal shift to the left.

Discussion

A leading cause of death due to infectious disease is pulmonary tuberculosis and is among the top 10 causes of mortality worldwide [8].

Since the last 25 years, universal burden of tuberculosis has been considered a public health emergency and despite public health interventions, tuberculosis remains out of control in terms of incidence, prevalence, mortality, and morbidity. China, India, Indonesia, Nigeria, and South Africa rank first to fifth, respectively, in terms of the incident TB cases [9].

The burden of tuberculosis in children is high in Nigeria [10]. Nigeria has the sixth highest TB burden globally, with an estimated 4.3 per cent multi-drug resistance in new cases. Yearly, over 245,000 Nigerians give in to tuberculosis (TB), with an estimated 590,000 new cases [11]. This increased number also parallels the incidence of tuberculous complications.

Pulmonary tuberculosis can be complicated by Cor pulmonale, or right ventricular failure, due to the development of pulmonary hypertension. This occurs when tuberculosis destroys the lungs, resulting in raised pressure in the pulmonary arteries, rendering it difficult for the heart to pump blood to the lungs, resulting in cor pulmonale. Case reports on cor pulmonale complicating TB in children in Nigeria are sparse. To the best of our knowledge, our report appears to be the first to be published in Nigeria. Hence the need to bring this case to the fore.

Most complications of tuberculosis are usually not sought for in Nigeria for many reasons. First, tuberculosis is a disease of poverty. Current tuberculosis program does not make room for free investigations to cover complications [12]. Hence, raising the need for out-of-pocket expenditure. Secondly, the awareness of potentially serious cardiopulmonary complications of tuberculosis appear to be low as data appears to be scarce on the subject in published literature. Thirdly, post TB surveillance and follow up after initial treatment is scarcely done due to financial considerations. Finally, the programmatic nature of tuberculosis allows most TB patients to be managed outside Specialist hospitals where such diagnosis is usually made.

Unfortunately, children with tuberculosis represent a vulnerable subset who are also prone to tuberculosis with disseminated forms as our index patient [13]. Since poverty is a factor, they are more likely to present late with complications. Our index patient presented three months after symptom onset with significant evidence of dissemination. Finance was a constraint in doing echocardiography and most investigations for which she had to be assisted by her managing team. Furthermore, children are more likely to suffer from missed school days due to prolonged hospitalization in the advent of complications like our index patient who was already too old to be a primary school pupil. This adds to the burden of illiteracy and other psychosocial maladies in the region [14]. The most tragic effect of complicated tuberculosis is that children will have longer years to live with disabilities. This impacts negatively on quality of life and productivity in adulthood. Being female in an African setting like our index patient imposes the pressure for child bearing in the future. Pregnancy with the increased volume status adds some risk for failure on an already compromised right ventricle.

Two children were reported to have cor pulmonale as a complication of pulmonary tuberculosis following an autopsy in India [15]. Restriction of the pulmonary blood bed with hypoxia and decrease of functional parenchyma represents the major factors responsible for limitation of pulmonary diffusion and cor pulmonale [16]. Ershov *et al* [17]. discovered that sclerotic changes and specific circulating immune complexes cause irreversible injuries. Central hemodynamics are influenced by circulating immune complex, decreasing cardiac output and circulating blood volume by 30%-40%, there by leading to deficiency of blood inflow to the right compartments of the heart so that the atrium functions at a higher load like a suction pump which leads to cardiac hypertrophy.

Cor pulmonale may be asymptomatic or may complicate right heart failure presenting with dyspnoea, chest pain, leg swelling, cyanosis, tachycardia and tender hepatomegaly. Occasionally, this may result in compression of the left ventricle with subsequent symptoms of orthopnoea and fatigue as was seen in our index patient. Specific signs of TB can also be present, such as fever, cough, weight loss, and night sweats. These were typical presentation of index patient.

In chronic cor pulmonale, enlargement of the central pulmonary arteries with oligemic peripheral lung fields may be seen on chest x-rays. Pulmonary hypertension should be suspected when the right descending pulmonary artery is larger than 16 mm in diameter and the left pulmonary artery is larger than 18 mm in diameter. Right ventricular enlargement leads to an increase of the transverse diameter of the heart shadow to the right on the postero-anterior view and filling of the retrosternal air space on the lateral view. This findings were obscured in our patient possibly due to widespread opacities in the lung field. However, she had very mild cardiomegaly on the radiograph which could have easily been dismissed as normal if further investigations were not done.

Electrocardiographic (ECG) abnormalities in cor pulmonale may include the following:

- Right axis deviation
- R/S amplitude ratio in V1 greater than 1
- R/S amplitude ratio in V6 less than 1
- P-pulmonale pattern (an increase in P wave amplitude in leads II greater than 2.5mm with a prominent positive P wave in V1 greater than 1mm) indicating right atrial enlargement
- S1 Q3 T3 pattern and incomplete (or complete) right bundle branch block, especially if pulmonary embolism is the underlying etiology
- T wave inversions in V1-3 indicative of right ventricular strain.
- Low-voltage QRS because of underlying COPD with hyperinflation

Two-dimensional (2-D) echocardiography usually demonstrates signs of chronic right ventricular (RV) pressure overload. As this overload progresses, increased thickness of the RV wall with paradoxical motion of the interventricular septum during systole occurs. Right Ventricle dilatation occurs, with the septum showing abnormal diastolic flattening at advanced stage. Doppler echocardiography is used to estimate pulmonary arterial pressure, taking advantage of the functional tricuspid insufficiency that is usually present in pulmonary hypertension [18]. This was classically demonstrated in our index patient.

Medical therapy for tuberculous Cor pulmonale is generally focused on treatment of the underlying pulmonary tuberculosis and improving oxygenation and right ventricular (RV) function by increasing RV contractility and decreasing pulmonary vasoconstriction [19].

Oxygen therapy, diuretics, vasodilators, digitalis, theophylline, and anticoagulation therapy are all different modalities used in the long-term management of chronic cor pulmonale.

Conclusion

We recommend cardiac workup in all pulmonary tuberculosis cases with disproportionate tachycardia.

Declarations

UN declarations

All authors confirm and accept UN declaration of human rights

Ethical approval and consent to participate

Ethical clearance was gotten from the ethics committee of the National Obstetrics Fistula Center Abakaliki Ebonyi State.

Consent for publication

Assent for publication was obtained from patient and consent from parents.

Availability of data and materials

All data generated and analysed during this study are included in this published article and its supplementary information files.

Competing interests

Authors declare no competing interest.

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Authors did not receive any external funding.

Authors contribution

OCV: Actively managed the patient, analysed and interpreted patient data, manuscript writing
ASE: Managed patient, analysed and interpreted data, manuscript writing
OVI: Managed patient, analysed and interpreted data
EJE: Managed patient, analysed and interpreted data
AGA: Analysed and interpreted data, manuscript writing
OKJ: Supervised report, managed patient, interpretation of data.

All authors approved final version of submitted manuscript.

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