

Case Report

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Challenging Diagnosis of Respiratory Effects in a Patient with Chronic Kidney Disease (CKD) Admitted into the Intensive Care Unit



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Abstract

Respiratory complication in CKD patients is the major cause to increase the frequency of hospitalization and acute respiratory distress in a patient with CKD is the most prevalent cause of emergency calls usually in ICU. Intensive care unit has generally focused on dialysis to maintain the renal function and on their clinical course of respiratory distress, but the most demanding diagnosis of these comorbidities was unrevealed. Diagnosis of respiratory complications in CKD patients is usually incorporated on clinical presentation and chest radiograph, which exhibits similar characteristics in most of the cases like pulmonary edema, pneumonia, and pleural effusion. The objective of this study is to evaluate the clinical parameter of respiratory complications to correlate with patient history and elucidating diagnostic challenges in a patient with CKD. In this case study, we manifested respiratory complications in a chronic dialysis patient who suddenly developed acute respiratory distress. Her clinical features and radiology results were ambiguous to make an absolute diagnosis of respiratory distress. It is demanding to get a clear picture of respiratory complications because once the diagnosis is made then it is satisfactory to establish the standard treatment protocol for this patient.

Keywords: Chronic kidney disease; Hemodialysis; Pulmonary edema; Pneumonia; Intensive care unit

Abbreviations: CKD: Chronic kidney disease; RRT: Renal replacement therapy

Case presentation

A 60-year-old female diagnosed with CKD was admitted into a nephrology ward with the chief complaint of shortness of breath. After starting hemodialysis, she was referred to intensive care unit due to severe respiratory distress with oliguria. Her oxygen saturation levels (SPO₂) fall on pulse oximetry between 75 to 85 percent and creatinine level was 5.4mg per dl. She had a history of HTN and was being treated with Prazosin and Amlodipine for almost 10 years. She was on maintenance hemodialysis diagnosed with 4th stage of chronic renal disease. Due to inadequate financial support, she refused to get renal replacement therapy (RRT). She reported mild cough and shortness of breath over 1 week and slight weight gain over 1 month. She had no family history of CKD and respiratory disease. Besides, she was non-smoker with no substance abuse history. On physical examination, the patient was toxic, mildly edematous with severe respiratory distress, the pupils were constricted, and blood pressure was 170/100mm of Hg. On lung auscultation, Crackles and Rhonchi with tachypnea

were presented but physical findings on gastrointestinal and neurological examination were unremarkable. She had a mild fever (99.5°F temperature) with indifferently altered levels of consciousness and urine volume was scanty. On cardiac examination, she had tachycardia (heart rate 90 beats per minute in normal rhythm) with the absence of murmur and abnormal heart sounds. When severe respiratory distress was not managed by nasal oxygen intubation, the assisted ventilatory system was provided to her.

Laboratory findings

Hematology reports: Hemoglobin was 10.5mg/dl; ESR 30 in 1st hour, the total number of leukocytes was 7460 in count with neutrophils 65%. Total platelets count 130000. Serum electrolyte: Na⁺ 134.3mmol/L, k⁺3.79mmol/L. S. urea 54.5mg/dl, serum creatinine 5.4mg/ dl. Chest X-ray: patchy opacities with air bronchogram and lobar consolidation with slightly larger heart shadow.

Differential diagnosis of respiratory distress of this patient

Pneumonia, Pulmonary edema, Pleural effusion, Fibrothorax, Urinothorax, Pulmonary calcification.

Discussion

The relationships between lungs and kidney are clinically important to maintain homeostasis, the respiratory function can help to mitigate the effect of metabolic acid-base disturbance where renal function is important to regulate the fluid-electrolyte balance in the body [1,2]. The fluid imbalance may contribute to developing pulmonary edema, pleural effusion, pneumonia in chronic dialysis patients [3] comorbid conditions, and immune dysfunction observed in uremic states. Although one may hypothesize that pulmonary infectious mortality is higher among patients with ESRD compared with the general population (GP). Chronic kidney disease is a complex disorder that is associated with a number of serious complications including anemia, metabolic bone disease, cardiovascular disease [4]. Recently it is proven that the risk of developing pneumococcal pneumonia is more common in patients with CKD compared with the patients without CKD [5]. However, the diagnosis of respiratory effects in CKD patients is hypothetical; frequently it is misdiagnosed as pneumonia. Chronic kidney disease patients are often experienced fluid overload where hemodilution promotes leakage of interstitial fluid from pulmonary capillary and decreased plasma oncotic pressure as a result of hypoalbuminemia which may lead to developing alveolar and chest wall edema [6] the pathogenesis of impaired pulmonary functions has not been completely elucidated in these patients. We designed a study to investigate acute effects of hemodialysis treatment on spirometry parameters, focusing on the relationship between pulmonary function and fluid status in hemodialysis patients. In respective of this case, patients had a clinical sign of respiratory distress, cough with sputum, a slightly high temperature which favors the diagnosis of pneumonia and pulmonary edema. But the diagnosis of pneumonia has never been appraised systematically in a dialysis patient because dialysis patient is more susceptible to develop pulmonary edema with excessive fluid imbalance [7] which occurs commonly in hemodialysis patients, may frequently be misdiagnosed as pneumonia. Methods: We retrospectively reviewed the records of 105 hemodialysis patients admitted with the diagnosis of pneumonia. Two experienced radiologists masked to the clinical course and subsequent imaging, independently interpreted the admission chest radiographs. In 68 of the patients, 2 internists independently reviewed the hospitalization records to diagnose pneumonia and pulmonary edema. The level of agreement among the radiologists was assessed using the kappa test. Using the clinical diagnoses, chest radiograph attributes were calculated. Logistic regression was performed to identify clinical and laboratory markers associated with pneumonia and pulmonary edema. Results: The radiologist showed slight agreement on pneumonia ($\kappa = 0.32$) Interpreting the chest radiographs in ICU patients poses a challenge because

of patients prone to several cardiopulmonary disorders and air space shadow is obstructed by instrumentation [2,8]. Air space opacities with consolidation was presented on chest x-ray findings of this patient, but there were considerably overlapping features of pulmonary edema. The major difference between pneumonia and pulmonary edema is infectious pathology but CKD itself causes increase uremia related infection and sometimes the infection is also observed in pulmonary edema. If pneumonia is caused by the atypical organism, then it is difficult to confirm the diagnosis quickly by sputum gram stain. Finally, CT chest was performed for further pulmonary diagnosis, it showed pulmonary consolidation but in case of diagnosis of pulmonary edema, presence of symmetrical interstitial opacities and Kerley B lines are required. But the chest radiograph of this patient consisted of asymmetric mixed interstitial and basal lung opacities. Then we correlated the radiology findings with cardiovascular disease because the cardiac implication is obvious in pulmonary edema. Cardiac events were excluded by examining the level of positive biomarkers (Troponin). Finally, Pneumonia was excluded from the differential diagnosis after assessing the culture result of sputum and pleural fluid. So, this is the case of non-cardiogenic pulmonary edema and this edema is caused by fluid congestion resulting from ineffective ultra-filtration in between dialysis sessions. So, there is no gold standard diagnostic criterion to establish the diagnosis of the pulmonary complication in CKD patients who are undergoing dialysis. Chest x-ray findings were believed as the first diagnostic tool in pneumonia but limitations of CXR findings in hemodialysis patients debilitate clear judgment of respiratory diagnosis [9]. Restrictive effects of pulmonary function in CKD patients cause acute ventilatory failure. Pulmonary edema is the most common feature in cardiovascular disease which is associated with restrictive and obstructive pulmonary abnormalities [6]. It is known that CKD patients under regular hemodialysis may contribute to develop excessive dialytic overweight or alter the body fluid status which is the predisposing factor to develop pulmonary edema [10,11]. However, the pathogenesis under pulmonary deterioration has not been completely elucidated in CKD patients. In the case of a dialytic patient, extracellular volume expansion or fluid overload secondary to poor compliance to diet and inappropriate estimation of the dry weight, and chest infections were also major causes for this condition [7,12]. Therefore, patients on hemodialysis with respiratory distress frequently misdiagnosed with pneumonia, resulting in prolonged unnecessary antibiotic therapy. So before concluding the diagnosis is pneumonia in CKD patients on hemodialysis, we should exclude all the possible diagnostic criteria carefully. It will assist physician to make clear treatment protocol with avoiding unnecessary medication because unnecessary medication can deteriorate the renal function. So, our case report gives a real picture of diagnostic challenge of respiratory effects in dialysis patient and demonstrates the possible outcome of diagnostic failure.

Confirmatory diagnosis of this case

4th stage chronic kidney disease with non-cardiogenic

pulmonary edema.

Treatment

Managing fluid status in dialysis patients is a challenge due to dialysis patients usually oliguric or anuric [13]. This report suggests that fluid overload between dialysis sessions is really common and causes adverse outcomes of respiratory and heart failure [14]. In this case, IV furosemide was administered to the patient combined with oral doses of sorbitol every half hour. This treatment resulted in clinical improvement of both conditions of patients as well as sustained decrease the pulmonary capillary permeability.

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