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Clinical Profile and Spectrum of Respiratory Disorders in Patients with Chronic Kidney Disease

Dr. M. Ramulu[1], Dr. S. Shravya[2]

[1] Associate Professor, Department of Respiratory Medicine, Prathima Institute of Medical Sciences, Naganoor, Karimnagar, Telangana.
[2] Assistant Professor, Department of General Medicine, Prathima Institute of Medical Sciences, Naganoor, Karimnagar, Telangana.

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*Corresponding Author:

Dr. S. Shravya
Assistant Professor, Department of General Medicine, Prathima Institute of Medical Sciences, Naganoor, Karimnagar, Telangana

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A B S T R A C T

Background: Chronic kidney disease (CKD) is associated with a wide range of systemic complications, of which respiratory system involvement is commonly present. These patients are found to be present with fluid overload, metabolic derangement, and diminished immunity, which leads to pulmonary complications and increases the risk of morbidity and mortality. The current study aimed to determine the clinical profile and spectrum of respiratory disorders in patients with CKD presenting to our hospital.

Methods: This cross-sectional study of 50 patients with CKD (stages 3 -5) hospitalized in a tertiary care hospital was carried out. Clinical evaluation of patients, radiological investigations (CX-Ray and HRCT where necessary), pulmonary function test, arterial blood gases (ABG) analysis, along with tuberculosis screening, was performed. The analysis of the data was conducted to find out the prevalence of respiratory involvement, as well as to determine the patterns of respiratory vs. CKD stage and comorbidity.

Results: In the 50 cases, we found that Pleural effusion was present in (44%, and pulmonary edema in 36% of cases, were the most common respiratory complications. Restrictive lung disease was present in 56% of cases, correlating with low FVC (62.3% predicted). Hypoxemia was prevalent in 82% of cases, with metabolic acidosis decreased (HCO_3^-) in 78%. Tuberculosis was confirmed in 26.7% of suspected cases, predominantly via molecular testing (CBNAAT). Advanced CKD (Stage 4 –5) showed stronger associations with pleural effusion ($p<0.01$)

Conclusion: Respiratory complications are common in CKD populations and tend to be aggravated as the patient develops increasingly higher renal impairment. Therefore, early detection and management are crucial for better clinical outcomes and the reduction of complications.

Keywords: Chronic Kidney Disease (CKD), Respiratory Complications, Hypoxemia, Metabolic Acidosis

INTRODUCTION

Chronic kidney disease (CKD) is increasingly becoming a public health issue globally because of its increasing prevalence, and it is associated with significant morbidity and mortality. The kidney is a vital organ that plays an important role in the elimination of metabolic waste, maintains electrolyte balance, and regulates systemic homeostasis. A progressive decline in renal function, as occurs in CKD, results in the accumulation of uremic toxins and dysregulation of fluid, acid -base balance, and immune function, which predisposes patients to several systemic complications that also affect the respiratory system [1, 2]. Chronic kidney disease (CKD), and especially end-stage renal disease (ESRD), can have numerous respiratory disorders, which may be due to direct and indirect consequences of renal dysfunctions. The pathophysiologic characteristics of the respiratory involvement are fluid overload, anemia, metabolic acidosis, immune suppression, and infection susceptibility. Furthermore, diseases that exist with CKD (comorbidities) like diabetes mellitus, hypertension, and cardiovascular disease, which are very frequent in CKD, further pose a risk of pulmonary complications [3]. The respiratory disorders that are found to occur in CKD patients are wide-ranging and include pulmonary edema, pleural effusion, pulmonary infections, uremic lung, obstructive and restrictive pulmonary dysfunction, sleep -disordered breathing, pulmonary hypertension, and increased threat to tuberculosis infection, especially in high -endemicity areas [4, 5]. Volume overload and hypoalbuminemia are frequent reasons for the development of pulmonary edema and pleural effusions. The apnea and other breathing disorders in sleep also occur among CKD patients, especially those on hemodialysis [6].

Moreover, dialysis in and of itself, particularly hemodialysis, may be an additional cause of respiratory complications based on the formation of microemboli, complement activation, and pulmonary sequestration of leukocytes, which contributes to dialysis-related pulmonary injury [7]. There is an additional possibility that peritoneal dialysis can cause pleuroperitoneal communication, resulting in hydrothorax. Tuberculosis (TB) has been a challenge in CKD conditions, especially in developing countries. The low immune defenses due to impaired cellular immunity and disordered nutrition of patients with CKD cause unusual manifestations and a higher prevalence of extrapulmonary and diffuse TB manifestations [8]. The complexity of the interplay between renal insufficiency and pulmonary dysfunction highlights the need for early recognition of such conditions and application of multidisciplinary management for respiratory complications of CKD. The initial clinical presentation may be atypical and sudden, which requires a high index of suspicion. Subjecting the cases to routine screening, pulmonary function tests, and imaging studies can play an important role in the timely diagnosis and management of these complications [9]. Although the association between respiratory disease and CKD is well known, there is a paucity of data that shows the clinical spectrum of pulmonary manifestations of CKD. Therefore, the current study aimed to evaluate the clinical profile and spectrum of respiratory disorders among patients with CKD. The results of this study can provide a better understanding of the pattern of respiratory involvement and help in formulating intervention strategies to improve the quality of life and patient outcomes.

Material and Methods

This cross-sectional observational study was conducted in the Departments of Pulmonology and Nephrology, Government Medical College and Hospital, over a period of 12 months. Institutional ethical approval was obtained for the study after explaining the nature of the disease in the vernacular language. Written consent was obtained from all participants of the study. The sampling method used for the present study was convenience sampling.

Inclusion Criteria

1. Patients aged 18 years and above.
2. Diagnosed cases of CKD (Stage 3–5) as per KDIGO 2012 guidelines.
3. Patients with one or more respiratory symptoms such as cough, breathlessness, wheezing, hemoptysis, or chest pain.
4. Patients who consented to participate in the study.

Exclusion Criteria

1. Patients with known pre-existing chronic respiratory diseases like COPD, bronchial asthma, and interstitial lung disease unrelated to CKD.
2. Patients with malignancy or terminal illness unrelated to CKD.
3. Pregnant women.
4. Unwilling or non-cooperative patients.

The study included 50 patients diagnosed with chronic kidney disease (CKD), from stage 3 to stage 5 (including dialysis-dependent patients), who presented with respiratory symptoms or were found to have respiratory abnormalities on clinical or radiological evaluation. The patient's demographic profile, age, gender, addresses, and contact numbers were recorded, including the duration and stage of CKD. The mode of replacement therapy (hemodialysis, peritoneal dialysis, or conservative). The duration of respiratory complaints, including onset duration, and associated features. Each patient underwent a detailed examination of the respiratory system. Laboratory investigations included Complete blood count, Renal function tests (serum urea, creatinine, electrolytes), arterial blood gas (ABG) analysis, blood sugar, calcium, and phosphate levels, sputum examination, and blood cultures if indicated. Radiological evaluation was done by subjecting them to a Chest X-ray (PA view). High-resolution CT (HRCT) chest for selected patients; in addition, patients were subjected to USG of the chest or echocardiography based on the clinical examination.

Pulmonary Function Tests (PFT): Conducted using spirometry to assess obstructive or restrictive patterns. Parameters analyzed included FEV_1, FVC, and FEV_1/FVC ratio. Tuberculosis Screening was done with the Montoux test, sputum AFB smear, CBNAAT, or culture as per WHO and RNTCP guidelines in suspected cases.

Statistical analysis: The data obtained were refined, segregated, and uploaded to an MS Excel spreadsheet and analyzed by SPSS version 25 in Windows format. The continuous variables were expressed as mean, standard deviation, frequencies, and percentages. The categorical variables were analysed by Student's t-test for differences in means between two groups and the Chi-square test for differences between two groups. Values of p (<0.05) were considered statistically significant.

Results

A total of n=50 cases were studied during the duration of the present study. The demographic characteristics of the study cohort are presented in Table 1. The mean age of the cohort was 58.3 ± 12.1 years, with a male predominance (64%). The analysis of the table showed that most patients of the study were in advanced stages of CKD, 40% in stage 5 and 36% in

stage 4. The most frequent comorbidities were hypertension in 76% of cases, followed by diabetes mellitus in 64% of cases. The table shows that higher-stage CKD patients are more vulnerable to systemic complications in general and pulmonary complications in particular.

Table 1: Baseline Characteristics of Study Population (n=50)	
Characteristic	*Value*
Age (years)	58.3 ± 12.1 (mean ± SD)
Gender (Male: Female)	32:18 (64%: 36%)
CKD stage	
Stage 3	12 (24%)
Stage 4	18 (36%)
Stage 5	20 (40%)
Diabetes Mellitus	32 (64%)
Hypertension	38 (76%)

The analysis of the spectrum of respiratory disorders is given in Table 2. The respiratory disorders in decreasing order were pleural effusion in 44% of cases, followed by pulmonary edema (36%) and pneumonia (24%). There was a presence of Interstitial lung disease and pulmonary hypertension at a lower frequency. The study showed that 6% of cases had no signs of respiratory involvement. This shows that respiratory complications are highly prevalent in CKD patients, particularly pleural and parenchymal pathologies, which are generally attributed to fluid overload and uremic effects, including immunosuppression.

Table 2: Spectrum of Respiratory Disorders	
Respiratory Disorder	*n (%)*
Pleural Effusion	22 (44%)
Pulmonary Edema	18 (36%)
Pneumonia	12 (24%)
Interstitial Lung Disease	8 (16%)
Pulmonary Hypertension	5 (10%)
No Respiratory Involvement	3 (6%)

Table 3 depicts the results of pulmonary function tests done in the cohort. We found that restrictive lung disease was the most frequently prevalent ventilatory abnormality in 56% of cases. These patients showed a markedly decreased FVC (62.3%); however, the FEV1/FVC ratio (0.78 ± 0.05) was within normal limits. The results also showed normal spirometry in 24% of cases. The high prevalence of restrictive lung disorders could be due to fluid overload, uremic lung changes, and interstitial involvement, which occurs due to CKD.

Table 3: Pulmonary Function Test			
PFT Pattern	*n (%)*	*FEV_1/FVC Ratio (mean)*	*FVC (% predicted)*
Restrictive	28 (56%)	0.78 ± 0.05	62.3% ± 8.1
Obstructive	10 (20%)	0.63 ± 0.07	84.5% ± 6.2
Normal	12 (24%)	0.81 ± 0.04	92.0% ± 5.8

The results of arterial blood gas analysis are presented in Table 4. Results of the ABG analysis indicated a significant prevalence of abnormalities in this population. Hypoxemia (pO_2 < 80 mmHg) was observed in 82% of the patients, and metabolic acidosis (HCO_3- < 22 mmol/ L) was present in 78% of cases, which reflects the CKD-related acid-base disturbances. The mean pH was also mildly decreased (7.32 ± 0.08), and 64 % showed acidemia. Less prevalent, 30 percent of patients had hypercapnia. These data underline the impact of CKD on the gas exchange and acid-base balance at the systemic level; therefore, such patients should be carefully monitored regarding these respiratory parameters.

Table 4: Arterial Blood Gas (ABG) Analysis		
Parameter	Mean ± SD	Abnormal Values (n)
pH	7.32 ± 0.08	32 (64%)
pO_2 (mmHg)	68.4 ± 12.3	41 (82%)
pCO_2 (mmHg)	34.1 ± 6.7	15 (30%)
$HC0_3$- (mmol/L)	18.2 ± 4.1	39 (78%)

The assessment of radiological abnormalities is shown in Table 5. A critical analysis of the table revealed by the chest X-ray was pleural effusion in 44% and pulmonary congestion in 36% of patients, correlating with fluid retention and cardiac involvement. Consolidation was seen in 24%, suggesting an infectious etiology. HRCT chest, performed in n=20 selected patients, showed ground-glass opacities (70%), interstitial fibrosis (40%), and bronchiectasis (20%), pointing to chronic lung involvement likely related to uremia, recurrent infections, or fluid overload. These findings support the multifactorial pulmonary burden in CKD.

Table 5: Radiological Abnormalities		
Imaging Modality	*Finding*	*n (%)*
Chest X-ray (On = 50)	Pleural Effusion	22 (44%)
	Pulmonary Congestion	18 (36%)
	Consolidation	12 (24%)
HRCT Chest (n = 20 selected)	Ground-Glass Opacities	14 (70%)
	Interstitial Fibrosis	8 (40%)
	Bronchiectasis	4 (20%)

Results of Tuberculosis Screening (n=15 suspected cases) are given in Table 6. Four patients (26.7%) of the 15 patients clinically suspected of tuberculosis were confirmed positive. Three patients (20%) had TB detection by CBNAAT, 1 (6.7%) and 2 (13.3%) patients had TB detection by sputum smearing and culture, respectively. The comparably high rate of detection by molecular techniques underlines the necessity of early and sensitive diagnostic tools in the case of immunocompromised CKD patients. This highlights the vulnerability of patients with CKD to opportunistic diseases, such as TB, and how specific screening in this vulnerable population is relevant.

Table 6: Tuberculosis Screening Results (n=15 suspected cases)		
Test	*Positive (n)*	*Detection Rate*
Sputum AFB Smear	1	6.7%
CBNAAT	3	20.0%
Culture	2	13.3%
Overall TB Cases	4	26.7%

Discussion

Chronic kidney disease (CKD) is a progressive disease that slowly leads to multisystem involvement, of which the respiratory system is commonly involved. The current study was done on 50 CKD patients presenting to our hospital with respiratory disorders. The overall findings of our study confirm the high burden and complex nature of complications in patients with CKD, especially those in advanced stages. In this study, we found that the most frequently reported respiratory complication was pleural effusion in 44% of cases, followed by pulmonary edema in 36% of cases. These findings are in concordance with observations of the other previous studies which indicated volume overload and hypoalbuminemia are the major contributors for transudative effusion in CKD patients particularly those undergoing dialysis [10, 11] The cause of pulmonary edema was fluid retention and cardiac dysfunction which is the leading cause of respiratory distress in end-stage renal disease (ESRD) [12]. Therefore, it becomes critical for fluid management and cardiovascular monitoring in CKD patients. This highlights the importance of fluid management and cardiovascular monitoring in CKD care. The results of pulmonary function tests (PFT) in our study showed that restrictive ventilatory defects were most frequent (56%) in cases and decreased FVC values (62.3% predicted). These findings are in agreement with observations of the other studies done in this field previously. [13, 14] These patterns are the results of interstitial fibrosis, uremic lung changes, and chronic fluid overload. The results also showed that 20% of cases had obstructive patterns, which may be because of coexisting COPD or bronchial disease.

Rao et al. [15] and Palmar et al. [14] have made similar observations in their studies, highlighting that pulmonary restriction is quite dominant in dialysis-dependent CKD patients. The arterial blood gas (ABG) analysis of this study showed a high prevalence of hypoxemia (82%) and metabolic acidosis (78%). This occurs due to impaired gas exchange and acid-base disturbances in CKD due to reduced buffering capacity of the kidneys and pulmonary compensation [16]. These abnormalities lead to persistent acidosis and worsen respiratory muscle function and increase morbidity [17]. Radiological imaging of the cases confirmed the clinical and functional changes. Chest X-rays commonly showed pleural effusion and pulmonary congestion reflecting fluid imbalance. A few selected individuals who underwent HRCT showed ground-glass opacities and interstitial fibrosis, highlighting uremic lung involvement and subclinical infections, which have also been reported by other similar studies [18]. More importantly, we found 26.7% of our cases with tuberculosis (TB), and all the cases were confirmed by Cartridge-Based Nucleic Acid Amplification Test (CBNAAT), which is a sensitive molecular test. CKD patients, especially those who are on dialysis, are immunocompromised and at higher risk of tuberculosis [4, 19]. We found there was a relatively low detection rate by sputum smear 96.7%) compared to CBNAAT (20%), which shows the need for rapid molecular diagnostics to be used in these patients. The current study found an association between advanced CKD stage (4 -5) and respiratory complications, which include pleural effusion and restrictive lung defects. This is in agreement with previous research, which shows that respiratory dysfunctions progress with decreasing renal functions as occurs in CKD advanced stages [20]. The presence of preexisting comorbidities in cases such as hypertension and diabetes mellitus may exacerbate pulmonary risks by mechanisms of heart failure or vascular remodeling [21].

Conclusion

Within the limitations of the current study, we found that respiratory disorders are very commonly present in CKD patients, especially in later stages. Our study found a high prevalence of pleural effusion, pulmonary edema, restrictive lung defects, and acid-base imbalance, such as metabolic acidosis and hypoxemia, in CKD patients. Infectious diseases such as tuberculosis pose a considerable risk due to immunosuppression. Regular respiratory assessment, which includes imaging, spirometry, and arterial blood gas, is crucial for early identification and management. A multidisciplinary approach model, including Pulmonologists and Nephrologists, is required to improve outcomes in this group of patients.

References

1. Levey AS, Coresh J. Chronic kidney disease. Lancet. 2012;379(9811):165 –180.
2. Stenvinkel P, Zoccali C, Ikizler TA. Obesity in CKD – what should nephrologists know? J Am Soc Nephrol. 2013;24(11):1727–36.
3. Piñera C, et al. Respiratory complications in chronic kidney disease. Nefrologia. 2013;33(6):848 –60.
4. Agarwal SK, Dash SC. Spectrum of respiratory diseases in end-stage renal disease patients on maintenance hemodialysis. Ren Fail. 2003;25(1):35–40.
5. Bush A, Gabriel R. Pulmonary complications in chronic renal failure. Arch Dis Child. 1991;66(7):802 –05.
6. Tang SC, Lam B, Lai KN. Sleep disorders in dialysis patients. Nephrol Dial Transplant. 2007;22(6):1521 –29.
7. Goto T, et al. Dialysis-related lung injury: mechanisms and management. Clin Nephrol. 2000;53(3):206 –12.
8. Naqvi R, Akhtar SF, Rizvi SA. Pulmonary tuberculosis in end-stage renal disease patients on dialysis. Nephrol Dial Transplant. 2001;16(2):395–98.
9. Panda A, et al. Pulmonary function in patients with chronic kidney disease. Saudi J Kidney Dis Transpl. 2013;24(3):500–05.
10. Agarwal R, Light RP. Pleural effusions in chronic kidney disease. Curr Opin Pulm Med. 2009;15(4):355 –59.
11. Kalra OP, Agarwal SK. Chronic kidney disease and its complications. J Assoc Physicians India. 2004; 52:1130–38.
12. Douvris A, Chan CT. Pulmonary edema in hemodialysis: mechanisms and management. Semin Dial. 2017;30(3):230–35.
13. Reddy BV, Ram R, Swarnalatha G, et al. Lung function in patients with chronic kidney disease. Indian J Nephrol. 2014;24(2):94–99.
14. Palmar MF, Sharma RK, Kaul A, et al. Pulmonary function tests in chronic renal failure. Indian J Physiol Pharmacol. 2003;47(4):489–492.
15. Rao M, Bandela PV, Bandi VK, et al. Pulmonary function tests in patients with chronic kidney disease: a cross-sectional study. Indian J Nephrol. 2020;30(4):270 –276.
16. Leung JC, Szeto CC, Lai KN. Chronic kidney disease and acid-base disorders. Kidney Int. 2009;75(5): 513–517.
17. Madias NE. Respiratory complications in ESRD: acid–base and electrolyte disorders. Adv Ren Replace Ther. 2001;8(1):37–47.
18. Hida T, Ichikawa Y, Saito A, et al. HRCT features of uremic lung: correlation with the severity of chronic renal failure. Eur Radiol. 2006;16(1):102–09.
19. Hussein MM, Mooij JM, Roujouleh H. Tuberculosis and chronic renal disease. Semin Dial. 2003;16(1):38 –44.
20. Saxena R, Meshram SV, Gharde P. Pulmonary manifestations in patients with chronic kidney disease: a prospective study. Int J Res Med Sci. 2016;4(11):4869 –72.
21. Chia YC, Ching SM, Chew BN, et al. Hypertension and comorbidities in chronic kidney disease: impact on cardiovascular risk. Int J Hypertens. 2013; 2013: 898406.