Original Research Paper

Volume - 16 | Issue - 06 | June - 2026 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Respiratory Medicine

PLEUROPARENCHYMAL MANIFESTATIONS IN CHRONIC KIDNEY DISEASE PATIENTS

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ABSTRACT **Introduction:** Chronic Kidney Disease (CKD) affects nearly 10–15% of the global population. Its systemic effects involve not only cardiovascular and metabolic systems but also the respiratory system, particularly the pleura and lung parenchyma. Pulmonary complications contribute to reduced quality of life and increased hospitalization in CKD patients.

Aims and Objectives:

1. To study and assess the spectrum of pleural and parenchymal manifestations in chronic kidney disease.
2. To study the clinical, radiological aspects of pulmonary manifestations in patients diagnosed with chronic kidney disease.

Methods: History, clinical evaluation and relevant investigations chest xray,pleural fluid analysis, sputum analysis, haemotological, biochemical investigations are taken into consideration **Results:** CKD is associated with a wide array of pulmonary manifestations. Pleural involvement includes uremic pleuritis, transudative or exudative pleural effusions, and in rare cases, pleural fibrosis. Parenchymal abnormalities include pulmonary edema, calcification, chronic interstitial lung disease, and uremic pneumonitis. Volume overload, hypoalbuminemia, immune dysfunction, and chronic inflammation contribute significantly to these changes. Hemodialysis alters the pulmonary dynamics, occasionally exacerbating or unmasking these conditions. **Conclusion:** Pleuro-parenchymal involvement in CKD is multifactorial and clinically significant. Early recognition and differentiation from primary pulmonary diseases are critical to optimizing patient outcomes. Regular respiratory assessment should be an integral part of CKD management, especially in advanced stages and dialysis-dependent patients.

KEYWORDS : Chronic Kidney Disease, Pleural Effusion, Pulmonary Edema, Uremic Lung, Dialysis, Pleuroparenchymal, Lung Fibrosis

1. INTRODUCTION

Chronic kidney disease (CKD) is a global public health problem.

Its prevalence is increasing worldwide and is estimated to be between 11 and 13% of the total population[1]Kidney disease is often characterized by multiple organ dysfunction.

Lung diseases are a major cause of mortality and morbidity worldwide, prevalence rate of 4.7% in patients with CKD[3].

The symptoms are commonly linked to a variety of pleuro-parenchymal conditions, including pulmonary edema, pleural effusion, uremic lung, increased risk of pulmonary infections, and rare but serious complications like metastatic pulmonary calcification. Fluid overload, altered immune response, and the effects of dialysis contribute to these manifestations, often making diagnosis and management more complex.

Pleuro-parenchymal lung manifestations contribute significantly to mortality in CKD, accounting for ~20–30% of deaths, mainly due to pulmonary edema, infections, and respiratory failure.

2. Aim and Objectives

I. To assess the spectrum of pleural and parenchymal manifestations in chronic kidney disease.

ii. To study the clinical, radiological aspects of pulmonary manifestations in patients diagnosed with chronic kidney disease

3. MATERIALS AND METHODS

This prospective observational study was conducted in Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation.

Study Design: Prospective observational comparative study.
Study Setting: Department of Respiratory Medicine [Dr.PSIMS & RF].
Sample Size: 100 patients

Inclusion Criteria:

1. Patients more than 18 yrs of age.
2. Diagnosed with chronic kidney disease and respiratory illness

Exclusion Criteria

1. Patients denying consent.
2. Immunocompromised state-HIV.

4. RESULTS

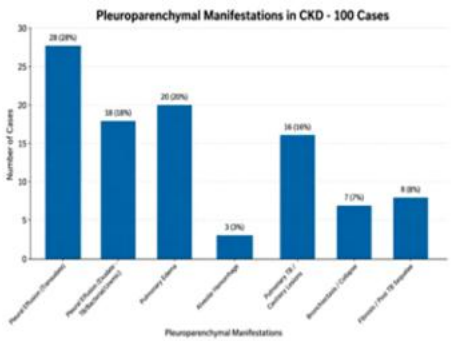
A total of 100 patients with CKD presenting with pleuroparenchymal manifestations were analyzed.

Table 1: Demographic Profile of Study Population

Variable	Number (n=100)	Percentage (%)
Age < 40 yrs	18	18%
Age 40–60 yrs	52	52%
Age > 60 yrs	30	30%
Male	64	64%
Female	36	36%
Dialysis-dependent	58	58%
Non-dialysis CKD	42	42%

Table 2: Clinical Presentation

Symptom	Number	Percentage (%)
Dyspnea	78	78%
Cough	60	60%
Fever	34	34%
Chest pain	22	22%
Hemoptysis	10	10%



Graph 1: Pleuroparenchymal Manifestations in CKD Patients

The most common finding was pleural effusion, observed in 46% of cases, of which 28% were transudative and 18% exudative (tuberculous, bacterial, or uremic).

Pulmonary edema was seen in 20% of patients, while pulmonary tuberculosis with cavitary lesions accounted for 16%.Alveolar hemorrhage was noted in 3% of cases.

Other manifestations included bronchiectasis/collapse (7%) and fibrosis/post-tuberculous sequelae (8%).

Infective causes (tuberculosis and bacterial infections) together contributed to 34% of all cases.The majority of patients, 72 (72%), improved with treatment and were discharged successfully. A smaller proportion of patients, 18 (18%), required intensive care unit (ICU) admission due to severe disease or complications during the course of hospitalization. Mortality was observed in 10 (10%) patients, reflecting the severity of illness in a subset of the study population.

5. DISCUSSION

Age Distribution

In the present study, the majority of patients 40–60 years age group (52%), followed by patients aged >60 years (30%), while only 18% were below 40 years. This shows lung manifestations are more common in middle-aged and elderly CKD patients. Increasing age is associated with prolonged duration of renal dysfunction, reduced immunity, multiple comorbidities, and increased susceptibility to pulmonary complications. Similar findings were observed by Mehta KS et al., who reported a higher prevalence of CKD-related complications among middle-aged and elderly individuals. Advanced age predisposes patients to fluid overload, cardiovascular dysfunction, and recurrent infections, which contribute significantly to pulmonary involvement.

Gender Distribution

The present study demonstrated male predominance, with males constituting 64% and females 36% of cases. Similar male predominance has been reported in previous CKD studies. The higher incidence among males may be attributed to increased prevalence of risk factors such as hypertension, diabetes mellitus, smoking, occupational exposure, and delayed healthcare seeking behavior. Studies by Sarkar M et al. and Singh NP et al. also documented a greater burden of pulmonary complications among male CKD patients.

Dialysis Dependence

In the present study, 58% of patients were dialysis-dependent while 42% were non-dialysis CKD patients. Pulmonary manifestations were more common among dialysis patients, particularly pleural effusion and pulmonary edema. Hemodialysis patients are prone to recurrent fluid shifts, chronic inflammation, uremic toxin accumulation, and immune dysfunction, which increase respiratory complications. Similar observations were reported by Taskapan H et al., who noted higher pulmonary complications among hemodialysis patients. Dialysis-related pulmonary congestion and altered capillary permeability may further aggravate respiratory symptoms.

Clinical Presentation

Dyspnea was the most common presenting symptom (78%), followed by cough (60%), fever (34%), chest pain (22%), and hemoptysis (10%). Dyspnea predominance may be explained by pulmonary edema, pleural effusion, anemia, and metabolic acidosis commonly associated with CKD. Similar findings were reported by Bush A et al., who observed respiratory symptoms to be highly prevalent among CKD patients undergoing dialysis. Fever and cough were mainly associated with infective etiologies such as tuberculosis and bacterial pneumoni.

Diagnosis

The present study showed that pleuroparenchymal manifestations are common among patients with Chronic Kidney Disease, with pleural effusion and pulmonary edema being the predominant findings. Similar observations were reported by Pant et al. (2019)[13], who found pulmonary edema in 38%, pleural effusion in 30%, pneumonia in 22%, and tuberculosis in 10% of CKD patients. A study conducted at Saveetha Medical College (2023) reported pleural effusion in 70% and pulmonary edema in 52% of patients, with most pleural effusions being transudative due to fluid overload and cardiac dysfunction.

Ray et al. (2014)[14] observed that 75% of pleural effusions in CKD patients were transudative, while 25% were exudative, commonly caused by tuberculosis and uremic pleuritis. Similar findings were noted in the present study. Berger et al. also demonstrated that uremic pleuritis is an important cause of exudative pleural effusion in dialysis patients.

Afroz et al. (2024) [16]reported heart failure-related pleural effusion in 40%, tuberculosis in 25%, and pneumonia in 20% of CKD patients, highlighting the role of infections and comorbidities. Overall, the findings of the present study are comparable with previous studies, confirming that respiratory complications contribute significantly to morbidity in CKD patients and require early diagnosis and prompt management.

6. CONCLUSION

Pleuroparenchymal manifestations are important yet often underrecognized pulmonary complications in patients with Chronic Kidney Disease. These manifestations arise due to a complex interplay of fluid overload, uremia, immune dysfunction, metabolic derangements, infections, and associated comorbidities.With the increasing global burden of CKD, greater awareness and further research into the pathophysiology, early detection, and management of pleuroparenchymal manifestations are necessary to reduce respiratory complications and improve quality of life in affected patients as lung significantly contributes to morbidity and mortality in CKD patients.

7. Limitations of Study

Different types of CKD patients → results are not uniform
Other diseases (like diabetes, TB, infections) → confuse the cause
Small studies / short follow-up → results may not be fully reliable (single centre based study)

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