



RESPIRATORY SYMPTOMS AND CHEST X-RAY ABNORMALITIES IN PATIENTS ON MAINTENANCE HAEMODIALYSIS

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ABSTRACT

Background: Patients undergoing maintenance haemodialysis frequently experience respiratory complications due to fluid overload, uremic toxins, and coexisting comorbidities. These manifestations often remain under-recognised despite contributing significantly to morbidity. This study was undertaken to evaluate the spectrum of respiratory symptoms and chest radiographic abnormalities in patients receiving long-term haemodialysis.

Objectives: To assess the prevalence of respiratory symptoms and to correlate these findings with chest X-ray abnormalities in patients on maintenance haemodialysis.

Methods: A cross-sectional observational study was conducted among 100 patients undergoing maintenance haemodialysis at a tertiary care centre. Adult patients receiving haemodialysis for more than three months were included. Clinical evaluation focused on respiratory symptoms such as breathlessness, cough, and chest discomfort. All participants underwent chest radiography, and findings were categorised into pulmonary oedema, pleural effusion, cardiomegaly, consolidation, and normal patterns. Data were analysed using descriptive statistics, and associations were assessed using the chi-square test.

Results: Among the 100 patients studied, 68% were males and 32% were females, with a mean age of 52.4 ± 11.6 years. Breathlessness was the most common symptom, reported in 64% of patients, followed by cough in 38% and chest pain in 22%. Chest X-ray abnormalities were observed in 72% of cases. The most frequent radiological finding was cardiomegaly (46%), followed by pulmonary oedema (34%), pleural effusion (28%), and consolidation (12%). Normal chest X-rays were seen in 28% of patients. A significant association was observed between breathlessness and pulmonary oedema ($p < 0.01$), as well as between pleural effusion and the presence of cough ($p = 0.03$). Patients with longer dialysis duration (>2 years) showed a higher prevalence of radiological abnormalities (81% vs. 63%, $p = 0.04$).

Conclusion: Respiratory symptoms are highly prevalent among patients on maintenance haemodialysis and are often associated with identifiable chest X-ray abnormalities. Breathlessness and cardiopulmonary changes such as cardiomegaly and pulmonary oedema predominate. Routine respiratory assessment along with periodic chest imaging may aid in early detection and better management of these complications.

Keywords: Haemodialysis, Respiratory Symptoms, Chest X-Ray, Pulmonary Oedema, Pleural Effusion, Chronic Kidney Disease.

INTRODUCTION

Chronic kidney disease (CKD) is a major public health concern worldwide, with a steadily rising incidence due to increasing prevalence of diabetes

Mellitus, hypertension, and ageing populations [1]. Patients who progress to end-stage renal disease (ESRD) require renal replacement therapy, of which maintenance haemodialysis remains one of the most commonly utilised modalities, particularly in developing countries [2]. Although haemodialysis improves survival, it is associated with a wide range of systemic complications that significantly impact quality of life and overall prognosis. Among these, pulmonary complications are frequently encountered but often under-recognised



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in routine clinical practice [3]. The respiratory system is particularly vulnerable in patients on haemodialysis due to multiple interacting factors such as fluid overload, altered immune function, chronic inflammation, metabolic disturbances, and cardiovascular comorbidities [4]. These factors predispose patients to both acute and chronic respiratory manifestations, ranging from mild symptoms such as cough to severe conditions like pulmonary oedema and pleural effusion [5].

Fluid overload is one of the most important contributors to respiratory morbidity in haemodialysis patients. Inadequate fluid removal or non-adherence to fluid restriction can lead to increased hydrostatic pressure in the pulmonary circulation, resulting in pulmonary congestion and oedema [6]. Additionally, hypoalbuminaemia and increased capillary permeability may further aggravate fluid accumulation in the interstitial and pleural spaces [7]. Cardiovascular changes, particularly left ventricular hypertrophy and heart failure, also play a significant role in the development of pulmonary symptoms in this population [8].

Apart from fluid-related complications, patients on long-term haemodialysis are also at increased risk of infections, including pneumonia and tuberculosis, due to impaired immunity [9]. Uremia itself contributes to altered host defence mechanisms, including dysfunction of neutrophils and lymphocytes, thereby increasing susceptibility to respiratory infections [10]. Furthermore, repeated exposure to dialysis membranes and bioincompatible materials may induce chronic inflammatory responses, which can affect pulmonary function over time [11].

Chest radiography remains a simple, cost-effective, and widely available imaging modality for evaluating pulmonary abnormalities in haemodialysis patients [12]. It plays a crucial role in identifying cardiomegaly, pulmonary oedema, pleural effusion, and infective lesions, thereby aiding in early diagnosis and management [13]. Despite its utility, routine chest imaging is not always performed unless clinically indicated, which may result in missed or delayed detection of subclinical abnormalities.

Previous studies have reported a high prevalence of radiological abnormalities in patients undergoing haemodialysis, even in the absence of overt respiratory symptoms [14]. Breathlessness has been consistently identified as the most common presenting complaint, often correlating with fluid overload and cardiac dysfunction [15]. However, there is considerable variability in the reported prevalence and pattern of respiratory manifestations across different populations, likely due to differences in dialysis practices, comorbidities, and healthcare access [16].

In the Indian context, where resource constraints and late presentation of CKD are common, the burden of respiratory complications in haemodialysis patients may be even higher [17-22]. Limited data are available from tertiary care settings evaluating the combined clinical and radiological profile of these patients. Understanding the relationship between respiratory symptoms and chest X-ray findings is essential for timely intervention and prevention of complications.

Therefore, the present study was undertaken to assess the prevalence of respiratory symptoms and to evaluate chest radiographic abnormalities in patients undergoing maintenance haemodialysis. The study also aims to explore the association between clinical features and imaging findings, which may help in improving routine screening and management strategies in this vulnerable population.

MATERIALS AND METHODS

Study Design and Setting

This study was carried out as a hospital-based cross-sectional observational study in the Department of Pulmonary Medicine, Government Medical College, Mahbubnagar, Telangana. The study period extended over one year, from January 2025 to December 2025. The institution functions as a tertiary care centre catering to a diverse population, including patients referred from peripheral healthcare facilities. The dialysis unit attached to the hospital manages a substantial number of patients with chronic kidney disease, providing an appropriate setting to evaluate respiratory manifestations in individuals undergoing long-term haemodialysis. The cross-sectional design was chosen to provide a snapshot of the clinical and radiological profile of these patients during the study period.

Study Population

The study population comprised patients diagnosed with end-stage renal disease who were receiving maintenance haemodialysis at the hospital. Only adult patients aged 18 years and above were included to ensure uniformity in clinical assessment and interpretation of findings. Both male and female patients were considered without any gender-based restriction. To minimise variability related to early dialysis adaptation, only those patients who had been on regular haemodialysis for a minimum duration of three months were enrolled. This ensured that the respiratory findings observed were more likely related to chronic haemodialysis status rather than acute fluctuations.

Sample Size

A total of 100 patients were included in the study. The sample size was determined based on the average number of patients attending the haemodialysis unit during the study period and the feasibility of conducting detailed clinical and radiological evaluations within the available

timeframe. While formal sample size calculation was not applied, the selected number was considered adequate to provide meaningful descriptive and analytical insights into the prevalence of respiratory symptoms and associated chest X-ray abnormalities in this population.

Inclusion Criteria

Patients were considered eligible for participation if they met the following criteria: age of 18 years or above, confirmed diagnosis of chronic kidney disease requiring maintenance haemodialysis, duration of haemodialysis of at least three months, and willingness to participate in the study. Written informed consent was obtained from all participants before enrolment.

Exclusion Criteria

Patients with pre-existing chronic respiratory conditions such as bronchial asthma, chronic obstructive pulmonary disease, bronchiectasis, or interstitial lung disease were excluded in order to avoid confounding of respiratory findings. Individuals with active pulmonary tuberculosis undergoing treatment were also excluded due to the potential overlap of clinical and radiological features. Additionally, patients with a recent history of thoracic trauma or surgery were not included, as such conditions could independently influence chest X-ray findings. Critically ill patients who were unable to cooperate with clinical evaluation or radiographic procedures were also excluded from the study.

Data Collection Procedure

Data collection was carried out using a structured and pretested proforma. After obtaining informed consent, detailed demographic information including age and gender was recorded. Clinical details such as duration of haemodialysis, frequency of dialysis sessions per week, and underlying cause of renal failure were documented. Information regarding associated comorbid conditions, particularly diabetes mellitus and hypertension, was also collected as these are known to influence both cardiovascular and pulmonary status.

A detailed clinical history focusing on respiratory symptoms was obtained from each patient. Particular attention was given to symptoms such as breathlessness, cough, chest pain, orthopnoea, and paroxysmal nocturnal dyspnoea. The onset, duration, and progression of these symptoms were carefully noted. Breathlessness was further assessed in terms of its severity based on patient-reported limitation of daily activities.

All patients underwent a thorough general and systemic examination. Respiratory system examination included assessment of respiratory rate, chest movements, use of accessory muscles, percussion notes, and auscultatory findings such as crepitations, rhonchi, or reduced breath sounds. Signs suggestive of pleural effusion or pulmonary

congestion were specifically looked for during the examination.

Chest X-ray Evaluation

Chest radiography was performed for all enrolled patients in the posteroanterior view under standard conditions. Radiographs were interpreted by clinicians with experience in pulmonary medicine to ensure consistency in reporting. Each radiograph was evaluated systematically for the presence of abnormalities.

Findings were categorised into predefined groups, including cardiomegaly, pulmonary oedema, pleural effusion, consolidation, and normal radiographic appearance. Cardiomegaly was assessed based on the cardiothoracic ratio, while pulmonary oedema was identified by features such as bilateral perihilar shadowing or interstitial markings. Pleural effusion was diagnosed by the presence of fluid accumulation indicated by blunting of the costophrenic angle or homogeneous opacity in the lower lung zones. Consolidation was identified by localized areas of increased opacity with or without air bronchograms. In cases where more than one abnormality was present, all relevant findings were recorded.

Operational Definitions

For the purpose of uniformity, specific operational definitions were adopted. Maintenance haemodialysis was defined as regular dialysis sessions performed two to three times per week for a minimum duration of three months. Breathlessness was defined as a subjective sensation of difficulty in breathing as reported by the patient. Pulmonary oedema referred to radiological evidence of fluid accumulation within the lung parenchyma, while pleural effusion denoted the presence of fluid within the pleural cavity as identified on chest X-ray.

Statistical Analysis

The collected data were entered into Microsoft Excel and subsequently analysed using SPSS software version 20.0. Continuous variables such as age were expressed as mean with standard deviation, while categorical variables were presented as frequencies and percentages. The relationship between respiratory symptoms and radiological findings was assessed using the chi-square test to determine statistical significance. A p-value of less than 0.05 was considered indicative of a statistically significant association.

Ethical Considerations

Prior to initiation of the study, approval was obtained from the Institutional Ethics Committee of Government Medical College, Mahbubnagar. All procedures were conducted in accordance with ethical standards. Written informed consent was obtained from each participant after explaining the purpose and nature of the study. Patient confidentiality was maintained throughout the study, and all collected data were used solely for research purposes.

RESULTS

1. Demographic Profile of Study Participants

A total of 100 patients undergoing maintenance haemodialysis were included in the study. The study population showed a predominance of male patients (68%), while females accounted for 32%. The age of

the participants ranged from 24 to 75 years, with a mean age of 52.4 ± 11.6 years. The majority of patients (46%) belonged to the age group of 41–60 years, followed by 32% in the 61–75 years group (Table 1).

Table 1. Age and Gender Distribution of Study Participants

Variable	Category	Number (n=100)	Percentage (%)
Gender	Male	68	68
	Female	32	32
Age Group (years)	18–40	22	22
	41–60	46	46
	61–75	32	32

Values expressed as frequency and percentage.

Clinical Characteristics and Comorbidities

Hypertension was the most common comorbidity, observed in 78% of patients, followed by diabetes mellitus in 54%. A combination of both diabetes and

hypertension was seen in 42% of patients. The average duration of haemodialysis was 2.3 ± 1.4 years, with 58% of patients undergoing dialysis for more than two years (Table 2).

Table 2: Clinical Profile of Patients

Variable	Category	Number	Percentage (%)
Hypertension	Present	78	78
	Absent	22	22
Diabetes Mellitus	Present	54	54
	Absent	46	46
Duration of Dialysis	<2 years	42	42
	≥2 years	58	58

Comorbidities were self-reported and verified from medical records

Prevalence of Respiratory Symptoms

Respiratory symptoms were highly prevalent in the study population. Breathlessness was the most frequently reported symptom, present in 64% of

patients. Cough was noted in 38%, while chest pain was reported by 22% of participants. Orthopnoea and paroxysmal nocturnal dyspnoea were observed in 26% and 18% of patients, respectively (Table 3).

Table 3. Distribution of Respiratory Symptoms

Symptom	Number (n=100)	Percentage (%)
Breathlessness	64	64
Cough	38	38
Chest Pain	22	22
Orthopnoea	26	26
PND	18	18

Patients may have presented with more than one symptom.

Chest X-ray Findings

Chest radiographic abnormalities were detected in 72% of patients, while 28% had normal findings. Cardiomegaly was the most common abnormality

(46%), followed by pulmonary oedema (34%), pleural effusion (28%), and consolidation (12%). Some patients showed more than one radiological finding (Table 4 & 5).

Table 4. Chest X-ray Findings

Finding	Number (n=100)	Percentage (%)
Cardiomegaly	46	46
Pulmonary Oedema	34	34
Pleural Effusion	28	28
Consolidation	12	12
Normal	28	28

Multiple findings were recorded in some patients; hence percentages may overlap.

Association between Respiratory Symptoms and Chest X-ray Findings

A statistically significant association was observed between breathlessness and pulmonary oedema. Among patients with breathlessness, 28 out of 64 (43.7%) had radiological evidence of pulmonary

oedema, compared to only 6 out of 36 (16.7%) without breathlessness (Table 5).

Similarly, cough showed a significant association with pleural effusion. Among patients with cough, 16 (42.1%) had pleural effusion compared to 12 (19.4%) among those without cough (Table 6).

Table 5. Association between Breathlessness and Pulmonary Oedema

Breathlessness	Pulmonary Oedema Present	Absent	Total
Yes (n=64)	28	36	64
No (n=36)	6	30	36

$\chi^2 = 8.21$; $p = 0.004$; Chi-square test applied; $p < 0.05$ considered significant.

Table 6. Association between Cough and Pleural Effusion

Cough	Pleural Effusion Present	Absent	Total
Yes (n=38)	16	22	38
No (n=62)	12	50	62

$\chi^2 = 4.65$; $p = 0.031$; statistically significant association observed.

Influence of Duration of Haemodialysis on Radiological Findings

Patients undergoing haemodialysis for more than two years demonstrated a higher prevalence of

chest X-ray abnormalities (81%) compared to those with shorter duration (63%). This difference was statistically significant (Table 7).

Table 7. Duration of Dialysis Vs Radiological Abnormalities

Duration	Abnormal X-ray	Normal X-ray	Total
<2 years (n=42)	26	16	42
≥ 2 years (n=58)	47	11	58

$\chi^2 = 4.23$; $p = 0.039$; Longer dialysis duration associated with increased abnormalities.

Radiological Illustrations

Chest radiography provided valuable insight into the spectrum of pulmonary and cardiovascular changes observed in patients undergoing maintenance haemodialysis. The illustrative images included in this study highlight the commonly encountered abnormalities and their clinical relevance.

Cardiomegaly was one of the most frequently observed findings in the present study. As shown in **Figure 1**, the chest X-ray demonstrates an enlarged

cardiac silhouette with an increased cardiothoracic ratio in the posteroanterior view. This enlargement is often reflective of chronic volume overload and underlying cardiac dysfunction, which are well-recognised complications in patients with long-standing renal failure. In many cases, cardiomegaly was accompanied by subtle pulmonary vascular congestion, indicating early fluid accumulation within the pulmonary circulation.

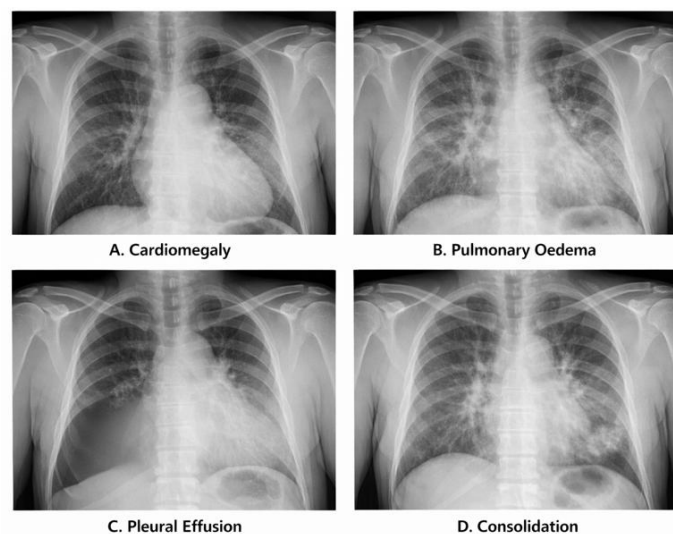


Figure 1. Representative chest X-ray findings in patients on maintenance haemodialysis

Panel A shows cardiomegaly with an enlarged cardiac silhouette. Panel B shows pulmonary oedema with bilateral perihilar fluffy opacities. Panel C shows pleural effusion with blunting of the costophrenic angle and basal homogeneous opacity. Panel D shows pulmonary consolidation with a focal area of increased lung opacity suggestive of infective involvement.

Pulmonary oedema, another prominent finding, is illustrated in **Figure 2**. The radiograph shows

bilateral, symmetrical perihilar opacities forming a characteristic “bat-wing” appearance. These changes are typically associated with fluid overload and increased hydrostatic pressure in the pulmonary capillaries. In some patients, interstitial markings such as Kerley B lines were also visible, suggesting early stages of fluid accumulation before alveolar involvement. This radiological pattern correlated well with the clinical complaint of breathlessness observed in a large proportion of patients.



Figure 2. Chest X-Ray Showing Pulmonary Oedema In A Patient On Maintenance Haemodialysis

Bilateral symmetrical perihilar fluffy opacities produce a typical bat-wing pattern, suggestive of alveolar fluid accumulation. Subtle interstitial markings, including Kerley B lines, are also visible, indicating early interstitial oedema.

Pleural effusion was another important abnormality noted on chest X-ray, as depicted in **Figure 3**. The image shows blunting of the costophrenic angle along with a homogeneous opacity in the lower lung

field, consistent with fluid accumulation in the pleural space. In some cases, a meniscus sign was appreciable, further confirming the presence of effusion. Pleural effusions in haemodialysis patients are often multifactorial, resulting from fluid overload, hypoalbuminaemia, or associated cardiac dysfunction. The presence of pleural effusion frequently coincided with symptoms such as cough and mild respiratory discomfort.



Figure 3. Chest X-ray showing pleural effusion in a patient on maintenance haemodialysis

Blunting of the costophrenic angle with a homogeneous basal opacity is seen, consistent with fluid in the pleural cavity. A subtle meniscus sign is also appreciable, supporting the diagnosis of pleural effusion

Figure 4 demonstrates an example of pulmonary consolidation. The radiograph reveals a localized area of increased opacity, often segmental or lobar

in distribution, with the presence of air bronchograms in certain cases. This finding is suggestive of infective pathology, such as pneumonia, which may occur in haemodialysis patients due to compromised immune function. Consolidation was less frequent compared to other abnormalities but remains clinically significant as it requires prompt recognition and management.



Figure 4. Chest X-Ray Showing Pulmonary Consolidation in a Patient on Maintenance Haemodialysis

A localized area of increased opacity is seen in the lung field, consistent with segmental or lobar consolidation. Faint air bronchograms are visible within the opacity, favouring an infective process such as pneumonia

Overall, the radiological illustrations emphasise the predominance of fluid-related changes, particularly cardiomegaly and pulmonary oedema, in patients undergoing maintenance haemodialysis. These findings underline the importance of regular imaging evaluation, especially in individuals presenting with respiratory symptoms, as early detection can guide timely intervention and improve clinical outcomes

The present study evaluated the pattern of respiratory symptoms and chest radiographic abnormalities in patients undergoing maintenance haemodialysis. The findings highlight a high burden of pulmonary involvement in this population, with both clinical and radiological manifestations being frequently observed.

In the current study, breathlessness emerged as the most common presenting symptom, affecting nearly two-thirds of the study population. This observation is consistent with earlier reports, where dyspnoea has been identified as the predominant respiratory complaint among haemodialysis patients [3,15]. The underlying mechanisms are multifactorial and include fluid overload, reduced pulmonary

compliance, and coexisting cardiac dysfunction. The accumulation of extracellular fluid, particularly in patients with inadequate ultrafiltration, leads to increased pulmonary capillary pressure and interstitial oedema, thereby contributing to breathlessness [6].

Cough and chest pain were also noted in a considerable proportion of patients. These symptoms may reflect a combination of pleural irritation, pulmonary congestion, or superimposed infection. Previous studies have indicated that chronic inflammation and impaired immune function in patients with end-stage renal disease predispose them to respiratory infections, which may present with cough and radiographic consolidation [9,10]. Although consolidation was less common in the present study, its presence underscores the importance of considering infective causes in symptomatic individuals.

Radiologically, cardiomegaly was the most frequently observed abnormality. This finding aligns with existing literature, where structural cardiac changes such as left ventricular hypertrophy and dilatation are commonly seen in patients with chronic kidney disease [8]. Persistent volume overload, anaemia, and hypertension contribute to cardiac remodelling, which is reflected as an enlarged cardiac silhouette on chest radiography. The high prevalence of cardiomegaly in this study

reinforces the close interrelationship between cardiac and pulmonary pathology in haemodialysis patients.

Pulmonary oedema was another significant radiological finding and showed a strong association with breathlessness. This correlation is well supported by earlier studies, which have demonstrated that pulmonary congestion is a major contributor to respiratory distress in dialysis patients [6,15]. The classical radiographic features, including bilateral perihilar opacities, were observed in many cases. These findings highlight the role of fluid management in preventing pulmonary complications, as even minor deviations in fluid balance can lead to clinically significant changes.

Pleural effusion was detected in a notable proportion of patients and was significantly associated with the presence of cough. The development of pleural effusion in haemodialysis patients is often attributed to a combination of fluid overload, hypoalbuminaemia, and increased capillary permeability [7]. In some cases, cardiac dysfunction may further exacerbate fluid accumulation in the pleural space. Similar observations have been reported in previous studies, where pleural effusion was identified as a common radiographic abnormality in patients on long-term dialysis [13].

An important observation in this study was the higher prevalence of radiological abnormalities among patients undergoing haemodialysis for more than two years. This finding suggests a cumulative effect of prolonged exposure to fluid shifts, metabolic disturbances, and cardiovascular stress. Previous research has also indicated that long-term dialysis is associated with progressive structural and functional changes in both the heart and lungs [19,20]. These changes may initially be subclinical but eventually become evident on imaging studies.

The association between clinical symptoms and radiological findings observed in this study further emphasises the importance of integrated assessment. For instance, the significant relationship between breathlessness and pulmonary oedema, as well as between cough and pleural effusion, supports the use of chest radiography as a complementary tool in evaluating symptomatic patients. Similar correlations have been reported in earlier studies, suggesting that clinical features can often provide useful clues to underlying radiological abnormalities [14,16].

From a clinical perspective, the findings of this study highlight the need for regular respiratory evaluation in patients undergoing maintenance haemodialysis. Routine assessment of symptoms, along with periodic chest imaging, may facilitate early detection of complications and timely intervention. In resource-limited settings, where advanced imaging modalities may not be readily available, chest X-ray remains a valuable and practical tool for initial evaluation [12].

The study also underscores the importance of optimising fluid management and addressing cardiovascular comorbidities in this population. Effective control of volume status, along with appropriate management of hypertension and anaemia, may help reduce the burden of pulmonary complications. In addition, early identification and treatment of infections can prevent further deterioration in respiratory function.

However, certain limitations should be considered while interpreting the results. The cross-sectional design limits the ability to establish causal relationships. The sample size, although adequate for descriptive analysis, may not capture the full spectrum of variability seen in larger populations. Furthermore, advanced imaging techniques such as computed tomography were not utilised, which may have identified additional subclinical abnormalities. Despite these limitations, the study provides valuable insight into the respiratory profile of haemodialysis patients in a tertiary care setting. The findings are particularly relevant in the Indian context, where late presentation of CKD and limited access to healthcare resources may contribute to increased morbidity [17]. Future studies with larger sample sizes and longitudinal follow-up may help to better understand the progression of pulmonary changes in this population.

In summary, the present study demonstrates that respiratory symptoms and chest radiographic abnormalities are highly prevalent among patients on maintenance haemodialysis. The strong association between clinical and radiological findings highlights the importance of comprehensive evaluation, which can aid in improving patient outcomes through timely diagnosis and management.

CONCLUSION

The present study brings out the considerable burden of respiratory involvement in patients undergoing maintenance haemodialysis. A large proportion of patients experienced respiratory symptoms, with breathlessness being the most prominent complaint, followed by cough and chest discomfort. These symptoms were not merely subjective but were supported by identifiable abnormalities on chest radiography in the majority of cases.

Among the radiological findings, cardiomegaly and pulmonary oedema were the most frequently observed changes, reflecting the combined impact of chronic volume overload and cardiovascular dysfunction in this population. Pleural effusion and, to a lesser extent, pulmonary consolidation were also noted, indicating that both fluid-related and infective processes contribute to respiratory morbidity. The study further demonstrated a clear association between clinical symptoms and specific radiological abnormalities, emphasising that careful clinical

evaluation can provide meaningful clues to underlying pathology.

An important observation was the increased prevalence of chest X-ray abnormalities in patients with a longer duration of haemodialysis. This suggests that the effects of sustained metabolic imbalance, repeated fluid shifts, and cardiovascular stress tend to accumulate over time, leading to progressive structural changes. These findings underline the need for ongoing monitoring rather than episodic assessment.

From a practical standpoint, the study highlights the usefulness of chest radiography as a simple, accessible, and cost-effective tool for evaluating respiratory complications in haemodialysis patients. When used alongside clinical assessment, it can aid in early detection and timely management, especially in resource-limited settings where advanced imaging may not be readily available.

Overall, the findings stress the importance of adopting a proactive approach in the routine care of patients on maintenance haemodialysis. Regular assessment of respiratory symptoms, periodic imaging, and meticulous control of fluid status and comorbid conditions may help reduce the burden of pulmonary complications. Early recognition and intervention can play a key role in improving quality of life and preventing further clinical deterioration in this vulnerable group.

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