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Original Article

Pathological Pulmonary Manifestations in Chronic Kidney Disease Patients Undergoing Hemodialysis

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ABSTRACT

Provenance of chronic kidney diseases is much more common in these days especially in patients suffering from secondary causes like diabetes mellitus and hypertension. **Objective:** To study the prevalence of pathological pulmonary manifestations in chronic kidney diseases patients. **Methods:** A descriptive cross-sectional study was done to examine the spectrum of pulmonary manifestations and any significant correlation with raised serum urea and creatinine level in patients on hemodialysis at various dialyzing units in Abbottabad for chronic kidney diseases. 200 patients with end-stage renal diseases were selected with convenience sampling for study with complaints of breathlessness, cough or chest discomfort. Evidence of pulmonary manifestations was gathered from histopathological and radiological reports records. **Results:** The most common findings in the acute phase of the patients were pneumonia 30% and 14% in males and females respectively. Pleural effusion was 20% prevalent in males while 6% in females. Empyema was 7% in males and 2% in females. Lung abscess and fibrosis was less common in patients suffering from chronic kidney disease. Spearmen rho results showed significant two tailed correlations between pulmonary manifestations and raised level of serum urea and creatinine levels. In most patients, co-morbidities such as diabetes mellitus and chronic hypertension, urolithiasis were evident as co-factors with significant raised urea and creatinine levels responsible for chronic kidney diseases. **Conclusions:** Pulmonary manifestations are common in patients on hemodialysis due to chronic kidney disease and strong correlation exists between raised serum urea and creatinine markers with pulmonary manifestations.

INTRODUCTION

Chronic renal failure commonly termed CKD is a pathological state in which glomerular structural derangements results in morphological and functional disruption of the whole kidney resulting in diminished GFR (Glomerular Filtration Rate) not less than or equal to 3 months. Globally estimated records suggest that about 10% population worldwide suffer from this fatal condition and deaths have been recorded in millions due to lack of inadequate treatment provided at time [1]. Pakistan has been ranked eight globally with a high rate of chronic kidney diseases, with almost 17 million people due to diagnosis at an advance stage, urolithiasis and secondary pathologies like diabetes mellitus and uncontrolled hypertension [2]. Initially it appears asymptomatic despite increased urea and creatinine concentration in serum. Symptoms usually appear at an advance in the form of decreased GFR and chronic anemia usually and untreated chronic kidney diseases results in kidney failure and renal dialysis become the mainstay of survival only [3]. Although hemodialysis improves the prognosis but it results in hemodynamic complications invading many systems of the body especially cardiovascular and respiratory system [4]. Organs in the thorax region are main targets of this fatal uremia, which can be diagnosed by histopathological and radiological techniques. Cardiovascular and pulmonary manifestations are more marked in complex format,

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pulmonary manifestations most commonly encountered are pneumonia, pleural effusion, pleural infections, and fibrosis in later stages etc [5]. Pleural effusion and pulmonary edema account for the majority of pulmonary symptoms in hemodialysis patients with chronic kidney diseases. These conditions are diagnosed radiologically and confirmed by pathological examination using needle aspiration cytology [6]. These pathological manifestations are caused by excess fluid in the systemic vascular system, which leads to cardiac failure indirectly. In hemodialysis patients, uremia becomes the primary cause of pulmonary edema, which is typically caused by excess fluid volume with left ventricular failure. These manifestations can occur with or without superimposed bacterial infections [7]. The primary diagnostic and confirmatory tests are thorax imaging and fine needle aspiration cytology. These are readily available, reasonably priced, and non-invasive diagnostic procedures. These pathologies are usually detected on radiological examinations and confirmed on histopathological examination [8].

METHODS

It was cross sectional descriptive study on patients undergoing hemodialysis at various dialyzing units in Abbottabad. The study duration was 6 months starting from June 2023 and was conducted at the Pathology Department of Women Medical and Dental College Abbottabad. IRB approval was taken via letter no: WMC/PL/1018-2023, Dated: 10-05-2023. 200 patients with end-stage renal diseases were selected with convenience sampling for study with complaints of breathlessness, cough or chest discomfort. The sample size using Open Epi (https://www.openepi.com/SampleSize/SSPropor.htm) with an error margin of 5 % and a 95 % confidence interval. Evidence of pulmonary manifestations was gathered from histopathological and radiological reports records. Inclusion Criteria was patients suffering from chronic kidney diseases with pulmonary manifestations were included in the study. Exclusion Criteria was patients OF CKD with non-pulmonary manifestation and patients of CKD without pulmonary manifestation were not included in the study. The patient's spectrum of lung pathologies was recorded from histopathological reports and radiological findings. The data of histopathological and radiological reports was taken from medical records. SPSS version 24.0 was applied for statistical analysis. Descriptive statistics were applied for frequency measures and inferential statistics like spearmen rho correlations were applied for any significant correlation between raised urea and creatinine levels with co-morbidities and pulmonary manifestations in chronic kidney disease patients.

RESULTS

The results of the study consist of 200 patients on hemodialysis suffering from chronic kidney disease secondary to multiple causes. The table depicts that the majority of patients with CKD with pulmonary manifestations belonged to the age group range of 51-60 years. The results also showed that CKD was more common in the male population (55%). The majority of the population with CKD (52.5%) were of normal weight and only 2.5% of patients were obese. Recording BMI has been considered vital in this study due to its association with diseases like diabetes and hypertension. Body Mass Index (BMI) is a measure of weight versus height of individuals calculated by dividing the weight by height (m2) and is characterized by different scales of measurement classified into 4 categories (Table 1).

Table 1: Frequency Distribution of CKD

Physiological/Biometric Index		N (%)
Age (Years)	30-40 Years	15 (7.5%)
	41-50 Years	45 (22.5%)
	51-60 Years	90 (45%)
	61-70 Years	40 (20%)
	>70 Years	10 (5%)
Gender	Male	110 (55%)
	Female	90 (45%)
BMI (Body Mass Index)	Under Weight	50 (25%)
	Normal Weight	105 (52.5%)
	Over weight	40 (20%)
	Obese Person	05 (2.5%)

The results shown in table 2 indicate the frequency/ percentage of CKD with different physiological or biometric indices like age, gender, and BMI. Table 2 shows the frequency distribution of comorbid diseases seen in patients of CKD. Hypertension was the most common disease with diabetes as second most frequent co morbid disease seen in CKD patients on hemodialysis.

Table 2: Distribution of Comorbid Diseases among Patients

Co Morbid Diseases	N (%)
Hypertension	82 (41%)
Diabetes Mellitus	86 (43%)
Serum Lipids Level	62 (31%)
Urolithiasis	42 (21%)

Figure 1 demonstrates that pneumonia was the most common pulmonary manifestation and it was more common in males as compared to females. While non-specific findings were more marked in female individuals rather in males. Lung abscess prevalence was marked in males (72%) and females (28%), empyema (80%) and (20%) in males and females respectively. Pleural effusion (70%), and fibrosis (60%) were seen in males while in females it was 30% and 40 % respectively. Metastatic findings were

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seen only in male individuals.

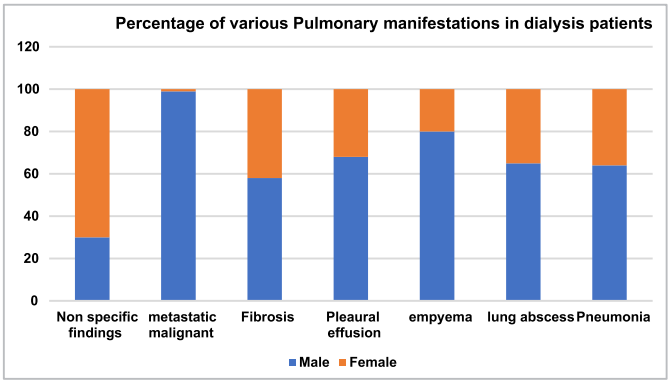

Figure 1: Frequency Distribution of Pulmonary Manifestations in Patients Suffering from Chronic Kidney Diseases on Hemodialysis

Table 3 shows the Spearman's rho Correlations results of the patients with pulmonary manifestations, co-morbidities suffering from chronic kidney disease. There is significant Sig. (2-tailed) correlation between raised levels of serum urea and creatinine of chronic kidney disease patients with severe pulmonary manifestations. Raised level serum urea and creatinine were also correlated with co-morbidities like high blood pressure and diabetes.

Table 3: Spearman's Rho Correlations Results of the Patients with Pulmonary Manifestations, Co-Morbidities Suffering from Chronic Kidney Disease.

Variables		Urea level mg/dl	Creatinine mg/dL	Pulmonary pathologies	Blood pressure	Blood sugar random
Urea Level mg/dl	Correlation Coefficient	10.00	0.50	0.46	0.46	10.00**
	Sig. (2-Tailed)	-	0.00	0.00	0.00	-
Creatinine mg/dL	Correlation Coefficient	0.59	-	0.21	0.21	0.59
	Sig. (2-Tailed)	0.00	-	0.01	0.01	0.00
Pulmonary Pathologies	Correlation Coefficient	0.46	0.21	10.00	10.00**	0.46
	Sig. (2-Tailed)	0.00	0.01	-	-	0.00
Blood Pressure	Correlation Coefficient	0.46	0.21	10.00**	10.00	0.46
	Sig. (2-Tailed)	0.00	0.01	-	-	0.00
Blood Sugar Random	Correlation Coefficient	10.00**	0.59	0.46	0.46	-
	Sig. (2-Tailed)	-	0.00	0.00	0.00	10.00

**. Correlation is significant at the 0.01 level (2-tailed).

DISCUSSION

Results of the study show that prevalence of pneumonia is much common in the patients on dialysis suffering from chronic kidney disease, study by Sise *et al.*, found the similar results in which majority of patients suffering from chronic kidney disease on hemodialysis found pneumonia on histopathological examination, 61% whereas 39% do not [9]. Several co-morbidity factors contribute towards chronic kidney disease like diabetes mellitus, hypertension, urolithiasis and high serum lipids levels. Similar results have been found in studies conducted by Sorino *et al.*, KN Mukhtar *et al.*, and M Yigla *et al.*, found that female patients suffer more with pulmonary manifestations than males, which is contradictory to our findings [10]. Various other studies also beckon our findings. Based on the study findings, 72% of females suffering from chronic kidney disease on hemodialysis have non-significant findings on histopathological examination while the non-significant percentage is lower in males in our study group which is the parallel study finding in a study done by Lee *et al.*, the 43% of chronic kidney disease patients under hemodialysis have non-significant findings on hemodialysis [11]. CKD patients suffer with higher prevalence of pleural effusion than the general population due to fluid overload during the dialysis process and at a greater risk. Age, diabetes mellitus uncontrolled hypertension, deranged serum lipids, malnutrition, and urolithiasis. Study based results show that, 7 % suffer from empyema and 6% from lung fibrosis which is common in females than in males [12]. Study conducted by DJ Piersonet *et al.*, and JA Herrero et al., show that 19 % of patients suffering from chronic kidney disease hemodialysis exhibit pulmonary fibrosis, whereas 81% do not, this assimilates with a study by Pradesya and Faesol in which findings on 69 subjects of chronic kidney disease on hemodialysis have histopathological findings and imaging techniques indicate similar results [13]. Study results, less than 1% of population showed malignant manifestation on histopathological findings counter confirmed by imaging techniques. Unilateral pleural effusion was 24% while 14% marked bilateral pleural effusion and 62% didn't indicate pleural effusion it is similar with the study conducted by Walter *et al* [14]. Study by Zhao *et al.*, demonstrates that from 257 hemodialysis patients on long term only 50 patients suffered from pleural effusion, half of the patients suffered from unilateral and the rest half from bilateral pleural effusion [15]. Pleural effusion is recurrent in nature in CKD present with dyspnea, paroxysmal nocturnal dyspnea, and in some cases orthopnea. Pleural effusion is secondary to uremic pleuritis, overhydration, and bronchopulmonary bacterial infection. A study done by Nitin *et al.*, found that transudative pleural effusion in CKD patients was commonly caused by cardiac failure whereas exudative effusions were due to tuberculosis [16]. There is a strong correlation between deranged pulmonary function tests and chronic kidney disease patients. This fact was supported by a study conducted by Anees *et al.*, in which pulmonary functions were abnormal in almost half of the patients with CKD [17]. Many studies focused on the association of pulmonary hypertension with CKD patients

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but in our research, we only assessed the pulmonary complications of our patients [18, 19]. Raised urea and creatinine always result in pulmonary edema and pulmonary effusion according to the study conducted by Borg *et al.* In our research, there is a significant two-tailed correlation with 0.00 which is found in one of the studies conducted by Zhou *et al* [20].

CONCLUSIONS

It can be concluded that patients on hemodialysis due to chronic kidney disease do have pulmonary manifestations especially pneumonia and pleural effusion and it is more common in males than females and in advanced ages particularly. There is a strong correlation between raised serum urea and creatinine markers with pulmonary manifestations in patients suffering from chronic kidney diseases especially having co-morbidities like hypertension and diabetes.

Authors Contribution

Conceptualization: HK
Methodology: HK, SA, AS
Formal analysis: MR, SS
Writing, review and editing: RB, AS, MR, SS

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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