Pakistan Journal of Intensive Care Medicine
eISSN: 2708-2261; pISSN: 2958-4728
www.pjicm.com
DOI: https://doi.org/10.54112/pjicm.v5i02.102
*Pak. J. Inten. Care Med., volume 5(2), **2025**: 102*
Original Research Article

FREQUENCY OF PULMONARY HYPERTENSION IN HEMODIALYSIS PATIENTS PRESENTING AT TERTIARY CARE HOSPITAL

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(Received, 05th May 2025, Revised 15th June 2025, Accepted 02nd July, Published 17th July 2025)

ABSTRACT

Background: *Pulmonary hypertension (PH) is a common and serious cardiovascular complication among patients undergoing hemodialysis. It contributes significantly to increased morbidity and mortality in this population, often remaining underdiagnosed due to a nonspecific clinical presentation.* ***Objective:*** *To determine the frequency of pulmonary hypertension in hemodialysis patients presenting at a tertiary care hospital.* ***Study Design:*** *Cross-sectional descriptive study.* ***Setting:*** *Nephrology Department, Rehman Medical College, Peshawar, Pakistan.* ***Duration of Study:*** *17-September-2024 to 17-March-2025.* ***Methods:*** *A total of 148 hemodialysis patients aged between 18 and 70 years were enrolled. Pulmonary hypertension was diagnosed using Doppler echocardiography, defined as a mean pulmonary arterial pressure (mPAP) >25 mmHg at rest. Clinical evaluation included assessment of angina (Visual Analogue Scale score >3) and shortness of breath. Data were analyzed using descriptive statistics, and results were expressed as frequencies, percentages, means, and standard deviations.* ***Results:*** *The mean age of the study population was 47.55 ± 16.11 years. Of the 148 patients, 85 (57.4%) were male and 63 (42.6%) were female. Pulmonary hypertension was detected in 76 (51.4%) patients, indicating a high prevalence of cardiovascular complications among individuals on long-term hemodialysis.* ***Conclusion:*** *The study found a high frequency (51.4%) of pulmonary hypertension among hemodialysis patients, emphasizing the need for routine cardiovascular monitoring in this high-risk group to improve clinical outcomes and reduce long-term complications.*

Keywords: Pulmonary Hypertension, Hemodialysis, Chronic Kidney Disease, Echocardiography, Prevalence, Tertiary Care

INTRODUCTION

The occurrence of kidney failure continues to rise alongside the prevalence of individuals going through chronic dialysis (1, 2). Hemodialysis (HD) represents the prevailing modality of dialysis, encompassing 89% of global cases, while peritoneal dialysis comprises the remaining 11% (3). The choice of vascular access for HD is a decision based on patient needs, with arteriovenous fistulas the most common choice due to their connection with reduced complication rates as well as enhanced durability over time (4, 5). Outcomes for patients going through HD treatment demonstrate significant variability worldwide, with overall death and morbidity rates remaining high. Improving HD outcomes via continuous quality improvement is hindered by insufficient tracking and communication of quality outcomes, incompatible outcome definitions that obstruct benchmarking as well as information comparison, the absence of a framework to ensure minimum along with optimal quality and safety requirements for HD and variability in practices as well as deficiencies in kidney failure care (6-9).

Pulmonary hypertension (PH) is a serious medical condition marked by higher pulmonary vascular resistance, which leads to right ventricular failure as well as increased mortality risk. The advancements in the treatment of PH have made significant improvements in its management (10-12). Timely diagnosis is crucial for effective treatment of PH. Nevertheless, early-stage PH is frequently disregarded due to the vague nature of its presenting symptoms. Symptoms can include fatigue, exertional dyspnea, and diminished capacity for physical activities. PH can impact individuals of all ages. Current evaluations indicate that around 1% of the global population is affected (13). In developing countries, significant causes of infectious diseases are PH. The incidence of PH is roughly 6 cases per million adults. PH was initially believed to impact young women (14, 15) primarily. According to a study, the reported frequency of PH was 56% in cases of hemodialysis (16).

Given the significant morbidity and mortality associated with PH, particularly in patients with end-stage renal disease undergoing hemodialysis, a deeper understanding of its pathophysiology, diagnostic challenges, and treatment implications is crucial. As there is no such literature available on this subject locally, the goal of this study is to determine the frequency of pulmonary hypertension in hemodialysis patients at our medical setup. The findings of this study will assist our health professionals in providing insights that could potentially inform targeted screening strategies and therapeutic interventions aimed at improving patient care and outcomes in this vulnerable population.

METHODOLOGY

This cross-sectional study was conducted in the Department of Nephrology at Rehman Medical Complex, Peshawar, from 17/September/2024 to 17/March/2025, following ethical approval from the institute. A sample of 148 patients was calculated using the assumed PH prevalence of 56% (16) from prior literature, with a 95% confidence level and 8% absolute precision. Consecutive non-probability sampling was employed.

Patients included adults who were aged 18 to 70 years diagnosed with chronic kidney disease (glomerular filtration rate <60 mL/min/1.73m² with the help of the CKD-EPI equation or albuminuria ≥30 mg/24 hours for over three months). These patients were undergoing hemodialysis. Exclusion conditions included patients with chronic obstructive lung disease, chest wall or parenchymal lung pathology, mitral or aortic valve disease, or obstructive sleep apnea.

Data collection was started after obtaining consent from each patient. A structured proforma was used to record demographics, which

included age, gender, body mass index (BMI), socioeconomic status, residence, education, and employment status, along with duration of dialysis. Clinical assessment for PH involved evaluating symptoms such as angina (visual analog scale score >3) and shortness of breath. Doppler echocardiography was used; PH was defined as a mean pulmonary arterial pressure >25 mmHg at rest. The entire process was carried out under the supervision of an experienced consultant with a minimum of 5 years of experience.

Statistical analysis was carried out using SPSS 25. Age, BMI, and dialysis duration were assessed using mean ± standard deviation. PH frequency, gender, and socioeconomic data were evaluated as frequencies and percentages. Stratification by demographics was conducted using a chi-square test at a 5% significance level.

RESULTS

Our study had 148 patients; their mean age was 47.55±16.11 years. The mean duration of dialysis was 29.39±11.66 months, and the mean body mass index (BMI) was 24.87±1.35 kg/m² (Table 1). Among the patients, there were 85 (57.4%) males while 63 (42.6%) were female patients. The rest of the demographic distribution can be seen in Table 2.

Pulmonary hypertension was present in 76 (51.4%) patients, while 72 (48.6%) did not display the condition (Table 3). Stratification of pulmonary hypertension with various demographic variables can be seen in Table 4.

Table 1: Descriptive statistics

	N	Mean	Std. Deviation
Age (Years)	148	47.55	16.115
Duration of dialysis (Months)	148	29.39	11.661
BMI (Kg/m2)	148	24.8763	1.35941

Table 2: Demographics

Demographics		Frequency	%
Gender	Male	85	57.4%
	Female	63	42.6%
Education status	Literate	76	51.4%
	Illiterate	72	48.6%
Occupation status	Employed	64	43.2%
	Unemployed	84	56.8%
Socioeconomic status	Lower class	47	31.8%
	Middle class	75	50.7%
	Upper class	26	17.6%
Residence	Urban	101	68.2%
	Rural	47	31.8%

Table 3: Frequency of pulmonary hypertension

Pulmonary hypertension	Frequency	Percentage
Yes	76	51.4%
No	72	48.6%

Table 4: Stratification of PH with demographics

Demographics		Pulmonary hypertension				P value
		Yes		No		
		n	%	n	%	
Age distribution (years)	18 to 35	17	22.4%	18	25.0%	P > 0.05
	36 to 50	21	27.6%	20	27.8%	
	> 50	38	50.0%	34	47.2%	
BMI (Kg/m2)	18 to 24.9	42	55.3%	39	54.2%	P > 0.05
	25 to 29.9	34	44.7%	33	45.8%	
Duration of dialysis (Months)	10 to 24	32	42.1%	24	33.3%	P > 0.05
	> 24	44	57.9%	48	66.7%	
Gender	Male	52	68.4%	33	45.8%	P < 0.05
	Female	24	31.6%	39	54.2%	
Education status	Literate	43	56.6%	33	45.8%	P > 0.05
	Illiterate	33	43.4%	39	54.2%	
Occupation status	Employed	35	46.1%	29	40.3%	P > 0.05
	Unemployed	41	53.9%	43	59.7%	
Socioeconomic status	Low class	20	26.3%	27	37.5%	P < 0.05
	Middle class	46	60.5%	29	40.3%	
	Upper class	10	13.2%	16	22.2%	
Residence	Urban	50	65.8%	51	70.8%	P > 0.05
	Rural	26	34.2%	21	29.2%	

DISCUSSION

The frequency of pulmonary hypertension (PH) observed in our study was 51.4% in hemodialysis patients, which resonates with global evidence. Khurram et al. documented 57.76% PH prevalence in patients of hemodialysis (17). Gurusamy et al documented 64% prevalence of PH in their cohort (18). Karmani et al. showed that 65% patients had PH in their study (19). This consistency across diverse regions underscores PH as a pervasive complication of maintenance hemodialysis, which is likely driven by shared pathophysiological mechanisms like chronic volume overload, uremic endothelial dysfunction, and arteriovenous fistula-induced high-output cardiac stress (20). These findings suggest that dialysis itself is a primary PH driver, though local factors may modify risk. Demographically, our cohort had a mean age of 47.55 ± 16.11 years, which was notably younger than populations in comparable studies, such as Karmani et al., who reported a mean age of 56.7 ± 14.4 years, and Nagaraju et al., who reported 54.86 ± 9.2 years (19, 21). This may reflect regional differences in chronic kidney disease (CKD) etiology, earlier dialysis initiation due to limited transplant access, or genetic predispositions. However, Islam et al. reported a similar mean age of 41.4±9.7 years in their study on patients going through hemodialysis (22). Gender distribution showed that the majority in our study were male patients, which contrasts with Mukhtar et al.'s female-predominant PH cohort (67%) (16). Karmani et al. also reported higher PH frequency in females (19). Such discrepancies highlight the need to explore sex-

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specific biological factors, such as hormonal influences on vascular remodeling, in future studies.

Socioeconomically, half the participants were middle-class, with 31.8% in the lower class and only 17.6% in the upper class. Unemployment was high, 56.8%, a variable rarely analyzed in existing literature. This warrants investigation into whether financial instability delays healthcare access, exacerbates fluid retention (due to dietary sodium indiscretion), or limits medication adherence indirectly fueling PH progression (23). We observed that most of our patients with PH were from urban areas, which is a factor well documented by Islam et al. in their study; they reported that 76% patients with PH were from urban areas (22).

Dialysis duration in our study showed that patients with PH had a longer duration of dialysis, but we could not find a notable association; however, this higher frequency of PH in longer duration of dialysis aligns well with Khurram et al.'s finding that PH severity accelerates with treatment longevity (17).

PH is a severe condition that can potentially impact the cardiovascular health of hemodialysis patients. Karmani et al. demonstrated that PH was present in 65% of the patients in their cohort, was strongly associated with reduced ejection fractions, and could lead to heart failure, which is a critical concern for patients undergoing dialysis.

CONCLUSION

In conclusion, we found that the frequency of PH in hemodialysis patients in our study was 51.4%, which highlights the critical impact on cardiovascular health. These findings emphasize the need for routine screening and early intervention to mitigate the risks associated with PH in this vulnerable population.

DECLARATIONS

Data Availability Statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned. (RMI-REC/Ethical Approval/61)

Consent for publication

Approved

Funding

Not applicable

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

SADIA KHAN (Trainee Medical Officer)
Conception of Study, Development of Research Methodology Design, Study Design, Review of manuscript, final approval of manuscript. Manuscript drafting.
NISAR ANWAR (Professor)
Manuscript revisions, critical input, and final approval of anuscript
AZIZ AHMAD KHAN (Medical Registrar)
Review of Literature.
IRFAN MIRZA (Assistant Professor)
Critical Input, and Review of Literature
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Critical Input, and Review of Literature

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