

# PREVALENCE OF PULMONARY HYPERTENSION IN PATIENTS UNDERGOING REGULAR MAINTENANCE HEMODIALYSIS DUE TO END STAGE RENAL DISEASE

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## ABSTRACT

**Objectives:** To determine the prevalence of pulmonary hypertension (PH) in patients undergoing regular hemodialysis (HD) via arteriovenous access due to end stage renal disease (ESRD) and correlation of PH with variables such as Age, Gender, Body mass index, Hypertension, Diabetes, duration of dialysis, hemoglobin (HB) concentration.

**Methodology:** The type of study is a Cross sectional study that was conducted In Nephrology Department, Lahore General Hospital, Pakistan over a period of 6months, From July 2016, to Dec, 2016 in Age group 16yrs to 65yrs old Population, taking into consideration the inclusion & exclusion criteria and appropriate informed consent after taking detailed history of every patient. The study population consisted of n=50 with end stage renal disease. Various parameters including the Pulmonary Arterial systolic pressure (PASP) were recorded. A pulmonary arterial pressure greater than 25mmHg at rest was defined as pulmonary hypertension, and it was further divided into three sub categories mild (btw 25-40mmHg), moderate (btw 40-55mmHg) and severe (greater than 55mmHg). Data were correlated with different variables like Age, Gender, Body mass index, Hypertension, Diabetes, Duration of dialysis, HB concentration. Data was analyzed using SPSS v23.0.

**Results:** Out of the Total n=50 patients, 28(56%) were males and 22(44%) were females. The mean duration of time duration of dialysis was  $14.88 \pm 9.87$  months. 18(36%) patients were found to have PH, 32(64%) did not have PH. Pulmonary hypertension was found to be greater in patients who had been on dialysis for more than 5 months. It was also noticed that longer the duration of Hemodialysis, greater the prevalence of PH. Our study revealed a positive association between the duration of dialysis and the prevalence of PH along-with low levels of hemoglobin with mean  $10.02 \pm 2.12$  and high body mass index with mean  $24.0 \pm 6.62$ .

**Conclusion:** According to the results of our study patients on maintenance hemodialysis due to end stage renal disease ,the prevalence of PH is more common in males and has a strong correlation with the duration of maintenance hemodialysis, body mass index, old age group (46-65yrs), Diabetes, Hypertension and low HB concentration.

**Keywords:** Pulmonary Hypertension(PH), Hemodialysis (HD), Pulmonary Arterial systolic pressure (PASP) , End Stage Renal Disease (ESRD) ,Hemoglobin (HB), Chronic Kidney Disease (CKD).

## INTRODUCTION

Pulmonary Hypertension is an elevation of Pulmonary Arterial systolic pressure (PASP), which can be the result of heart, lung or systemic disorders. PH is defined as a sustained elevation of PASP of  $\geq 25$  mm Hg<sup>[1][3]</sup> at rest as determined by using a Doppler echocardiograph. There is significant epidemiological overlap with kidney disease and the underlying causes of World Health Organization group 1–4 pulmonary hypertension (pulmonary arteriopathy, left heart disease, chronic pulmonary disease, and chronic thromboembolic disease, respectively). In addition, an entity of ‘unexplained pulmonary hypertension, group 5,<sup>[2]</sup> in

patients with chronic kidney disease and end-stage renal disease has emerged, with prevalence estimates of 30–50%.<sup>[3]</sup>

Chronic Kidney Disease (CKD) is now becoming a major health burden day by day , and cardiovascular complications are well recognized source of morbidity and mortality in patients suffering from CKD<sup>[4][5]</sup> and cardiovascular complications account for about 50% deaths in patients of ESRD.<sup>[6]</sup> Along with cardiovascular complications, there is high incidence of PH among patients with ESRD receiving long-term hemodialysis with surgical arteriovenous access. Both ESRD and long-term hemodialysis via arteriovenous

access may be involved in the pathogenesis of PH by affecting pulmonary vascular resistance and cardiac output.<sup>[7]</sup>

In a multivariable Cox proportional hazard model, the development of pulmonary hypertension both before and after initiation of hemodialysis had significantly increased odds ratios and remained an independent predictor of mortality. According to a study by Yigle et al shows that the incidence of pulmonary hypertension, after initiation of hemodialysis therapy, is a strong independent predictor of mortality nearly equal to that associated with long-standing severe cardiac abnormalities.<sup>[8]</sup> The masking of clinical features of pulmonary hypertension which is mainly due to the underlying etiology is a major concern for clinicians as full blown effects are only revealed after right ventricular failure. Now the use of Doppler echocardiography has made it possible to accurately estimate the pulmonary arterial hypertension non-invasively.<sup>[9]</sup> The patients on maintenance hemodialysis are at an increased risk of developing pulmonary hypertension and has a strong correlation with the duration of maintenance hemodialysis and the arteriovenous access utilized.<sup>[10][11]</sup>

In patients suffering from ESRD pulmonary hypertension has multifactorial etiology.<sup>[12][13]</sup> Factors such as metabolic derangements, chronic volume overload, metastatic pulmonary artery calcification (caused by calcium and phosphate metabolic derangements), increased blood flow caused due to the arteriovenous fistula or grafts, may be the causes of pulmonary hypertension, which may ultimately cause heart failure and death.

The aim of this study is to determine the prevalence of pulmonary hypertension in patients undergoing regular hemodialysis via arterio-venous access due to ESRD and we try to establish the correlation of PH with variables such as Age, Gender, Body mass index, Hypertension, Diabetes, duration of dialysis, HB concentration. PH has been associated with increased morbidity and mortality in these patients. Those found to have pulmonary hypertension, can be offered alternative method of dialysis, reversal of AV fistula or may be suggested to have early renal transplant so that they may avoid the fatal complications of pulmonary hypertension.

## METHODOLOGY

The type of study is a Cross sectional study that was conducted In the department of Nephrology, Lahore General Hospital, Pakistan over a period of 6 months, From July 2016, to Dec, 2016 in Age group 16yrs to 65yrs old Population. The study population was selected

after taking appropriate informed consent, by applying proper inclusion and exclusion criteria and taking detailed history of every patient.

The study population consisted of n=50 patients out of which n=28 (56.00%) were males and n=22 (44.00%) were females with end stage renal disease, who undergo regular dialysis on maintenance basis via permanent arteriovenous access two times a week, and each session of about 4 hours duration. Patients with chronic obstructive lung disease, chest wall or parenchymal lung disease, previous pulmonary embolism, collagen vascular disease, moderate or severe mitral or aortic valve disease and having obstructive sleep apnea were excluded. On all the patients fulfilling the inclusion criteria Trans thoracic Echocardiography was performed by a cardiologist post dialysis when patients were at optimal dry weight. Systolic pulmonary artery pressure was measured.

A pulmonary arterial pressure greater than 25mmHg at rest was defined as pulmonary hypertension, and it was further divided into three sub categories mild (between 25-40mmHg), moderate (between 40-55mmHg), severe (greater than 55mmHg).

Data was correlated with different variables like Age, Gender, Body mass index, Hypertension, Diabetes, Duration of dialysis, HB concentration. Chi square test was utilized to analyze the categorical variables, regression analysis was used to analyze the effect of duration of hemodialysis on the pulmonary hypertension, student t-test was utilized to compare the difference of mean, a p value of less than 0.05 was considered to be significant. Data was analyzed using SPSS v23.0.

## RESULTS

Out of total 50 patients enrolled in the study, 28 patients (56%) were males and 22 patients (44%) were female. Minimum duration of hemodialysis was two month and maximum was 48 months and the mean time duration of dialysis was  $14.88 \pm 9.87$  months. Out of 50 patients enrolled all the patients were having arteriovenous fistula.

Out of total 50 patients 18(36%) patients were found to have Pulmonary Hypertension and 32(64%) did not have Pulmonary Hypertension. Out of 18 patients who developed PH, 9(52.9%) had mild PH, 6(42.9%) had moderate pulmonary hypertension and 3(15.8%) had severe PH.

Out of 28 male patients, 10(35.7%) male patients had ESRD with PH and 18(64.3%) had ESRD without PH. Out of 22 female patients, 8(36.4%) female patients had ESRD with PH and 14 (63.6%) had ESRD without PH. P-value was 0.962.

Out of 36% (n=18) patients with pulmonary Hypertension 27.8% had hypertension and p- value was 0.34. Out of 36% (n=18) patients with PH, 26.7% had diabetes and p-value was 0.368.

The prevalence of PH in different age group was found that showed 33.3% in 16-30yrs old patients,

23.1% in 31-45yrs old patients, and 45.5% in 46-65yrs old patients. P-value was 0.398.

Our study revealed a positive association between the duration of dialysis and the prevalence of PH along-with low levels of hemoglobin with mean  $10.02 \pm 2.12$  and high body mass index with mean  $24.0 \pm 6.62$ .

**Table-1:** Comparison between Pulmonary Hypertension and Gender

Gender	Pulmonary Hypertension		Total	P-value
	Yes	No		
Male	10	18	28	0.962
	35.7%	64.3%	100.0%	
Female	8	14	22	0.962
	36.4%	63.6%	100.0%	
Total	18	32	50	0.962
	36.0%	64.0%	100.0%	

**Table-2:** Comparison between Pulmonary Hypertension and Age groups

Age Groups	Pulmonary Hypertension		Total	P-value
	Yes	No		
16-30	5	10	15	0.398
	33.3%	66.7%	100.0%	
31-45	3	10	13	0.398
	23.1%	76.9%	100.0%	
46-65	10	12	22	0.398
	45.5%	54.5%	100.0%	
Total	18	32	50	0.398
	36.0%	64.0%	100.0%	

**Table-3:** Stratification of Pulmonary Hypertension with respect to different variables

Pulmonary Hypertension		Age	Duration of Dialysis (months)	Concentration of Hb	Weight	Height	Body Mass Index (BMI)
Yes	Mean	42.06	20.17	10.02	66.94	167.67	24.00
	Median	47.50	18.00	9.60	62.50	167.00	21.51
	Std. Deviation	14.31	12.99	2.12	16.13	7.65	6.62
	Minimum	17.00	2.00	6.40	45.00	155.00	16.37
	Maximum	62.00	48.00	14.30	100.00	183.00	40.06
No	Mean	40.00	11.91	9.39	55.97	163.88	20.92
	Median	37.00	12.00	9.10	56.50	164.00	20.36
	Std. Deviation	14.42	6.00	1.71	9.51	7.21	4.01
	Minimum	19.00	5.00	6.00	38.00	152.00	15.82
	Maximum	64.00	24.00	14.60	76.00	180.00	31.63

## DISCUSSION

In the current time, chronic diseases like hypertension and diabetes are becoming the leading cause of ESRD. Cardiovascular diseases are leading cause of mortality in ESRD, even after stratification by age, gender, race, and the presence or absence of diabetes, cardiovascular mortality in dialysis patients is 10 to 20 times higher than in the general population and is an independent predictor of death in chronic renal disease. Among hemodialysis and peritoneal dialysis patients, the prevalence of cardiac failure is approximately 40%. Both coronary artery disease and left ventricular hypertrophy are risk factors for the development of cardiac failure.<sup>[14]</sup>

When a patient develops ESRD then patient needs regular hemodialysis or renal transplantation for survival but hemodialysis has many of its own complications, one of which is pulmonary hypertension that is seen in patients who are on maintenance hemodialysis. It is under rated and shows associations with high morbidity and mortality. Its prevalence has been reported to be between 25% and 51%.<sup>[15][16]</sup> A study by Fabio Fabbian reported the highest prevalence of 58.6%.<sup>[16]</sup>

We also have done study to determine the Prevalence of Pulmonary Hypertension In patients undergoing regular maintenance Hemodialysis due to End stage renal disease and we have found that out of total 50 patients of ESRD on hemodialysis, 18 (36%) has developed PH with the mean duration of time duration of dialysis was  $20.17 \pm 12.99$  months. Among the factors that contributed to the development of PH arteriovenous access may be the one cause of development of unexplained PH.<sup>[13][17]</sup>

Our study has shown that out of 18 patients who developed PH, 9 patients (52.9%) had mild PH, 6 patients (42.9%) had moderate pulmonary hypertension, and where as only 3 patients (15.8%) had developed severe PH.

It is also showed that the Pulmonary Hypertension was more common in old age group people with age more than 46 years. The prevalence of PH in different age group was 33.3% in 16-30yrs old patients, 23.1% in 31-45yrs old patients, and 45.5% in 46-65yrs old patients. P-value was 0.398.

Our study showed that chronic diseases like Diabetes and hypertension are also prevalent in patients with PH Out of 36% patients with PH, 27.8% had hypertension and p- value was 0.34 .Out of 36% patients with PH, 26.7% had diabetes and p-value was 0.368.

Our study revealed a positive association between the duration of dialysis We have found that Pulmonary hypertension was found to be greater in patients who had been on dialysis for more than 5months .It was also noticed that longer the duration of Hemodialysis, greater the prevalence of PH and the study further shows more prevalence of PH along-with low levels of hemoglobin with mean  $10.02 \pm 2.12$  and high body mass index with mean  $24.0 \pm 6.62$ .

Our study a certain limitations that we do not have base line Pulmonary artery pressure so we don't know that whether the PH is before the start of HD or after that. Furthermore we cannot able to estimate the exact relationship between AVF and PH , are not able to understand the etiological factors of PH, are not able to devise management plan and follow up of PH , in this regard further studies are needed

## CONCLUSION

According to the results of study it is concluded that ESRD patients on maintenance hemodialysis are at risk of development of PH. Pulmonary hypertension is more common in patients with old age. Patients who are on hemodialysis from long time have increase prevalence of PH, moreover disease like diabetes and hypertension are also common in patients with PH. And PH is more prevalent with low hemoglobin and high body mass index.

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