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NON-INVASIVE CROSS SECTIONAL STUDY ON FREQUENCY OF PULMONARY HYPERTENSION IN PATIENTS WITH CHRONIC KIDNEY DISEASE

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ABSTRACT Pulmonary hypertension (PH) is frequently found in patients with chronic kidney disease (CKD) and is an independent predictor of mortality in end-stage renal disease (ESRD) patients. Pulmonary artery pressure (PAP) may be further increased by high cardiac output resulting from CKD itself and is often worsened by commonly occurring anemia and fluid overload. Therefore, the aim of this study was to determine the prevalence of pulmonary hypertension in chronic kidney disease patients. This cross-sectional study was conducted on 75 CKD patients. Data related to the history of renal disease, other co-morbidities, and the duration of dialysis, ECG ,2D ECHO, XRAY CHEST, CBC, RFT And other lab parameters were collected. Pulmonary hypertension was diagnosed using standard PAP measurement in all patients, employing Doppler echocardiography. In this predominantly male study, with a mean age of 55.41 years (SD = 15.8), 70.7% of the patients were in stage 5 CKD. Hypertension was seen in 60 out of 75 patients, and diabetes in 37 cases. PH was identified in 45.3% of the study participants. Among the 34 participants with PH, 58.8% had mild PH, 35.2% had moderate PH, and 5.88% had severe PH. Mean PAP was higher in patients with PH, averaging 46.5 mm Hg (SD = 8.73) compared to 27.5 mm Hg in those without PH, and it significantly increased as the stage of CKD advanced ($p < 0.001$).Pulmonary hypertension (PH) in chronic kidney disease (CKD) patients is positively correlated with the disease's stage and duration. Early detection using non-invasive techniques such as 2D echocardiography can improve patient outcomes by enabling timely treatment. Further research is needed to better understand the mechanisms of PH in advanced CKD and to evaluate the efficacy of PH therapies in this population. Increased awareness and appropriate management of PH in CKD patients can significantly improve clinical outcomes.

KEYWORDS : Pulmonary hypertension (PH),Chronic kidney disease (CKD),End-stage renal disease (ESRD),Pulmonary artery pressure (PAP), Anemia, Fluid overload, Cardiac output ,Doppler echocardiography, Hypertension, Diabetes

INTRODUCTION :

In the developed world, 13% of people have chronic kidney disease (CKD. End-stage renal disease (ESRD) significantly raises the risk of cardiovascular disease, death, and the need for specialised medical attention. Echocardiographic studies have estimated that between 17% to 56% of these patient populations had PH, and that PH is an independent predictor of death in these patients. Pulmonary hypertension (PH) is characterized by raised pulmonary artery pressure which can eventually lead to right ventricular dysfunction and failure. The development of peripheral vascular resistance as a result of chronic kidney disease (CKD) is most likely the result of the interaction of several changes in cardiovascular physiology, including anaemia, increased cardiac output from an arteriovenous fistula, and increased peripheral vascular resistance. In CKD, metabolic disturbances can change endothelial function, which can cause an imbalance between vasodilators and vasoconstrictors, which can modify the tone of the pulmonary vasculature. The equation for peripheral vascular resistance, which is derived from Ohm's law, physiologically characterises hemodynamic derangements that lead to increase pulmonary vascular resistance that lead to high Pulmonary Arterial Pressure (PAP). PAP readings tend to retreat following successful kidney transplantation (improvement in uremia), after each hemodialysis session, or following temporary closure of the arteriovenous access (decrease of CO), indicating that all are implicated in the pathophysiology. Studies have shown that the prevalence of PH in patients with severe CKD may be lower than that in individuals with ESRD, ranging from 8% to 39%.

The cause of PH determines how it should be treated, underscoring once more how crucial it is to accurately determine the PH aetiology in patients with CKD and ESRD. There is strong evidence that people with end-stage renal disease (ESRD) who have PH have higher death rates.

Therefore, the current study was undertaken to assess the frequency of PH in CKD patients, as the early diagnosis and treatment of PH can enhance these survival of these patients.

METHODOLOGY

MATERIALS AND METHODS :

Source Of Data:

Patients diagnosed with chronic kidney disease, including inpatients and those on maintenance hemodialysis (HD) at the HD Center of Raja Rajeswari Medical College and Hospital, who provided written informed consent, were included

Study Design: Cross-sectional study

Study Area: Rajarajeswari medical college and hospital, Bengaluru.

Study Duration: 18 months

Inclusion Criteria:

1. CKD patients who were willing to participate in the study
2. Age group >18 years
3. Those who provided written informed consent

Exclusion Criteria:

1. All known cases of PH secondary to left-sided heart diseases (e.g., coronary heart diseases), rheumatic heart diseases, and valvular heart diseases.
2. Systemic disorders that can cause PH such as collagen vascular diseases and HIV infection and pulmonary diseases (COPD, pulmonary embolism, and scleroderma).
3. All pregnant women.

RESULTS:

The study comprised a total of 75 CKD patients who were assessed for the presence of pulmonary hypertension in them. Among the 75 subjects, the gender comparison revealed that the study is male predominant with 45 males and 30 females (40%). The mean age of the participants 55.41 years with a standard deviation of 15.8 years. The minimum age seen in this study was 20 years, whereas the maximum age is 94 years old. Most of the respondents were in 41-60 years age group (45.3%), followed by 61-80 years age group (34.7%). Only 3 patients were more than 80 years.

Out of the 75 CKD patients examined, no patient was found to be in CKD stage one. Majority were in stage 5 (70.7%), followed by stage 3 (16%). 3 patients were in stage 2, and 7 patients were in stage 4.

In the current study, 53 CKD patients underwent dialysis (70.7%). 23 patients in Stages 2 and 3 did not undergo dialysis at all. The co-morbidities such as hypertension and diabetes in these CKD patients were also noted down in the study. Hypertension was the biggest co-morbidity in these patients (n=60), showing a prevalence of 80% in the study subjects. 48 of the hypertensive cases were seen in those with Stage 5 disease, and six were seen in stage 3 disease. This association

between hypertension and CKD was found to be significant with a p-value of 0.002. Similarly, Diabetes was also assessed in the CKD patients, which showed that it was seen only in half of the patients (49.3%).

Among the 37 patients with diabetes, 27 were in stage 5 chronic kidney disease (77.7%), 4 in stage 4, and only one in stage 2 CKD. This association is not significant statistically, as they showed equal distribution in all the stages of CKD.

The main variable of the study, Pulmonary hypertension was measured in the study subjects, and the prevalence was 45.3% in them.

Pulmonary Hypertension In Study Participants

Pulmonary Hypertension	Frequency	Percentage
Present	34	45.3%
Absent	41	54.7%
Total	75	100%

Out of the 34 subjects with PHTN, 20 had mild hypertension (58.8%), 12 had moderate pulmonary hypertension (35.2%) and only 2 had severe PHTN (5.88%).

The mean Pulmonary artery systolic pressure (PASP) in the study was 36.17 mm Hg, which was higher than the normal pressure, and showed a standard deviation of 11.37. The mean PASP in those with PHTN is 46.5, and a SD of 8.73. The PASP levels has a mean of 27.5 in those without PHTN, which was slightly lower than the cut-off of 35mm hg.

CKD stage was correlated with the level of pulmonary hypertension, which was found to be highly significant. Both of the Severe PHTN cases were in stage 5 CKD. As CKD stage increases, level of PHTN increased in this observation, with a p value of less than 0.001.

Severity Of PHTN In Association With CKD Staging

CKD Staging		PHTN Level				P-value
		No PHTN	Mild PHTN	Moderate PHTN	Severe PHTN	
Stage 2	N	3	0	0	0	**0.001**
	%	100.0%	0.0%	0.0%	0.0%	
Stage 3	N	8	2	2	0	
	%	66.7%	16.7%	16.7%	0.0%	
Stage 4	N	4	2	1	0	
	%	57.14%	28.57%	14.28%	0%	
Stage 5	N	26	16	9	2	
	%	49.05%	30.18%	16.98%	3.77%	

Pulmonary hypertension was analyzed with other variables in the study. With relation to gender, PHTN did not show any significant association, with equal distribution in both genders. In 32.4% of diabetics, pulmonary hypertension was seen (p=0.23). In 43.3% of hypertensives, PHTN was found, but this was not significant. Similarly, the presence of PHTN has a significant association with dialysis (p=0.042), but there was no association with the age group (p>0.05).

The current study compared the presence of pulmonary hypertension with the lab values of the patient. Urea, creatinine, calcium and Phosphorous, which were directly related to CKD were analysed, and among these, only Urea was significantly related to PHTN (p=0.011). The mean urea value was higher (98.06) in those with PHTN, than in those without (Mean=72.46). Creatinine also showed higher means in PHTN patients, but the statistical significance was not there. Hemoglobin, another lab parameter was found to be significant, with lower hemoglobin levels in those with PHTN.

Means And Standard Deviations Of Lab Values In Pulmonary Hypertension

Pulmonary HTN		Urea	Creatinine	Calcium	Phosphorous	Hemoglobin
Present	Mean	98.06	6.25	8.29	4.53	7.84
	Std. Deviation	25.60	3.41	0.86	2.07	1.87
Absent	Mean	72.46	5.45	8.39	4.36	9.38
	Std. Deviation	17.04	3.10	1.00	1.38	2.58
P-Value		0.011*	0.292	0.661	0.673	0.005

CONCLUSION:

According to the study's findings, pulmonary hypertension (PH) in chronic kidney disease (CKD) patients is positively correlated with the disease's stage and duration. Early detection using non-invasive techniques such as 2D echocardiography (Echo) allows for early treatment, improving patient outcomes by reducing associated mortality and morbidity. More detailed, prospective information about the benefits and drawbacks of pulmonary arterial hypertension (PAH) therapy in this particular group is needed due to the heterogeneity of PH in individuals with CKD and end-stage renal disease (ESRD). Increased awareness of this significant CKD complication, along with effective examination and appropriate management in certain cases, can improve outcomes. Precapillary PH appears to be primarily associated with end-stage kidney disease and/or hemodialysis rather than renal insufficiency. Post-dialysis diagnostic right heart catheterization (RHC) should be performed to distinguish between precapillary and postcapillary PH.

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