

Original research article

## Incidence of pulmonary arterial hypertension in chronic kidney disease at tertiary care hospital

<sup>1</sup>Gauswami Bhaveshgiri Surajgiri, <sup>2</sup>Dharam Prakash Bansal, <sup>3</sup>Ram Kishan Jat, <sup>4</sup>Puneet Rijhwani, <sup>5</sup>Kishore Moolrajani, <sup>6</sup>Priyank Shah

<sup>1,6</sup>Resident, Department of General Medicine, Mahatma Gandhi Medical College & Hospital, Jaipur, Rajasthan, India

<sup>2,5</sup>Professor, Department of General Medicine, Mahatma Gandhi Medical College & Hospital, Jaipur, Rajasthan, India

<sup>3</sup>Associate Professor, Department of General Medicine, Mahatma Gandhi Medical College & Hospital, Jaipur, Rajasthan, India

<sup>4</sup>Professor & Head, Department of General Medicine, Mahatma Gandhi Medical College & Hospital, Jaipur, Rajasthan, India

**Corresponding Author:**

Dr. Ram Kishan Jat ([drramkishanjat01@gmail.com](mailto:drramkishanjat01@gmail.com))

### Abstract

The incidence of pulmonary hypertension (PAH) in chronic kidney disease (CKD) in Indian patients has been evaluated in this study. In addition, association of PAH with CKD etiology, Association between the severity of PAH with CKD duration, various related biochemical parameters, and their relation to PAH in CKD patients were analyzed. This cross-sectional study included 101 CKD patients. Detailed history and clinical examination were recorded. Hemoglobin, blood urea nitrogen (BUN), serum creatinine, albumin, and calcium-phosphorus product were recorded. Pulmonary function test was evaluated and two-dimensional echo was done 4 hours post dialysis.

**Introduction:** Chronic kidney disease (CKD) is a worldwide public health problem both in form of burden of disease and treatment cost. CKD leads to various comorbidities that mark patients of all stages of the disease, currently relationship has been found between HD and Pulmonary Arterial Hypertension.

**Aims and Objectives:** To study incidence of Pulmonary Arterial Hypertension in chronic kidney disease patients. And To study association of chronic kidney disease stages with Pulmonary arterial hypertension

**Results:** The Incidence of PAH in CKD patients was 61.39%. PAH was more common in males (69.3%). The Incidence of PAH increased as CKD stage advanced ( $p < 0.001$ ). The Incidence ( $p = 0.001$ ) and severity ( $p = 0.05$ ) of PH increased with increase in CKD duration. The Incidence of PAH in CKD patients was 61.39%. There was a positive correlation between PAH and duration of CKD, duration of HD and Stages of CKD.

**Keywords:** Chronic kidney disease, hemodialysis, pulmonary arterial hypertension

### Introduction

Chronic kidney disease (CKD) is a worldwide public health problem both in form of burden of disease and treatment cost. The severity may have been undervalued as patients with CKD are at high possibility to die with cardiovascular diseases (CVD) than to reach end-stage renal disease (ESRD) <sup>[1]</sup>.

The World Health Organization categorizes PAH into five classes. Class I comprises idiopathic pulmonary arterial hypertension (PAH), class II contains PAH associated with left heart disease, class III consist PAH associated with lung disease, class IV includes chronic thromboembolic disease, and class V includes PAH with indistinct or multifactorial etiology <sup>[2-3]</sup>.

CKD leads to various comorbidities that mark patients of all stages of the disease. Renal function can only be partly substituted by maintenance dialysis <sup>[4]</sup>. Now these days, out of three modalities of treatment-kidney transplant, hemodialysis (HD) and peritoneal dialysis-majority number of patients are on HD <sup>[5]</sup>. Currently relationship has been found between HD and Pulmonary Arterial Hypertension (PAH) <sup>[6]</sup>.

CKD may lead to PAH by increasing pulmonary vascular pressure, diastolic dysfunction, Anemia, Volume overload with hyperdynamic state as well as interstitial pulmonary edema <sup>[7-8]</sup>. PAH may be due to biological factors like Uremic endothelial dysfunction, disrupting the balance between vasoconstrictors (like endothelin1, thromboxane, plasma and asymmetric dimethylarginine) and

vasodilators (nitric oxide and prostacyclin). Hence this study was conducted to study incidence of PAH in CKD patients.

### Aims and Objectives

- To study incidence of Pulmonary Arterial Hypertension in chronic kidney disease patients.
- To study association of chronic kidney disease stages with Pulmonary arterial hypertension.

### Materials and Methods

The study was conducted on patients attending the in-patient/outpatient department of Nephrology & Medicine in Mahatma Gandhi Hospital. All patients with a diagnosis of chronic kidney disease were taken up for the study after the application of the inclusion and exclusion criteria and after obtaining consent.

**Design:** Cross Sectional Study.

### Inclusion criteria

- CKD patients on HD or conservative management with eGFR<89ml/min/m<sup>2</sup>were selected. Patients with all the following were included.
- All CKD stage 2 and above (as per K-DOQI guidelines): (eGFR was calculated using the MDRD formula).
- Age group >18 years.
- Normal pulmonary function tests on spirometry.
- Written informed consent.

### Exclusion Criteria

- All pregnant females.
- All known cases of PAH secondary to left-sided heart diseases (e.g., coronary heart diseases [ruled out by normal ECG along with absence of regional hypokinetic segment and ejection fraction of >55% on two-dimensional (2D) ECHO], rheumatic heart diseases, and valvular heart diseases.
- Systemic disorders that can cause PAH such as collagen vascular diseases and HIV infection and pulmonary diseases (COPD, pulmonary embolism, and scleroderma).

### Result

**Table 1:** Frequency of CKD among male and female patients

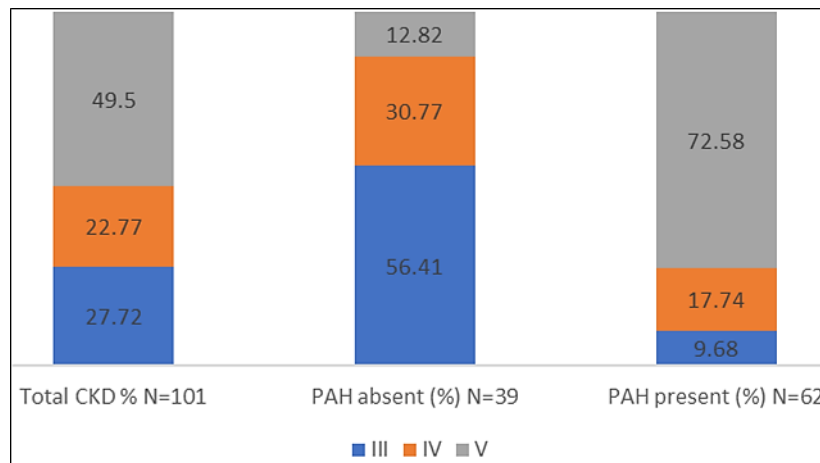
Sex	No.	Percent
Male	70	69.3
Female	31	30.7
Total	101	100.0

In present study, out of 101 CKD patients, 70 (69.3%) were males, and 31 (30.7%) were females (Table 1).

**Table 2:** Pulmonary Arterial Hypertension in CKD patients

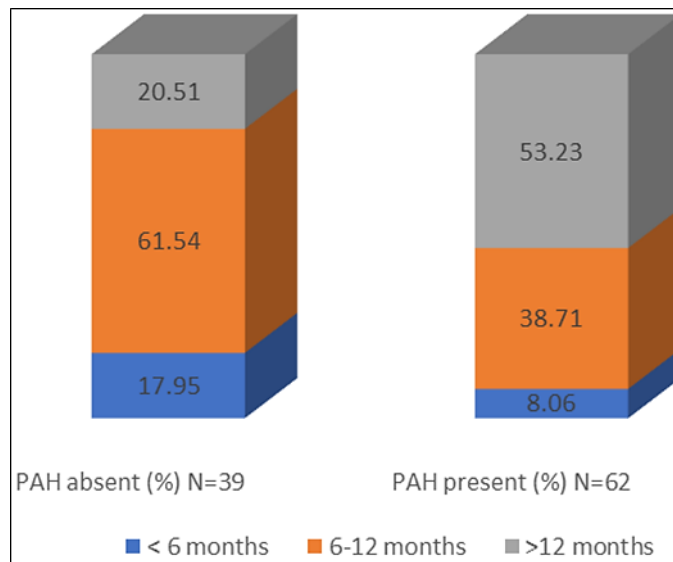
Pulmonary Arterial Hypertension	No.	Percent
Yes	62	61.39
No	39	38.61
Total	101	100.0

PH was detected in 62 (61.39%) CKD patients. 39 (38.61%) were in not detect Pulmonary Arterial Hypertension. (Table 2)



**Fig 1:** Incidence of Pulmonary Arterial Hypertension in various CKD stages

When study results were analysed according to PAH in various stages of CKD, mostly 22 (56.41%) of non-PAH CKD patients were included in III stage of CKD while majority 45 (72.58%) PAH with CKD patients included in V stage of CKD. This difference was statistically significant ( $<0.001$ ). (Figure 1)



**Fig 2:** CKD duration and incidence of Pulmonary Arterial Hypertension

When compared the presence of PH according to duration of CKD, it was found that most (52.23%) of PAH with CKD patients were had duration of CKD > 12 months while most of non-PAH CKD patients (61.54%) were had duration of CKD between 6-12 months. This association were statistically significant ( $<0.05$ ). (Figure 2)

### Discussion

Pulmonary Arterial Hypertension (PAH), a disorder characterized by elevated pulmonary artery pressure, is a progressive disorder complicating heart, lung or systemic diseases, with increased morbidity and mortality regardless of its etiology [12]. Recently it has been found that PAH is a strong independent predictor of morbidity and mortality in Hemodialysis (HD) patients [9, 13].

The incidence of PAH in CKD patients in the present study was 61.39% with mean PASP of  $43.57 \pm 6.43$  mmHg. Tarras *et al.* [11], found PAH prevalence to be as low as 26.74% and Moniruzzaman *et al.* found it to be as high as 68.6% [16]. In another Indian study Patel *et al.* studied 100 patients (69 males, 31 females) who were on conservative management, HD or continuous ambulatory peritoneal dialysis (CAPD) [14]. The prevalence of PAH in this cohort was 61% and the highest prevalence was in the HD group (40%). The variability in the prevalence of PAH among CKD patients in different studies [6, 10, 11, 14, 15] can be explained by the difference in the ethnicity of the population studied as well as in the study group, regarding stage of CKD, mode of dialysis (HD vs PD), comorbid conditions such as COPD/CHF and inclusion criteria. Though these studies considered different parameters and are not truly

comparable, most concluded that there was high prevalence of PAH among CKD patients.

### Conclusion

The Incidence of Pulmonary arterial Hypertension in CKD patients is 61.39% and The Association between CKD Stages and PAH showed positive statistically significant.

### References

1. Veerappan I, Abraham G. Chronic Kidney Disease: Current status, challenges and management in India. *Med Update*. 2013;593-7.
2. Waxman AB, Zamanian RT. Pulmonary arterial hypertension: New insights into the optimal role of current and emerging prostacyclin therapies. *Am J Cardiol*. 2013;111(5):1A-16A.
3. Fishman AP. Clinical classification of pulmonary hypertension. *Clin Chest Med*. 2001;22:385-391.
4. Gokul R. Replacement therapy by dialysis. In: Weatherall DJ, Ledingham JG, Warrell DA, editors. *Oxford textbook of medicine*. 3rd ed. Oxford: Oxford University Press; c1996. p. 3306-10.
5. Yigla M, Dabbah S, Azzam ZS, Rubin AH, Reisner SA. Background diseases in 671 patients with moderate to severe pulmonary hypertension. *Isr Med Assoc J*. 2000;2:684-9.
6. Moniruzzaman M, Islam MN, Alam MB, Alam M, Khan MMH, Ali Z, *et al*. Pulmonary Hypertension in Hemodialysis Patients. *Cardiovasc J*. 2012;4:148-52.
7. Okura H, Takatsu Y. High output heart failure as a cause of pulmonary hypertension. *Intern Med*. 1994;33:363-5.
8. Guazzi MD, Polese A, Bartonelli A, Loaldi A, Fiorentini C. Evidence of shared mechanism of vasoconstriction in pulmonary and systemic circulation in hypertension: A possible role of intracellular calcium. *Circulation*. 1982;66:881-6.
9. Yigla M, Fruchter O, Aharonson D, *et al*. Pulmonary hypertension is an independent predictor of mortality in hemodialysis patients. *Kidney Int*. 2009;75:969-975.
10. Nakhoul F, Yigla M, Gilman R, Reisner SA, Abassi Z. The pathogenesis of pulmonary hypertension in haemodialysis patients via arterio-venous access. *Nephrol Dial Transplant*. 2005;20:1686-1692.
11. Tarrass F, Benjelloun M, Medkouri G, Hachim K, Benganem MG, Ramdani B. Doppler echocardiograph evaluation of pulmonary hypertension in patients undergoing hemodialysis. *Hemodial Int*. 2006;10:356-359.
12. Martin KB, Klinger JR, Rounds SIS. Pulmonary arterial hypertension: new insights and new hope. *Respirology*. 2006;11:6-17.
13. Sise ME, Courtwright AM, Channick RN. Pulmonary hypertension in patients with chronic and end-stage kidney disease. *Kidney Int*. 2013;84:682-92.
14. Patel P, Abraham G, Pratap P, Ramalakshmi R, Mathew M, Jeevan JM, *et al*. Clinical and Biochemical parameters in Chronic Kidney Disease with Pulmonary Hypertension. *Indian J of Nephrol*. 2007;17:4-6.
15. Domenici A, Luciani R, Principe F. Pulmonary hypertension in dialysis patients. *Peritoneal Dialysis Int*. 2010;30:251-2.