ORIGINAL RESEARCH PAPER

General Medicine

KEY WORDS: Pulmonary hypertension; Chronic kidney disease; Dialysis

# CORRELATION OF PAH WITH CLINICAL VARIABLES AND BIOCHEMICAL PARAMETERS IN CKD

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ABSTRACT

**Background:** Pulmonary hypertension is an overlooked cardiovascular complication in chronic kidney disease. It has impact on morbidity of CKD.
**Aim :** To assess prevalence of pulmonary hypertension in CKD and to correlate PAH with clinical and biochemical parameters.
**Material and method:** Our study included 120 CKD patients; 79 on hemodialysis and 41 on conservative management. Detailed history, examination, and laboratory investigations were obtained. Systolic pulmonary artery pressure were evaluated by echocardiography.
**Results:** Out of 120 patients 28.33% had PAH. PAH was more in group on hemodialysis and in cases with AV fistula. Prevalence of PAH had significant correlation with longer duration of dialysis, low haemoglobin, high blood urea & serum creatinine and low serum bicarbonate. Diabetes and hypertension was not associated with PAH. Serum uric acid was not high in PAH.

## INTRODUCTION

Pulmonary hypertension is an overlooked cardiovascular morbidity in chronic kidney disease. Various pathologic process like endothelial dysfunction, inflammation, anemia, volume overload, left ventricular dysfunction and metabolic and hormonal derangements contribute.(1, 2) AV fistula and procedures such as access thrombectomy increase the risk.(3) Underlying diseases like scleroderma and lupus may also cause PAH. It is important to study this condition as it has impact on morbidity and mortality of CKD and is a potentially preventable condition to some extent.

## AIIMS:

- To assess prevalence of pulmonary hypertension in CKD
- To correlate PAH with clinical variables and biochemical parameters

## INCLUSION CRITERIA

All patients of CKD>12 years of age either on conservative trearment or hemodialysis

## EXCLUSION CRITERIA

- Chronic smokers
- Pulmonary hypertension due to other known causes
- Pregnant and postpartum females

## MATERIALS AND METHODS

This observational study was conducted in a tertiary care centre of central India over a period of 12 months. 120 patients of CKD whether on conservative management or hemodialysis were included. Aims, procedure and investigative course of the study was explained to patient and relatives. Written informed consent was taken before including in study. Detail history including age, sex, duration of illness, etiology of CKD and type of treatment (conservative vs hemodialysis) were noted. Detailed clinical examination was done with special attention to site of AV fistula in patients on dialysis. Investigations done were complete blood picture, renal function test, serum electrolytes, liver function test, urinalysis and ABG alongwith Xray chest, ECG and ultrasound abdomen. Each patient underwent Echocardiography by cardiologist of the institute to detect pulmonary hypertension. Systolic Pulmonary artery pressure were evaluated by Doppler echocardiography using tricuspid regurgitation jet velocity and modified Bernoulli's equation . AV Fistula flow was assessed by Doppler ultrasound.

CKD is defined as either kidney damage as evident by structural and functional abnormalities of kidney or by GFR <60ml/min for > three months. (4) PAH is defined as a systolic Pulmonary artery pressure > 35 mmHg. (5)

## RESULTS

In our study of 120 patients 53.3% were males and 46.6% were females. Mean age was 45.69years. 79 cases (65.4%) were on regular hemodialysis and 41cases (34.1%) were on conservative treatment.

34 cases (28.33%) had evidence of PAH as defined on echocardiography. The prevalence of PAH in group on hemodialysis was 36.70% and in group on conservative management was 12.19%. The difference was statistically significant. Prevalence of PAH was 43.3% in cases with AV fistula and 24.7% in group without AV fistula. Again the difference was significant.

In this study we divided CKD patients who are on hemodialysis into 4 groups according to duration of dialysis. Prevalence of PAH had significant correlation with duration of dialysis in our study ($p<0.05$).

**Table 1. Association between duration of dialysis and PAH**

| DURATION OF DIALYSIS(yrs) | NUMBER OF CASES(N=79) | CASES WITH PAH | PERCENTAGE (%) |
|---|---|---|---|
| <1 | 14 | 03 | 21.4 |
| 2-3 | 46 | 09 | 19.5 |
| 3-4 | 04 | 03 | 75 |
| >4 | 15 | 14 | 93.3 |

Presence of diabetes and hypertension also had positive correlation with PAH but it was not statistically significant. Mean haemoglobin was 8.23gm% in cases with PAH while 9.5gm% in cases without PAH and the association of low haemoglobin with PAH was significant. Similarly there was significant correlation between serum bicarbonate( 8.61 vs 11), blood urea(77.49 vs 62.56)and serum creatinine ( 9.31 vs 5.26) and occurrence of PAH. Serum uric acid was not high in cases with PAH.

**Table 2. Correlation between lab parameters and PAH**

| PARAMETERS( mean) | With PAH | Without PAH | P value |
|---|---|---|---|
| Haemoglobin(gm%) | 8.23 | 9.5 | <.001 |
| Serum Bicarbonate(mmol/L) | 8.61 | 11.0 | <.001 |
| Blood Urea(mg%) | 77.49 | 62.56 | <.001 |
| Serum Creatinine(mg%) | 9.31 | 5.26 | <.001 |
| Serum Uric Acid(mg%) | 6.33 | 6.44 | 0.738 |

## DISCUSSION

Pulmonary hypertension (PAH) has been reported to be high

among end-stage renal disease (ESRD) patients. (6) Development of PAH is associated with increased morbidity and mortality in CKD. With this background information this work was done to study prevalence of PAH in CKD in our institute and its correlation with various clinical and biochemical parameters. Pulmonary hypertension was found in 28.33%. This result is comparable with previous studies done by F. Tarrass et al (7) and Amin M et al (8) who reported PAH in 26.74% and 29% cases respectively in their study.

Out of 120 patients 79 were on regular hemodialysis and 41 on conservative management. The prevalence of PAH in hemodialysis group was 36.70% while in other group was 12.19% and the difference was statistically significant with p value of 0.001. Abdelwhab and Elshinnawy (6) demonstrated that PAH was found in 44.4% in group 1 (HD) and in 32.3% in group 2 (conservative treatment).

Out of 23 patients who had AV fistula 10 had PAH (43.3%) while only 24.7% in group without AV fistula had PAH (p value-0.042, significant). The results were comparable with previous study done by Yigla et al. (5) In these patients PAH may be secondary to hemodynamic modifications related to the creation of an arteriovenous fistula caused by a reduced ability of pulmonary vessels to accommodate the AV access-mediated elevated cardiac output, possibly because of a derangement of nitric oxide–endothelin metabolism [5] but its pathogenesis has not been completely elucidated.

In this study we divided CKD patients who are on hemodialysis into 4 groups according to duration of dialysis. Results show greater the duration of dialysis more is the prevalence of PAH. This was also seen in similar study done by Patel P et al. (9) On the contrary, Amin et al. (8) reported that there was no significant difference between patients with PAH and those without PAH in end-stage renal disease patients, who were receiving regular hemodialysis with regard to age, duration of dialysis, serum calcium, phosphorus , alkaline phosphatase, parathyroid hormone.

66 patients in our study had hypertension and 24 patients had diabetes. Although PAH was more common in group with hypertension( 33.3% vs 22.2%) and diabetes (31.11% vs 20%) the difference was not statistically significant. In a study by Magdy et al(10) diabetes mellitus and hypertension have a higher prevalence in the pulmonary hypertension subgroup than the normal pulmonary artrery pressure subgroup.

We tried to compare various lab parameters haemoglobin, serum bicarbonate, blood urea and serum creatinine in both groups. Mean haemoglobin was 8.23gm% in cases with PAH while 9.5gm% in cases without PAH and the difference was significant. This indicates the role of anemia in pathogenesis of PAH in CKD. Similar result is also seen in study by C. J. Rhodes et al (11) and Mazdeh et al. (12) Ii is well known that iron defiency influences pulmonary vasoconstrictor response to hypoxia.

Similarly there was significant correlation between serum bicarbonate (8.61 vs 11), blood urea(77.49 vs 62.56)and serum creatinine (9.31 vs 5.26) but serum uric acid didn't correlate with occurrence of PAH. These findings are comparable to study done by patel et al (9) in which acidosis and low serum bicarbonate as well as level of blood urea and creatinine was associated with PAH. Mean uric acid was 6.33mg% in cases with PAH and 6.44 mg% among cases without PAH and difference was not significant. Other study done by Norotoshi Nagaya et al (13) shows that serum uric acid increases in proportion to the clinical severity of PAH and has independent association with long term mortality of patients with Primary Pulmonary Hypertension.

## CONCLUSION

Prevalence of pulmonary hypertension in chronic kidney disease in our study was 28.33%. Prevalence was more in patients on hemodialysis and in this subgroup more in those with AV fistula. Prevalence had significant positive correlation with duration of dialysis, presence of anaemia, low serum bicarbonate and high blood urea and serum creatinine. There was no significant correlation with presence of diabetes and hypertension and also serum uric acid. Hence we conclude that early renal transplant may be important to prevent morbidity and mortality associated with disease and its treatment. Also correction of anaemia and serum bicarbonate may lead to decrease in prevalence of pulmonary hypertension.

## Compliance with ethical standards

**None of the authors have conflict of interest.**

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent was obtained from all individual participants included in the study.

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