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PULMONARY HYPERTENSION IN PATIENTS WITH CHRONIC KIDNEY DISEASE

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ABSTRACT

Introduction: Worldwide, chronic kidney disease (CKD) is a common health problem with cardiovascular disease being the most common cause of its morbidity and mortality with up to 50% deaths. Pulmonary hypertension, PHT, is a disorder that progressively leads to complications of the cardiopulmonary system. It also leads to other systemic diseases, and causes an increase in the morbidity and mortality. Material and Methods: A descriptive cross-sectional study was carried out over the period of 1 year, from May 2019 to May 2020. Patients aged 18 and above who were diagnosed with chronic kidney disease, both on and off dialysis were included. Systolic PAP, EF% and cardiac output were evaluated by doppler echocardiography. All statistical calculations were then performed using SPSS version 21. Results: Out of 91 patients enrolled in our study, 58 (63.7%) were male and 33 (36.3%) were female. 43 (47.3%) patients were free from pulmonary hypertension, while 31 (34.1%) had mild, 12 (13.2%) had moderate, and 5 (5.5%) had severe pulmonary hypertension. 12 (13.2%) patients had no anemia, while 13 (14.3%) had mild, 49 (53.8%) had severe, and 17 (18.7%) had severe anemia. 66 (72.5%) had preserved ejection fraction (EF), 15 (16.5%) had borderline EF, while 10 (11.0%) had reduced EF. Conclusion: Pulmonary hypertension is commonly seen in patients suffering from chronic kidney disease. Once diagnosed, appropriate management must be commenced to prevent complications of CKD as well as cardiopulmonary dysfunctions.

KEYWORDS: Hypertension, Pulmonary, Kidney Failure, Chronic, Prevalence.

INTRODUCTION

Worldwide, chronic kidney disease (CKD) is a common health problem with cardiovascular disease being the most common cause of its morbidity and mortality with up to 50% deaths.[1] Pulmonary hypertension, PHT, is a disorder that progressively leads to complications of the cardiopulmonary system. It also leads to other systemic diseases, and causes an increase in the morbidity and mortality.[2] It is a newly recognized disease in patients with renal disease. In a recent analysis, the prevalence of PHT in end stage renal disease patients was reported to be around 17-56%.[3] Pulmonary hypertension is defined as systolic pulmonary artery pressure (SPAP) > 35 mmHg at rest.[4] and is assessed by Doppler echocardiography. It has been frequently reported with a high but variable prevalence in patients with chronic kidney disease, both before dialysis and during management with dialysis.[5] Its presence has been recently recommended to be accompanying with a worse outcome.[6] A large number of factors are found to be related to this pathological finding. These factors include pulmonary artery calcification caused by hyperparathyroidism.[5] and hemodynamic changes resulting from the formation of an arteriovenous fistula (AVF). The change is caused by a reduced ability of pulmonary vessels to accommodate the arteriovenous access mediated elevated cardiac output, possibly because of an imbalance of nitric oxide endothelin metabolism.[6] but its pathogenesis has not been completely understood.

Pulmonary Hypertension is a common disorder among these patients and is also associated with poor outcomes and decreased survival rates. Therefore, in order to improve the survival rate of patients with chronic kidney disease suffering from pulmonary hypertension, prevention, early diagnosis and prompt treatment are the mainstay.[7]

OBJECTIVES

What is the prevalence of pulmonary hypertension in patients with chronic kidney disease and what are the associated factors?

MATERIALS AND METHODS

Study design - A descriptive cross-sectional study was carried out.

Study duration and sample size - The study was carried out over a period of one year, from May 2019 to May 2020, and data was collected from 91 patients.

Study population and setting

The study was hospital-based, conducted in Rawalpindi and Islamabad, Pakistan.

Inclusion criteria

Patients aged 18 and above who were diagnosed with chronic kidney disease, both on and off dialysis were included.

Exclusion criteria

Patients with any diagnosed cardiovascular and pulmonary diseases which lead to pulmonary hypertension, previous pulmonary embolism, collagen vascular disease, and those with volume overload at the time of echocardiography were excluded from our study. Unwilling patients were also excluded.

Sampling technique and data collection

After approval from IRB and hospital administration, consent was taken from each enrolled subject. Consecutive sampling technique was used and data was collected from 91 patients over the period of 1 year. All data was collected on a structured questionnaire.

Detailed medical history, examination, and complete laboratory investigations were carried out and recorded. Systolic PAP, EF% and cardiac output were evaluated by doppler echocardiography.

All statistical calculations were then performed using SPSS version 21 (Statistical Package for the Social Sciences, SPSS Inc. USA).

RESULTS

Out of 91 patients enrolled in our study, 58 (63.7%) were male and 33 (36.3%) were female. The age ranged from 22-90 years, with a mean of 55.02 years (SD 14.691). 38 (41.8%) patients had a history of smoking, comprising of 28 (73.7%) male and 10 (26.3%) female. 43 (47.3%) patients were free from pulmonary hypertension, while 31 (34.1%) had mild, 12 (13.2%) had moderate, and 5 (5.5%) had severe pulmonary hypertension. 12 (13.2%) patients had no anemia, while 13 (14.3%) had mild, 49 (53.8%) had severe, and 17 (18.7%) had severe anemia. Creatinine levels ranged from 1.5mg/dl – 12.2mg/dl with a mean of 5.9mg/dl (SD 2.91). 66 (72.5%) had preserved ejection fraction (EF), 15 (16.5%) had borderline EF, while 10 (11.0%) had reduced EF. The serum phosphate levels were ranging from 2.2-7.5mg/dl, with a mean of 6.24mg/d (SD 1.16). Similarly, serum calcium levels were found to be between 7-10mg/dl, with a mean of 8.32mg/dl (SD 0.75). The range of serum bicarbonate levels was 8.4-42mg/dl, with a mean of 20.18mg/dl (SD 7.56).

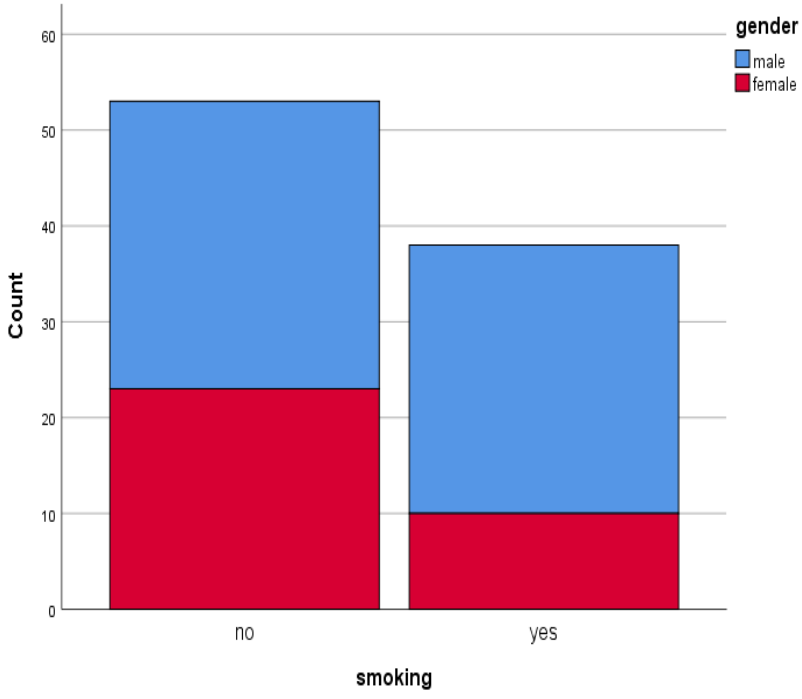

Figure I: Association between Gender and Smoking.

Table I: Frequency of Anemia in both genders according to severity.

		Anemia				Total
		No anaemia	Mild	Moderate	Severe	
Gender	Male	9	7	31	11	58
	Female	3	6	18	6	33
Total		12	13	49	17	91

Table II: Level of Ejection Fraction related to gender.

		Ejection Fraction			Total
		Preserved	Borderline	Reduced	
Gender	Male	39	9	10	58
	Female	27	6	0	33
Total		66	15	10	91

Table III: Severity Of pulmonary hypertension according to gender.

		Pulmonary Hypertension				Total
		Normal	Mild	Moderate	Severe	
Gender	Male	24	22	8	4	58
	Female	19	9	4	1	33
Total		43	31	12	5	91

Table IV: Relationship between Pulmonary Hypertension and Ejection Fraction.

		Pulmonary Hypertension				Total
		Normal	Mild	Moderate	Severe	
Ejection Fraction	Preserved	38	20	5	3	66
	borderline	4	7	3	1	15
	reduced	1	4	4	1	10
Total		43	31	12	5	91

Table V: Relationship between Severity of anemia and pulmonary hypertension.

		Pulmonary Hypertension				Total
		Normal	Mild	Moderate	Severe	
Anemia	No anemia	5	5	1	1	12
	Mild	5	5	2	1	13
	Moderate	27	15	4	3	49
	Severe	6	6	5	0	17
Total		43	31	12	5	91

Table VI: Relationship between severity of anemia and ejection fraction.

		Ejection Fraction			Total
		Preserved	Borderline	Reduced	
Anemia	No anemia	8	0	4	12
	Mild	9	1	3	13
	Moderate	40	7	2	49
	Severe	9	7	1	17
Total		66	15	10	91

Operational definitions and criteria

1. Anemia – hemoglobin levels above 12g/dl in female and 13g/dl in males is considered as non-anemic. 11-11.9g/dl in female and 11-12.9g/dl in male is considered as mild anemia. 8-10.9g/dl moderate while <8g/dl considered as severe anemia.[8]
2. Ejection fraction – greater than or equal to 50% as normal, less than or equal to 40% reduced, and levels in between as borderline.[9]
3. Pulmonary Hypertension – A value greater than or equal to 35 mm Hg is considered as pulmonary hypertension and is classified as mild (35-50 mm Hg), moderate (50-70 mm Hg), and severe (> 70 mm Hg).[10]

DISCUSSION

In a comprehensive review and meta-analysis that has been done, the worldwide prevalence of chronic kidney disease (CKD) was shown as 23.4% and 10.6% in Stage 1–5 and Stage 3–5, respectively.[11] The prevalence of pulmonary hypertension (PHT) in patients with end stage renal disease (ESRD) has been found to be very high.[12]

A study conducted by Yigla et al. revealed the presence of pulmonary hypertension in some chronic kidney disease patients undergoing hemodialysis.[3] Our study demonstrated a high prevalence of pulmonary hypertension with levels above 35mmHg among 48 patients (52.7%).

Prevalence of pulmonary hypertension is increased among patients with ESRD compared to the general population and the mortality is increased among ESRD patients suffering from pulmonary hypertension compared to those ESRD patients without it.[13]

In a study done by Han et al, a significant number of patients showed increased pulmonary artery pressure, which was closely related to volume status in end stage renal disease patients. It was concluded that echocardiography could play an important role in the detection of pulmonary hypertension and treatment of asymptomatic CKD patients.[14]

Patients with impaired renal function are also at an increased risk of sodium and fluid retention and are therefore more likely to develop heart failure. Comorbid CKD is an independent predictor of both short-term and long-term cardiovascular outcomes and death in patients with heart failure, with more advanced renal disease resulting in a worse prognosis.[15] Our study showed that 66 (72.5%) had preserved EF, 15 (16.5%) had borderline EF, while 10 (11.0%) had reduced EF.

This study, however, has certain limitations. Due to a significant exclusion criterion in our study, a small study group was only able to be enrolled, since the majority of patients with CKD were also suffering from simultaneous cardiac or pulmonary diseases. However, the exclusion of patients with CKD with cardiac or pulmonary disease from analysis was a methodological necessity. Moreover, PAP was measured by a non-invasive method, Doppler echocardiography, with-out obtaining direct invasive measurements, such as by right heart catheterization. However, measurements of PAP have been reported to have a very good correlation of SPAP between Doppler echocardiography and invasive RHC measurement.[17]

CONCLUSION

Pulmonary hypertension is commonly seen in patients suffering from chronic kidney disease. Once diagnosed, appropriate management must be commenced to prevent complications of CKD as well as cardiopulmonary dysfunctions.

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