

Pulmonary Hypertension in Patients with Chronic Renal Failure

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Abstract

Background: Pulmonary hypertension (PH) comprises a group of clinical and pathophysiological entities with similar features but a variety of underlying causes. Many etiologies causing PH have been reported, and one of the background disease seen with patients with PH is chronic renal failure (CRF).

Objective: To evaluate the prevalence of pulmonary hypertension in patient with chronic renal failure in predialysis state and in uremic patients undergoing hemodialysis

Patients and methods: One hundred patients had complaining chronic renal failure. 50 patients on conservative treatment and 50 patients on hemodialysis evaluated clinically and by echocardiography for the presence of pulmonary hypertension

Results: The prevalence of pulmonary hypertension >35 mmHg was found in 33% of patients with chronic renal failure. the patients

with pulmonary hypertension had significantly lower albumin and arteriovenous fistula and long duration of dialysis

Conclusion: This study demonstrated that 42% of patients with chronic renal failure receiving regular hemodialysis have pulmonary hypertension and 24% of patients with chronic renal failure in predialysis have pulmonary hypertension.

The presence of pulmonary hypertension was related to the low level of albumin, presence of arteriovenous fistula and long duration of hemodialysis.

Keywords: Pulmonary hypertension, hemodialysis, predialysis, echocardiography.

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Introduction

Pulmonary hypertension is characterized by elevated pulmonary arterial pressure and secondary right ventricular failure. It is life threatening condition with a poor prognosis if untreated. pulmonary hypertension is defined as a mean pulmonary pressure greater than 25 mmHg at rest or 30 mmHg with exercise as measured by right heart catheterization⁽¹⁾.

Pulmonary hypertension (PH) comprises a group of clinical and pathophysiological entities with similar features but a variety of underlying causes. Many etiologies causing PH have been reported, and one of the background disease seen with patients with PH in chronic renal failure (CRF).

however, the pathogenesis of pulmonary hypertension (PH) in this group of patients is not explained satisfactorily⁽²⁾.

Chronic hemodialysis patients are exposed to continuous pulmonary insults of multifactorial origin. there are several explanations for the development of pulmonary arterial pressure (PAP) in CRF. High cardiac output (CO) resulting from the arteriovenous fistula (AVF) may increase pulmonary artery pressure (PAP)⁽³⁾.

Metabolic and hormonal derangements caused by chronic renal failure may lead to pulmonary arterial vasoconstriction. Moreover, pulmonary calcification in chronic dialysis patients has been associated with pulmonary dysfunction. Besides, fluid overload and anemia may cause PH. Since 1966, arteriovenous fistula (AVF), developed by Brescia and Cimino, has provided the best vascular

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access allowing long-term hemodialysis increased PAP was found in chronic renal failure patients with surgically created arteriovenous fistula⁽⁴⁾

Patients with PH may develop right ventricular failure with features of systemic venous congestion, pleural effusion, and ascites. it can also result in reduced systemic arterial pressure and intradialytic hypotension⁽⁵⁾.

Patients And Methods

The study was performed in AL-Nahrain College of Medicine in AL-Kadhmiya Teaching Hospital during the period of August 2008 to February 2009. One hundred patients (60 male and 40 female) involved in this study of different age group ranging from (10 to 70) years (mean of age 37.3 year) complaining chronic renal failure. 50 patients on regular hemodialysis and 50 in predialysis (conservative treatment).

Exclusion criteria for this patient includes chronic obstructive lung disease, interstitial lung disease, chest wall disease , primary pulmonary hypertension , previous pulmonary embolism, collagen vascular disease, left to right shunt and moderate or sever mitral or aortic valve disease.

Each patient underwent full clinical evaluation with special emphasis on any clinical condition that predisposes to pulmonary hypertension, chest radiography, and pulmonary function tests (PFTs), standard 12-lead electrocardiography (ECG), and echocardiography before enrollment to the study and repeated after 6 month. Two-dimensional and M-mode, Doppler echocardiography was performed in all patients. In the presence of tricuspid regurgitation, continuous-wave Doppler echocardiography was used to estimate the systolic pulmonary artery pressure(PAP). Systolic right ventricular (or pulmonary artery)

pressure was calculated using the modified Bernoulli equation: $PAP = 4 \times (\text{tricuspid systolic jet})^2 + 10 \text{ mmHg}$ (estimated right atrial pressure).pulmonary hypertension(PH) was defined as a systolic PAP > 35 mmHg⁽⁶⁾.

Patients general data (age, sex, comorbidity, medication used), data regarding the kidney disease (etiology of renal disease, duration of renal failure, duration of hemodialysis therapy) and data pertaining to the arteriovenous fistula (AVF) (duration and location of arteriovenous fistula (AVF) were recorded directly from the patients. Laboratory investigations included blood urea nitrogen, creatinine, serum calcium, phosphorus, hemoglobin, hematocrit and protein

Patients were followed for at least 6 months. During follow-up, patients with end-stage renal disease (ESRD) who were maintained on chronic hemodialysis therapy were dialyzed for 3 hour 3 times per week.

Statistical analysis was performed using chi-square test. at level of significance $\leq p.05$ regarded as statistically significant.

Results

The echocardiography findings in patients complaining chronic renal failure are presented in Table 1 and 2.

Pulmonary hypertension (>35mmHg) was found in 12(24%) patients in predialysis (on conservative treatment) and 21(42%) patients under hemodialysis procedure.

Pulmonary artery pressure values are presented as in table 1. Mild pulmonary pressure (35---50mmHg) presented in 22% of the patients. While pulmonary pressure more than 50mmHg was finding in 11% patients.

Data on 33 patients with pulmonary hypertension compared with 67 patients without pulmonary hypertension in table 2. There was no significant difference between both

groups, with regard to the sex, hemoglobin level and ejection fraction ($p > 0.05$).

Albumin level, presence of arteriovenous fistula and duration of hemodialysis associated with high significant pulmonary hypertension ($p < 0.05$).

All patients had normal baseline cardiac output as expressed by ejection fraction.

Pericardial effusion was observed in 17(34%) patients in predialysis on (conservative treatment) and 28(56%) patients receiving hemodialysis.

Table 1: Systolic pulmonary artery pressure (PAP) in chronic renal failure

	predialysis	hemodialysis	percentage
Total patients	50	50	
PAP ≤ 35 (mmHg)	38	29	67%
PAP—35--50 (mmHg)	9	13	22%
PAP-- ≥ 50 (mmHg)	3	8	11%

Table 2: Echocardiography finding in patient with chronic renal failure

Abnormal Echocardiography finding	predialysis No.= 50	Hemodialysis No. = 50
Pulmonary artery pressure > 35 mmHg	11	19
Ejection fraction mean $\pm$ SD (%)	57 ± 6	58 ± 3
Pericardial effusion	34%	56%
Left ventricular pressure overload	74%	86%
Ischemic heart disease	22%	30%

Table 3: Clinical and laboratory data in patient with normal pulmonary arterial pressure (PAP) group 1 versus patient with high PAP group 2

Variables	Group 1	Group 2	P value
Patients number	67	33	
Male/female	32/25	18/15	
Hemoglobin mean $\pm$ SD	10 ± 2 g/dL	9 ± 2 g/dL	> 0.05
Albumin mean $\pm$ SD	4.6 ± 1.3 g/dL	3.3 ± 0.4 g/dL	< 0.05
Ejection fraction $\pm$ SD	$49\% \pm 4\%$	$47\% \pm 11\%$	> 0.05
Duration of dialysis	0----2 year	6 month ---2 year	< 0.05
Presence of AVF	7	26	< 0.05
Systolic blood pressure mmHg	135—180 mmHg	120—190 mmHg	> 0.05
Diastolic blood pressure mmHg	70—110 mmHg	75—130 mmHg	> 0.05

Discussion

Although there are probably genetic determinants, environmental exposures and acquired disorders that predispose the patients to pulmonary arterial hypertension, it is clear that none of the factors alone is sufficient to activate the pathways essential for the development of this vascular disease. Pulmonary hypertension (PH) involves vasoconstriction and obliteration of the lumen of small vessels in the lungs by plexiform lesions resulting in increased resistance to flow.^(7, 8)

In this study, the prevalence of pulmonary hypertension as defined by Doppler echocardiography assessment of tricuspid valve was almost 21(42%) in hemodialysis patients and 12(24%) in predialysis.

The reported prevalence of pulmonary hypertension disease in other study range from 26% to 40 %⁽⁹⁾

We compared the clinical and biochemical variables of the patients with different severity and without pulmonary hypertension in chronic renal failure. The patients with pulmonary hypertension had significantly lower albumin, presence of arteriovenous fistula and more than 6 month duration of dialysis (p. value < 0.05). There was no significant difference between hemodialysis and predialysis groups according to ejection fraction, systolic and diastolic pressure, hemoglobin and hematocrit levels (p. value >0.05).

Arteriovenous fistula(AVF), used for hemodialysis access, causes a large left to-right shunt whose capacity often increases with time, and this shunt causes left ventricular failure by imposing an extra volume load on the left ventricle.

In other study, Yigla et al evaluated the incidence of PH in 58 end stage renal disease (ESRD)

patients using Doppler echocardiography. Almost 40% of patients had systolic PAP above 35 mmHg, and their cardiac output was significantly higher compared with hemodialysis patients without PH. Because the study population had no obvious cause for PH, they assumed that some factors, such as the size or the location of arteriovenous fistulae are involved in the mechanism that increases cardiac output and contribute to the pathogenesis of pulmonary hypertension(PH)⁽⁴⁾.

Pulmonary hypertension (PHT) has an insidious nature and results in extremely serious morbidity. Early detection of the disease is necessary before the development of significant pathophysiological changes. Despite the possibility of common mediators for all the mechanisms of pulmonary hypertension, there are clear differences observed in the potential reversibility of pathophysiological responses of the three components of pulmonary artery pressure that include volume of pulmonary blood flow, resistance in the pulmonary vascular bed and pulmonary venous pressure⁽¹⁰⁾.

Pulmonary hypertension has an insidious nature and results in serious morbidity and mortality so that early detection of pulmonary hypertension is necessary before the development of significant pathophysiological changes.

References

1. Lewis J., William H. overview of pulmonary hypertension: 2007 update.
2. Havlucu Y. , Kursat S. , Ekmekci C. , Celik P. , Pulmonary hypertension in patient with chronic renal failure :Respiration 2007 ; 74:503-510
3. Okura H. , Takatsu Y.: high output failure as cause of pulmonary hypertension .Inter. Med. 1994; 363-365
4. Yigla M., Nakhoul F, Sabag A, Tov N, Reisner A, pulmonary hypertension in patient with end stage renal disease. Chest 2003; 123: 1577-1582.

5. Tarrass F, Benjelloun M, Hachim K, Benghanem M, B Ramdani B, Pulmonary hypertension in patients with end-stage renal disease. *Indian J Nephrol* 2005;15: 223-226
6. Robyn H, Barst R, Mcgoon M, Torbicki A, Sitbon O, Krowka M. Diagnosis and differential assessment of pulmonary arterial hypertension. *Journal of the American College of Cardiology*, 2004; 43(12): 40-47
7. Soroush-Yari A, Burstein S, Hoo GW, Santiago SM: Pulmonary hypertension in men with thyrotoxicosis. *Respiration* 2005; 72:90-94
8. Kolilekas L, Gallis P, Liasis N, Anagnostopoulos GK, Eleftheriadis I: Unusual case of pulmonary hypertension. *Respiration* 2006; 73: 117-119.
9. Abolghasemi R, Sang-sefidi J, Miri R, Soluk M: Pulmonary Hypertension in Hemodialysis patients; *Iranian Journal of Kidney Disease*, Vol 1, supp.1 2007: 9
10. Galie N, Manes A, Branzi A: Evaluation of pulmonary arterial hypertension. *curr opin cardiol.* 2004;19(6):575-581