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Pulmonary Artery Pressure in Maintenance Hemodialysis Patients

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Abstract: To consider the prevalence of pulmonary artery pressure in End-stage Renal Disease (ESRD) patients, a study was conducted on maintenance of hemodialysis patients and a group of normal subjects. For assessment of pulmonary artery pressure all participants were subjected to two-dimensional and doppler echocardiographic studies that for patients were done after their hemodialysis session. In this study a significant difference of Pulmonary Artery Systolic Pressure (PASP) between patients and normal subjects with more values in hemodialysis patients was seen. A significant positive correlation of pulmonary artery pressure with age of control group and also significant positive correlation of pulmonary artery pressure with age of hemodialysis group were found. A significant positive correlation of PASP with duration and dosages of hemodialysis treatment were seen too. A high prevalence of pulmonary hypertension in hemodialysis needs more attention to this aspect of hemodialysis patients because pulmonary hypertension is a disease with poor prognosis.

Key words: Pulmonary hypertension, hemodialysis, parathormone, pulmonary artery pressure

INTRODUCTION

Cardiovascular Disease (CVD) remains the main cause of morbidity and mortality in patients with End-stage Renal Disease (ESRD)[1]. Left Ventricular Hypertrophy (LVH), interstitial myocardial fibrosis, arteriolar wall thickening and coronary artery calcification are hallmarks of this disorder[2,3]. It was suggested that the abnormalities in right ventricular function in patients with End-stage Renal Disease (ESRD) are in largely due to Pulmonary Hypertension (PH) which may develops secondary to ESRD[4]. Few studies have reported the prevalence of Pulmonary Artery Hypertension in HD-patients. We therefore aimed to study the prevalence of pulmonary artery hypertension in maintenance hemodialysis patients compared with a group of normal persons.

MATERIALS AND METHODS

This study is cross-sectional that was conducted on patients with end-stage renal disease undergoing maintenance hemodialysis treatment through an arteriovenous fistula which was created on the hand. Patients were under hemodialysis (HD) for two or three times per week. Exclusion criteria were past history of Chronic Obstructive Lung Disease (COPD), multiple lung infections, cigarette smoking, history of cough, allergy, asthma, using drugs affects pulmonary function or structure, chest wall or parenchymal lung disease, previous pulmonary embolism, systemic lupus erythmatosous, left-to-right shunt and significant mitral or aortic valve disease and also any other past history of lung disease and also any lung abnormality on chest x-ray. Control group were normal subjects selected from persons with no history of dyspnea and lung disease or tobacco use with normal chest x ray and choused after echocardiography assessments of four chamber and also valves to have no structural and functional cardiac disease. Patients after their hemodialysis session were subjected to two-dimensional and doppler echocardiographic studies. Systolic right ventricular (or pulmonary artery) pressure was calculated using the Bernoulli equation ($p = 4 v^2$, where, p is the pressure drop (mmHg) and v is the velocity of blood flow (m/sec)), the pressure in the RV can be calculated by RV pressure = RA pressure + (4 x (TR jet velocity)^2)[5,6]. All echocardiography

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were done by a single cardiologist. Pulmonary Hypertension (PH) was defined as a systolic PAP greater than or equal to 35 mm Hg[4]. Duration and doses of hemodialysis treatment were calculated from patient's records and the duration of each hemodialysis session was four hour. From 3 years before study, the polysulfon membranes were used in our hemodialysis center. For statistical analysis descriptive data are expressed as Mean±SD. Comparison between groups were considered using students' t test. For correlations Pearson and partial correlation tests were used. All statistical analysis was performed using the SPSS (version 11.5.00). Statistical analysis was considered significant when $p<0.05$.

RESULTS

The total participants were 272 consisting of 102 (F = 46, M = 56), hemodialysis patients due to end-stage renal failure which were consisted of 73 non diabetic hemodialysis patients (F = 33, M = 40) and 29 diabetic hemodialysis patients (F = 13, M = 16) and also 170 normal persons (F = 100, M = 70) (control group). The mean±SD of age of total patients were 51±17.6 years. The mean±SD of age of control group were 52±18.5 years. The length of the time patients had been on hemodialysis were 17.8±29 months (Table 1). The mean±SD of Pulmonary Artery Systolic Pressure (PASP) of normal subjects (control group) was 32±3.3 mmHg, Mean±SD of Pulmonary Artery Systolic Pressure (PASP) of total HD patients, diabetic HD group and non diabetic hemodialysis were 41.5±12.6, 45±9.8 and 40±18 mmHg, respectively. Pulmonary Artery Systolic Pressure (PASP) of 35 and more was found in 76.5% of total HD patients. This value in diabetic and non diabetic hemodialysis were 89.7 and 71.2%, respectively. In this study no significant difference of age was seen between males and females of hemodialysis patients. A significant difference of PASP between patients and normal subjects was found ($p<0.001$, Fig. 1). A near significant difference of PASP between males and females of normal subjects was seen too ($p = 0.09$, Fig. 2). A significant difference of age in control group with PASP under and more than 35 mmHg was found ($p<0.001$, Fig. 3). A near significant difference of PASP($p = 0.089$) and a significant difference of age ($p = 0.007$, Fig. 4) between diabetic and nondiabetic HD patients were found too. No significant difference of PASP was found between males and females of total HD-patients. A significant differences of PASP between

Table 1: Mean±SD, Minimum and Maximum of age, duration, dose and also laboratory results of total, non-diabetic and diabetic hemodialyzed patients

Total HD patients (n = 102)	Minimum	Maximum	Mean±SD
Age (Years)	14	84	51.0±17.6
DH (Months)*	1	145	17.8±29
Dialysis			
dose sessions	12	1740	199.0±349
PASP (mmHg)	20	80	41.5±12.6
Non diabetics (n = 73)			
Age (Years)	14	84	48.3±18
DH (Months)*	1	145	18.8±31
Dialysis			
dose sessions	12	1740	208.0±375
PASP (mmHg)	20	80	40.0±18
Diabetics (n = 29)			
Age (Years)	15	79	58.0±15
DH (Months)*	2	110	15.0±22
Dialysis			
dose sessions	15	1300	175.0±277
PASP (mmHg)	30	65	45.0±9.8
Normal subjects (n = 170)			
Age (Years)	12	85	52.0±18
PASP (mmHg)	20	39	32.0±3.3

*Duration of hemodialysis treatment

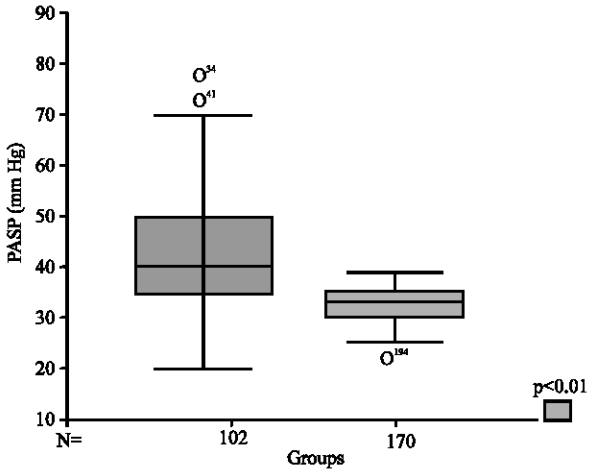

Fig. 1: Significant difference of PASP between patients and normal subjects

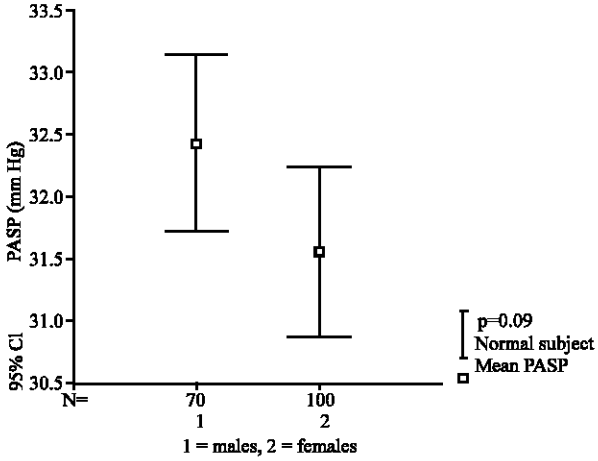

Fig. 2: Near significant difference of PASP between males and females of normal subjects

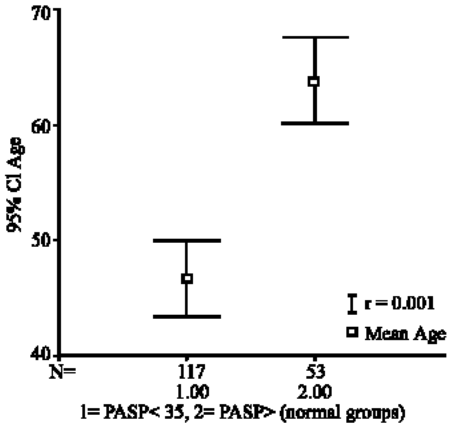

Fig. 3: Significant difference of ages of control group when they divided by PASP <35 mmHg and more than 35 mmHg

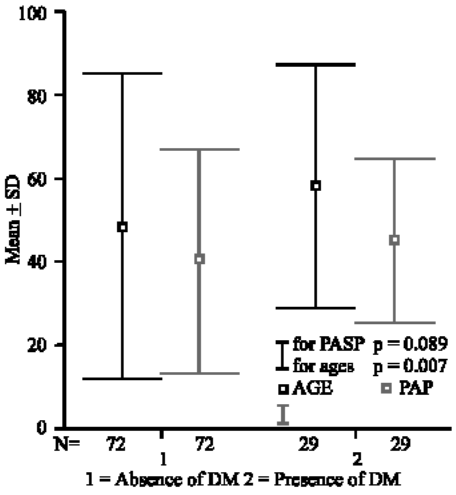

Fig. 4: Near significant difference of PASP and significant difference of age between diabetic and nondiabetic HD patients

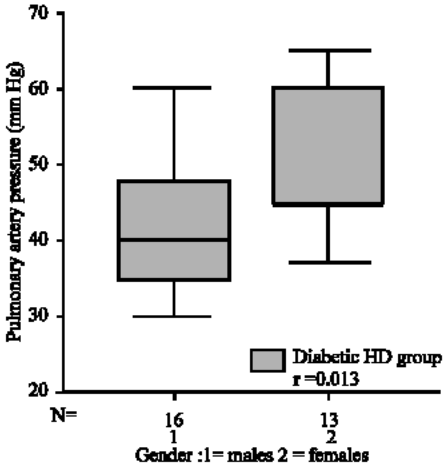

Fig. 5: Significant difference of PASP between males and females of diabetic HD patients

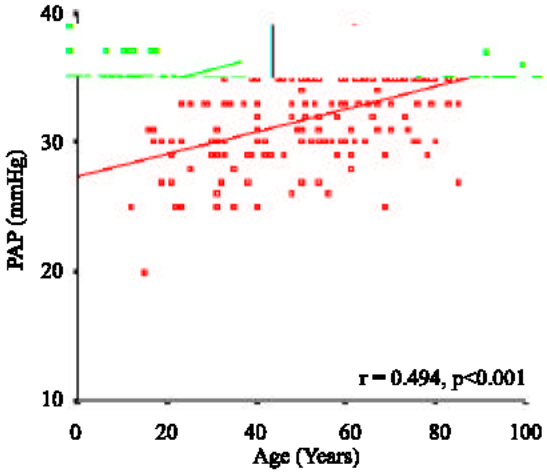

Fig. 6: Significant positive correlation of PASP with ages of control group

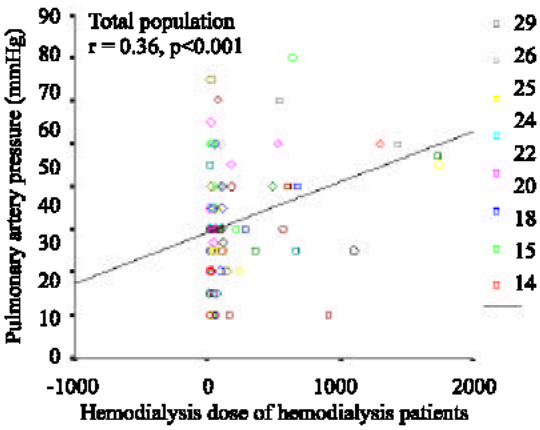

Fig. 7: Significant positive correlation of PASP with hemodialysis doses of HD patients

males and females of diabetic HD patients were found (p = 0.013, Fig. 5). In this study a significant positive correlation of PASP with age of control group (r = 0.494, p<0.001 and Fig. 6) was seen (Pearson correlation test). A significant positive correlation of PASP with age of hemodialysis patients was found too(r = 0.20, p = 0.045) (adjusted for duration of hemodialysis treatment). More over a significant positive correlation of PASP with duration (r = 0.35 p<0.005) and dosage (r = 0.36, p = 0.001 and Fig. 7) of hemodialysis (adjusted for ages of patients) were seen too.

DISCUSSION

In this study we found a significant difference of pulmonary artery systolic pressure between patients and normal subjects with more values in hemodialysis patients. A near significant difference of PASP between

males and females of normal subjects with more values in males of normal persons and a near significant difference of PASP between diabetic and nondiabetic HD patients with more values in diabetic HD patients and also a significant difference of PASP between males and females of HD patients with more values in females group were found too. Moreover there was a significant positive correlation of PASP with age of control group and also a significant positive correlation of PASP with age of hemodialysis patients were seen. A significant positive correlation of PASP with duration and dosage of hemodialysis were seen. Studies concerning the prevalence of PH in patients with end-stage renal failure undergoing regular hemodialysis are scarse. Yigla *et al.*[4] in a study on 58 patients with ESRD under receiving long-term hemodialysis and on control groups of 5 patients receiving Peritoneal Dialysis (PD) and 12 predialysis patients, found a 39.7% of pulmonary hypertension in patients who where under hemodialysis, (mean±SD = 44±7 mm Hg; range, 37 to 65 mm Hg)[4]. Amin *et al.*[7] in a study on 51 patients (28 men and 23 women) with end-stage renal disease, who were receiving regular hemodialysis PH was detected in 15 patients (29%), this study showed women had a higher prevalence of PH (48 vs 14%). Amin showed that 29% of patients with ESRD receiving regular hemodialysis have PH, also there was no relation between PH and the presence or the severity of pulmonary artery calcification. Amin *et al.*[7] showed PH is detected more frequently in women. Present study is in an agreement with the previous two works which ESRD patients under regular hemodialysis had pulmonary hypertension. In contrast to the study that conducted by Amin *et al.*[7] only our female diabetic hemodialysis patients had PASP more than male diabetic patients. Pulmonary hypertension is a disease with poor prognosis and needs more notice to this aspect oh hemodialysis patients.

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