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Prevalence Of Orthostatic Hypotension And Pulmonary Function In Patients On Hemodialysis

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Abstract:

Background: Orthostatic hypotension and compromised pulmonary function are common concerns in patients undergoing hemodialysis, potentially impacting their overall health and quality of life. Understanding the prevalence of these conditions in this population is crucial for improving patient management and outcomes. The aim of the study was to evaluate the prevalence of orthostatic hypotension and assess pulmonary function in patients undergoing hemodialysis.

Materials and Methodology: This observational study was conducted with 30 patients in the age group 50-65 years with a mean dialysis period of 12 months, receiving hemodialysis at YCRH Dialysis unit and Deshpande hospital dialysis unit, Latur. Orthostatic hypotension was assessed using blood pressure measurements taken in supine and standing positions. Pulmonary function was evaluated through spirometry, measuring parameters such as forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and peak expiratory flow rate (PEFR). Data were analyzed to determine the prevalence of orthostatic hypotension and the degree of pulmonary impairment.

Results: Among the 30 patients studied, 20% exhibited orthostatic hypotension, characterized by a significant drop in blood pressure upon standing. Pulmonary function tests revealed that the prevalence rate of FVC was 80%, FEV1 was 96.66% and PEFR was 100%, indicating varying degrees of pulmonary dysfunction.

Conclusion: The prevalence of orthostatic hypotension and pulmonary dysfunction is notable among patients on hemodialysis. These findings highlight the need for routine screening and integrated management strategies to address these conditions, aiming to improve patient care and outcomes.

Keywords: Hemodialysis, Orthostatic hypotension, Pulmonary function, Spirometry.

I. Introduction

Orthostatic hypotension is caused by an excessive decrease in cardiac output (CO) and/or compensatory vasoconstrictor mechanisms such as autonomic failure and age-related physiological changes.[1]

Orthostatic hypotension after hemodialysis is a significant and independent factor that affect mortality in hemodialysis patient. Orthostatic hypotension is known to adversely affect daily living activities and the quality of life of hemodialysis patients.[2]

Patients with renal failure are at increased risk for impaired orthostatic blood pressure stabilization. A previous study examined the determinants of orthostatic hypotension in over 5000 middle-aged men and found that reduced eGFR is independently associated with systolic orthostatic impairment. [3-4]

Although relevant data are limited in patients with end-stage renal disease (ESRD), it is likely that these patients are extremely prone to developing exaggerated orthostatic blood pressure reduction because reduced

baroreflex sensitivity and autonomic dysfunction, two of the most important physiologic mechanisms for the maintenance of orthostatic homeostasis, are prevalent as renal function declines.[3]

The relationship between the lungs and the kidneys is clinically important for both health and disease. Kidney failure directly and indirectly impacts the mechanical function and ventilation of the lungs, and treatment with drugs and HD are responsible for part of this effect.[5]

Pulmonary function test (PFT'S) help in the evaluation of the mechanical function of the lungs. The pulmonary function test are categorized as volume, flow, or diffusion studies.[5] Chronic renal failure may affect virtually every system in the body, including the lungs. Pulmonary oedema and pleural effusions, attributed to fluid overload and an increase in pulmonary capillary permeability, are relatively common. Rarer complications include pulmonary fibrosis, and calcification, pulmonary hypertension, pleuritis, and pleural fibrosis [6]

Spirometry measures the combination of lung volumes and provides adequate information about the physiological derangement of the lung. It measures the forced vital capacity (FVC), which is a combination of tidal volume (TV) expiratory reserve volume (ERV) and inspiratory reserve volume (IRV). The other indices like forced expiratory volume in one second (FEV1), the ratio of FEV1 with FVC (FEV1/FVC), forced expiratory flow 25% to 75% of forced vital capacity (FEF 25%-75%) are measured from FVC.[7]

Dialysis is an artificial replacement of kidney functioning, especially in renal failure cases. It is used to treat end-stage renal disease and remove accumulated toxins from the body.[8]

Hemodialysis is a therapeutic procedure that uses the extracorporeal circulation of a patient's blood to ameliorate the azotemia, fluid, electrolyte, and acid-base abnormalities characteristic of the uremic syndrome. Hemodialysis is principally used for the management of acute and chronic renal failure that is refractory to conventional medical therapy.[9]

II. Material and Methods

Study population and sample

The study included 30 patients in the age group 50-65 years with a mean dialysis period of 12 months. The observational study was conducted at YCRH Dialysis unit and Deshpande hospital dialysis unit, Latur. Participants were selected according to inclusion and exclusion criteria. The aim, objective and method of study was explained to the participants Ethical clearance was taken from the Institute Ethical Committee of Maharashtra Institute of Physiotherapy, and written consent was obtained from all patients at the time of study enrollment.

Inclusive criteria were: (1) Age: 50-65yrs, (2) Gender: both male and female, (3) Known case of End stage renal disease with patient who is on hemodialysis, (4) Patients should have ability to stand up at least for 3-4 minutes, (5) Mean dialysis period -12months.

Exclusive criteria were: (1) Patients with unstable vitals such as acute infection, recent MI, Acute stroke, (2) Patient having history of COPD or other Respiratory disorders, (3) Severe cognitive or mental disabilities, (4) Patients who have undergone major surgery within the previous 3 months, (5) Hemodynamically unstable patients.

Methodology

Spirometry

Pulmonary Function Test (PFT) was done using spirometrySPBT10. All patients were able to perform acceptable and re-producible forced expiratory maneuvers with the same physician. The patients were studied in sitting posture while wearing a nose clip using standard methodology. This spirometer meets the spirometry standards determined by the ATS/ERS guideline. [10] Forced vital capacity (FVC), forced expiratory volume in the first second (FEV1), peak expiratory flow rate (PEFR) were measured and calculated as% predicted using normal values determined on the basis of age, sex (FVC%, FEV1%, PEFR%).[11]

Sphygmomanometer

The response to orthostasis was evaluated at our center according to a standardized protocol of the European Society of Cardiology/European Society of Hypertension. [12] Briefly, systolic and diastolic BP (SDB and DBP, respectively) were measured three times after 10 min in a supine position and once after 1–2 min in an

upright position. As no specific indications are recommended in the guidelines of ESC/ESH 2018 [12] ,according to the rules followed at our center, we used the last value for both supine SBP/DBP. Orthostatic hypotension was defined as a drop of ≥20 mmHg in SBP and/or ≥10 mmHg in DBP [12].

III. STATICTICAL ANALYSIS

Data was collected using a structured proforma. Data entered in MS Excel sheet and analyzed by using SPSS24.0 version. Qualitative data will be expressed in terms of proportions. Quantitative data will be expressed in terms of Mean and Standard Deviation.

RESULT

1.Findings related to Descriptive Statistics

Table no.-01

N=30

Blood Pressure									
Supine Position									
Systolic Pressure					Diastolic Pressure				
Mean	**Median**	**Mode**	**Standard Deviation**	**Range**	**Mean**	**Median**	**Mode**	**Standard Deviation**	**Range**
133.86	135	135	±1.56816	110-166	86.53	86.53	135	±1.11656	70-113

Table no. -02

N=30

Blood Pressure									
Standing Position									
Systolic Pressure					Diastolic Pressure				
Mean	**Median**	**Mode**	**Standard Deviation**	**Range**	**Mean**	**Median**	**Mode**	**Standard Deviation**	**Range**
127.63	128	133	±1. 4104	90-165	83.13	84	85	±1. 3651	60-103

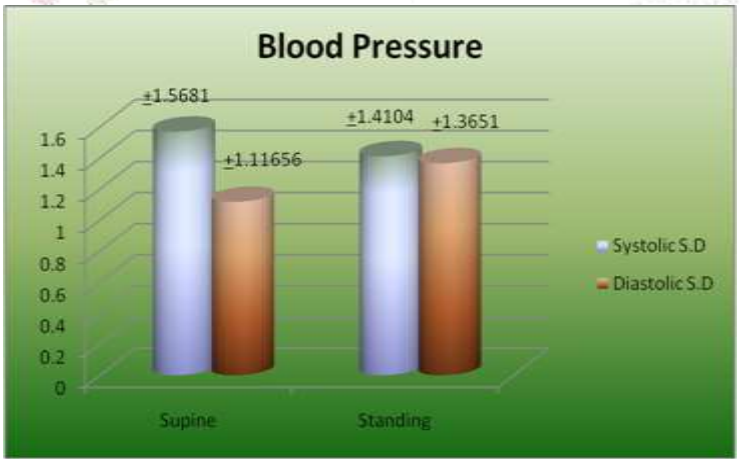

Figure-01

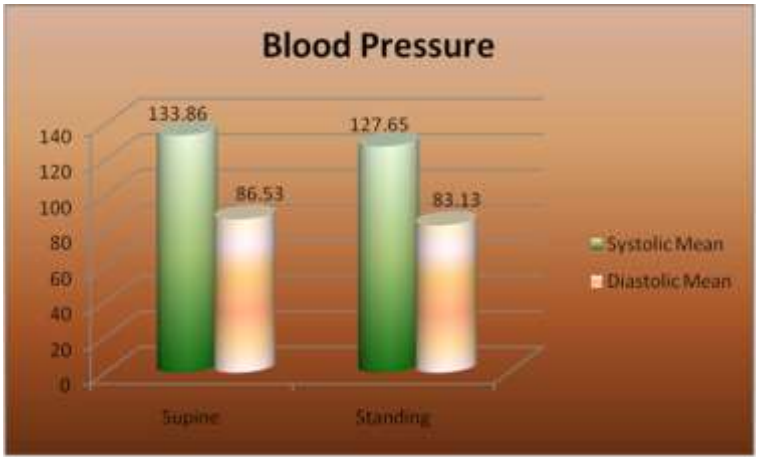

Figure-02

The data presented in Figures-1,2 and Tables -1, 2, shows the Systolic and Diastolic pressures of samples in supine and standing positions, In case of Supine position the mean systolic pressure was 133.86, Median, Mode was 135 each with Standard deviation +1.56816 and the scores of the samples ranged from 110-166. While in case of Diastolic pressure the Mean was 86.53, Median was 86.53, Mode was 135 with standard deviation +1.11656 and samples scores ranged from 70-113.

In case of Standing position the mean systolic pressures was 127.63, Median was 128, Mode was 133 with Standard deviation +1. 4104 and the scores of samples ranged from 90-165. While in case of Diastolic pressure the Mean was 83.13, Median was 84; Mode was 85 with standard deviation +1. 3651 and the scores of the samples ranged from 60-103.

Table no.-3

N=30

Pulmonary Function Test									
FVC					**FEV1**				
Mean	**Median**	**Mode**	**Standard Deviation**	**Range**	**Mean**	**Median**	**Mode**	**Standard Deviation**	**Range**
3.429	2.94	2	±1.56774	1.21 – 7.28	1.895	1.7200	0.88	±0.96315	.81 – 4.60

Table no.-4

N=30

Pulmonary Function Test				
PEFR				
Mean	**Median**	**Mode**	**Standard Deviation**	**Range**
2.896	2.7600	0.96	±1.57122	0.56 – 6.23

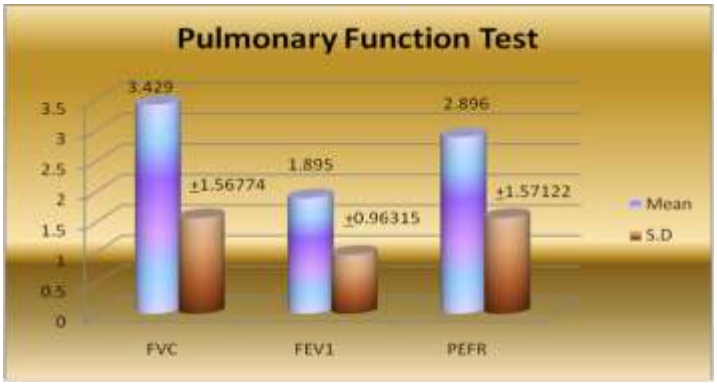

Figure-03

The data presented in Figure-3 and Tables -3 & 4, shows the Pulmonary function test results of FVC, FCV1 and PEFR of samples, In case of FVC the mean value was 3.429, Median was 2.94, Mode was 2 with Standard deviation +1. 56774 and the scores of the samples ranged from 1.21 – 7.28. While in case of FEV1 the Mean was 01.895, Median was 1.7200, Mode was 0.88 with standard deviation +0.96315 and samples scores ranged from 0.81 – 4.60. In case of PEFR the mean value was 2.896, Median was 2.7600, Mode was 0.96 with Standard deviation +1.57122 and the scores of samples ranged from 0.56 – 6.23.

2.Findings related to Prevalence.

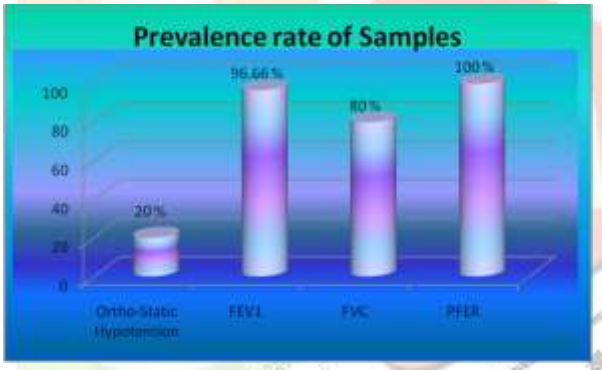

Figure-04

The data represented in Figure-04 reveals, the prevalence rate of Ortho-Static hypotension and Pulmonary Function test's results of samples who under-went Dialysis, In case of Ortho-static hypotension the prevalence rate was found to be 20 % (06 Samples), while in case of Pulmonary Function test's parameters i.e FVC, FEV1 & PEFR, the prevalence rate of FVC was found to be 80% (24 Samples), in case of FVC1 the rate was found to be 96.66% (29 Samples) and in case of PEFR the prevalence rate is 100 % (30 Samples).

IV. DISCUSSION

This study is designed to find out the prevalence of orthostatic hypotension and pulmonary function in patient on hemodialysis . Study presents the important information regarding the orthostatic hypotension and pulmonary function in patient on hemodialysis . In this study 30 people aged between 50-65 years old with a mean dialysis period of 12 months completed this study . In case of Ortho-static hypotension the prevalence rate was found to be 20 % , while in case of Pulmonary Function test's parameters that is FVC, FEV1 & PEFR, the prevalence rate of FVC was found to be 80% , in case of FVC1 the rate was found to be 96.66% and in case of PEFR the prevalence rate is 100 % .

Orthostatic hypotension is a common issue in patients undergoing hemodialysis ,often leading to dizziness , falls , and decreased quality of life . Additionally , pulmonary function can be compromised in this population due to fluid overload , uremic toxins , and other comorbidities .

Another consecutive study by Süreyya Yilmaz .et.al (2016): A cross-sectional study was conducted on Pulmonary Function in Patients with End-Stage Renal Disease: Effects of Hemodialysis and Fluid Overload . 54 patients on hemodialysis were enrolled in this study . Multifrequency bioimpedance analysis (BIA) was

used to assess fluid status before and 30 min after the midweek of hemodialysis (HD). Overhydration (OH)/extracellular water (ECW)% ratio was used as an indicator of fluid status. Fluid overload was defined as OH/ECW ³7%. Spirometry was performed before and after hemodialysis . Spirometry was performed before and after hemodialysis. Forced vital capacity (FVC), FVC%, and forced expiratory volume in the first second (FEV1) levels were significantly increased after hemodialysis. FVC, FVC%, FEV1, FEV1%, mean forced expiratory flow between 25% and 75% of the FVC (FEF25–75), FEF25–75%, peak expiratory flow rate (PEFR), and PEFR% were significantly lower in patients with fluid overload than in those without. OH/ECW ratio was negatively correlated with FVC, FVC%, FEV1, FEV1%, FEF25–75, FEF25–75%, PEFR, and PEFR%. Stepwise multiple regression analysis revealed that male sex and increased ultrafiltration volume were independently associated with higher FVC, whereas increased age and OH/ECW ratio were independently associated with lower FVC.

Another consecutive study by Toshiyuki Mochizuki .et.al(): A cross-sectional study was conducted on Hemodynamic response to orthostatic stress immediately after dialysis session in chronic hemodialysis patients . n. Twenty-one HD patients (mean age, 70.2 ± 8.1 years; HD duration, 7.5 ± 6.4 years) participated in this study. Each 5-min hemodynamic monitoring was performed in the supine, semi-recumbent, and sitting positions immediately after an HD session. Hemodynamic variables were measured using a noninvasive beat-to-beat monitoring device during the test. . Patients were divided into an intradialytic hypotension (IDH) group and a non-IDH group according to the presence or absence of IDH on the day of the measurements, and intra- and intergroup comparisons were performed. In the IDH group, the nadir values of systolic blood pressure in the semi-recumbent and sitting positions were significantly lower than those in the supine position and the last systolic blood pressure in the semi-recumbent position. The nadir of stroke volume in the sitting position was significantly lower than that in the supine position. There were no statistically significant intergroup differences in the changes for any positions. These results suggest that patients with IDH require special attention when getting out of bed to prevent post-dialytic falls.

V.CONCLUSION

This study was designed to find out the prevalence of orthostatic hypotension and pulmonary function in patient on hemodialysis. Study presents the important information regarding the orthostatic hypotension and pulmonary function in patient on hemodialysis. In this study 30 people aged between 50-65 years old with a mean dialysis period of 12 months completed this study. In case of Ortho-static hypotension the prevalence rate was found to be 20 %, while in case of Pulmonary Function test's parameters that is FVC, FEV1 & PEFR, the prevalence rate of FVC was found to be 80%, in case of FVC1 the rate was found to be 96.66% and in case of PEFR the prevalence rate is 100 %.

VI. LIMITATIONS AND FUTURE SCOPE

Limitations :(1) This study was only bounded to 50-65years of age group. (2) The study was limited to YCRH dialysis and Deshpande Hospital Dialysis unit, Latur.

Suggestions:(1) Study can be done with large sample size, (2) Different outcome measures can be used for future studies, (3) Further studies can be done to look for risk factors for orthostatic hypotension and pulmonary function.

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