

Effect of Dry Weight Reduction on Blood Pressure Control among End-Stage Renal Disease Patients on Maintenance Hemodialysis

Dry Weight Reduction on Blood Pressure Control among End-Stage Renal Disease

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ABSTRACT

Objective: To find mean change in post-dialysis blood pressure after dry weight reduction among patients on hemodialysis.

Study Design: Quasi-Experimental study

Place and Duration of Study: This study was conducted at the Dialysis Unit, Nephrology Department, Sir Ganga Ram Hospital, Lahore from June 2017 to March 2018.

Materials and Methods: Sixty patients were enrolled. The mean of the blood pressures was calculated as a baseline. Dry weight was reduced through ultrafiltration by additional weight loss of 0.9 kg/10 kg per dialysis. Follow-up was done after 4 weeks and a mean change in post-dialysis systolic and diastolic BP was recorded.

Results: Forty six (76.7%) were males and 14 (23.3%) were females. The mean age was 45.4±11.8 years. Mean SBP at baseline was 160.7±12.4 mmHg and 152.0±12.8 mmHg at 4 weeks, which is statistically significant (p=0.000). Mean DBP at baseline was 93.2±3.1 mmHg and 89.5±7.9 mmHg at 4 weeks, which is also statistically significant (p=0.000).

Conclusion: The reduction of dry weight is an effective maneuver to improve BP control in hemodialysis patients.

Key Words: Hemodialysis, Hypertension, Dry weight

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INTRODUCTION

World health organization considers hypertension (HTN) a major health ailment affecting 1.28 billion adult population worldwide, almost 46% of these individuals remain ignorant and undiagnosed, 42% get proper diagnosis and treatment, whereas only 21% achieve adequate control of HTN with treatment.¹

Hypertension if left untreated or poorly controlled leads to weakening of blood vessels walls, formation of

atherosclerotic plaques, and eventually leads to cerebrovascular accidents, acute coronary syndrome, and chronic kidney disease. Hypertension being a silent killer bags 9.4 million deaths yearly which accounts for 2.58% of all deaths.² In different parts of the world, many guidelines have been established based on age, race, and region but the American College of Cardiology (ACC)/American Heart Association (AHA) and European Society of Cardiology (ESC)/European Society of Hypertension (ESH) guidelines having little difference are widely followed. ACC/AHA 2017 guidelines suggest blood pressure (BP) more than 130/80 as HTN whereas the 2018 ESC/ESH report states >140/90 as HTN.³ International Society of Hypertension 2020 report and 2017 JNC 8 endorse ≥140/90 blood pressure for labelling HTN.⁴

Chronic HTN leads to chronic kidney disease (CKD) and CKD itself develops secondary HTN. Prevalence of HTN is 60 to 90% at different stages of CKD being highest among patients of end-stage renal disease (ESRD) on hemodialysis (HD). Glomerulosclerosis, sympathetic over activity, hormonal imbalance, and atherosclerosis are important pathogenic mechanisms for the development of HTN in CKD patients, but fluid overload and salt retention play a vital role among HD patients.⁵ Hypertension of HD patients is a risk factor for the development and progression of left ventricular hypertrophy (LVH), cardiovascular disease (CVD), and

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total mortality. More than 50% of HD patients have some form of CVD, 75% have LVH and overall cardiovascular mortality is 20 times higher than the normal population.⁶ Surprisingly better survival is reported by some studies with high BP among HD patients.⁷ Because of high mortality with very high and low BP, Kidney Disease Outcome Quality Initiatives (KDOQI) guidelines recommend pre hemodialysis and post hemodialysis blood pressure readings of <140/90 mmHg and <130/80 mmHg respectively.⁸ Recent studies have proved the better quality of life among HD patients with adequate control of BP.⁹

Along with antihypertensive medications removing excess water from the body by HD is an effective way of managing hypertension among ESRD patients keeping in mind that >90% of HTN is due to hypervolemia.¹⁰ Removal of excess body water depends upon a careful assessment of volume status and estimation of dry weight. There is no census on dry weight definition but generally, it is that post HD body weight at which patient remain normotensive until the next dialysis despite salt and water retention during the intradialytic period.¹¹ Reduction of dry weight to the point where a patient is not clinically hypovolemic helps in controlling BP and reduces hospitalization rates.¹²

This study is designed to find meaningful change in post-dialysis blood pressure after dry weight reduction among hypertensive end-stage renal disease patients on maintenance hemodialysis.

MATERIALS AND METHODS

This quasi-experimental study was conducted at Nephrology Unit, Sir Ganga Ram Hospital Lahore from 23rd June 2017 to 28th March 2018. Using the Non-Probability Consecutive Sampling technique, the

sample size of 60 cases was calculated by using a 95% confidence level with a 10% margin of error.¹³ End-stage renal disease hypertensive patients on thrice-weekly maintenance HD for more than 3 months were included. Patients with congestive cardiac failure and stroke in the previous six months and patients who failed to achieve a reduction in dry weight at 4 weeks were excluded from the study. Demographical characteristics and medication record was reviewed among patients already taking anti-hypertensive. At the start of the study post-HD, Systolic BP (SBP) and diastolic BP (DBP) were recorded from the non-arteriovenous access arm, 3 readings were taken for each patient, and the mean was calculated as baseline BP. All patients underwent thrice-weekly HD and the dry weight of the patients was reduced from 0.9 to 1 kg through ultrafiltration gradually over a period of 4 weeks. Follow-up was done after 4 weeks and a mean change in post-dialysis SBP and DBP was recorded. Data were entered and analyzed on SPSS-23. The difference between post-dialysis blood pressures was analyzed by using Paired sample t-test. Data were stratified for age, BMI, duration of ESRD, and gender. Post-stratification, a t-test was applied. A p-value ≤ 0.05 was considered significant.

RESULTS

Forty six (76.7%) were males and 14(23.3%) were females. 9(15.0%) were between 15-30 age group, while 22(36.7%), 29(48.3%) were between 31-45 years and >45 age groups respectively. The mean age of the patients was 45.4 ± 11.8 years with 25 and 67 as the minimum and maximum ages. 39(65%) patients had normal weight, while 19(31.7%) and 2(3.3%) were overweight and obese respectively.

Table No.1: Demographic and statistical analysis of the data

Variable	No. (%)	SBP		P value	DBP		P value
		Baseline	At 4 weeks		Baseline	At 4 weeks	
Total	60 (100%)	160.7 \pm 12.4	152 \pm 12.9	0.000	93.2 \pm 3.1	89.6 \pm 7.9	0.000
Gender							
Male	46 (76.7%)	160.8 \pm 12.4	152.1 \pm 12.4	0.000	93.4 \pm 3.0	90.4 \pm 3.9	0.000
Female	14 (23.3%)	160.4 \pm 13.0	151.8 \pm 14.8	0.003	92.5 \pm 3.6	86.8.2 \pm 14.9	0.162
Age (years)							
15-30	9 (15%)	157.5 \pm 13.0	152.4 \pm 18.0	0.141	94.2 \pm 2.7	86.9 \pm 19.6	0.254
31-45	22 (36.7%)	164.7 \pm 15.0	154.7 \pm 12.3	0.000	94.2 \pm 4.3	90.7 \pm 3.1	0.001
≥ 45	29 (48.3%)	158.7 \pm 9.3	149.8 \pm 11.5	0.000	92.1 \pm 1.6	89.6 \pm 3.5	0.000
BMI (kg/m²)							
Normal	39 (65%)	161.5 \pm 13.1	152.7 \pm 14.2	0.000	93.5 \pm 3.2	89.9 \pm 9.7	0.010
Overweight	19 (31.7%)	159.0 \pm 11.7	150.4 \pm 10.5	0.000	92.8 \pm 3.1	89.9 \pm 2.9	0.000
obese	2 (3.3%)	163.2 \pm 3.0	153.6 \pm 3.3	0.013	91.3 \pm 0.4	87.7 \pm 0.1	0.053
HD duration (months)							
10-48	20 (33.3%)	160.3 \pm 12.7	150.1 \pm 9.6	0.000	93.4 \pm 4.1	86.9 \pm 12.1	0.018
48-72	13 (21.7%)	162.0 \pm 13.6	150.0 \pm 15.5	0.000	93.5 \pm 2.7	89.7 \pm 3.7	0.002
>72	27 (45%)	160.5 \pm 12.1	154.4 \pm 13.7	0.003	92.9 \pm 2.6	91.5 \pm 4.4	0.088

Among these patients, 20(33.3%) had ESRD from 10-48 months, while 13(21.7%), 27(45.0%) had 48-72 months, and >72 months respectively. The mean BMI of the patients was 22.9 ± 4.4 with 17 and 36 as the minimum and maximum values. The mean duration of ESRD was 66.5 ± 35.0 months with 10 and 132 as the minimum and maximum months. Mean SBP at baseline was 160.7 ± 12.4 mmHg with 144 and 197.6 as the minimum and maximum values. Mean SBP at 4 weeks was 152.0 ± 12.8 mmHg with 122.3 and 181.2 as the minimum and maximum values. Mean DBP at baseline was 93.2 ± 3.1 mmHg with 90 and 104.3 as the minimum and maximum values. Mean DBP at 4 weeks was 89.5 ± 7.9 mmHg with 87.6 and 98.5 as the minimum and maximum values. Mean SBP at baseline was 160.7 ± 12.4 mmHg and 152.0 ± 12.8 mmHg at 4 weeks, which is statistically significant ($p=0.000$). Mean DBP at baseline was 93.2 ± 3.1 mmHg and 89.5 ± 7.9 mmHg at 4 weeks, which is also statistically significant ($p=0.000$) [Table 1].

DISCUSSION

Management of HTN among HD patients is a difficult task and the target of BP in these patients is always a matter of debate. The first point of contention is the use of pre-dialysis, post-dialysis, or interdialytic BP readings as a target of HTN management. Pre-dialysis BP is affected by volume accumulation whereas post-dialysis BP is affected by ultrafiltration volume and rate, dialysate temperature, and food intake during dialysis. There are strong chances that patients are hypertensive pre-dialysis and develop hypotension after hemodialysis.¹⁴ Contrary to that, in 10 to 15 % of patients excessive and rapid removal of water during HD leads to sympathetic overactivation resulting in post-dialysis HTN. In these individuals keeping pre-dialysis BP as a target may lead to serious consequences. It has been seen that pre-dialysis SBP <110 mm Hg or >150-159 mm Hg is associated with higher mortality.¹⁵ BP readings of <140/90 pre-dialysis and <130/80 mmHg post-dialysis are endorsed by National Kidney Foundation Kidney Disease Outcomes Quality Initiative guidelines as the target of HTN management.¹⁶

Removal of fluids during HD by ultrafiltration is an effective method of volume-dependent HTN. In 2009 DRIP trial was published, this experimental study has led to an important finding of lowering BP with the reduction in dry weight. In this study, 0.9 kg weight was lowered with ultrafiltration in 4 weeks resulting in a lowering of 6.9 mm Hg SBP and a lowering of 3.1 mm Hg in DBP. A recent study from China also reported lowering intradialytic BP with dry weight reduction.¹⁷ Our study findings are in favor of previous research, SBP reduced to 8.7 mmHg and DBP reduced to 3.6 mmHg with 0.9 kg lowering of dry weight. Use of antihypertensive medication, salt restriction, and dry

weight probing among HD patients improve quality of life and reduction in cardiovascular mortality.¹⁸ However, using the Crit-Line Intradialytic Monitoring system for dry weight reduction and ultrafiltration may lead to the worst outcomes¹⁹.

CONCLUSION

Dry weight reduction is a simple and well-tolerated method to control BP in hypertensive hemodialysis patients. Long-term control of BP will depend on continuous assessment and maintenance of dry weight.

Author's Contribution:

Concept & Design of Study:	Shahid Anwar
Drafting:	Tanzila Saleh, Abad-ur-Rehman
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Revisiting Critically:	Shahid Anwar, Tanzila Saleh
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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