Original Article

Effect of Low Sodium Dialysate on Regression of Left Ventricular Hypertrophy in Hemodialysis Patients

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ABSTRACT

Objective: To compare the effect of low sodium dialysate with the standard sodium dialysate in terms of regression of left ventricular hypertrophy in dialysis patients.

Study Design: Randomized controlled trial study

Place and Duration of Study: This study was conducted at the Nephrology Department, PIMS Islamabad. Duration of study from March, 2018 to August, 2018.

Materials and Methods: This study involved eighty-four Dialysis dependent patients (n=84) of either gender aged between 18-65 years with hypertension and LVEF>40%. They were randomly divided into two groups. Intervention group was switched to 136 mmol/L dialysate sodium (low sodium) while control group were kept on dialysate sodium concentration of 140 mmol/L (standard sodoum). Study outcomes were measured in terms of interdialyctic weight gain, blood pressure response and left ventricular mass index (LVMI) at six months.

Results: There were 71.4% (n=30/42) males and 28.6% (n=12/42) females in low sodium group and were 57.1% (n=24/42) males and 42.9% (n=18/42) females in standard sodium group. In low sodium group, mean age was 41.2 years ± 8.8 SD, mean height was 1.64 m ± 0.06 SD and mean weight was 73.4 Kg ± 10.4 SD. In standard sodium group, mean age was 44.7 years ± 9.5 SD, mean height was 1.68 m ± 0.06 SD and mean weight was 74.2 Kg ± 9.9 SD. In low sodium group, mean LVEF was 48.5 % ± 2.3 SD, mean interdialyctic weight gain was 2.58 Kg ± 0.43 SD, mean systolic BP was 155.2 mmHg ± 7.5 SD, mean diastolic BP was 99.5 mmHg ± 6.6 SD and mean LVMI was 123.6 g/m^2 ± 13.5 SD. In standard sodium group, mean LVEF was 49.1 % ± 2.6 SD, mean interdialyctic weight gain was 2.53 Kg ± 0.44 SD, mean systolic BP was 156.1 mmHg ± 7.9 SD, mean diastolic BP was 101.2 mmHg ± 6.6 SD and mean LVMI was 123.3 g/m^2 ± 14.6 SD. At six months, mean interdialyctic weight gain was 2.02 Kg ± 0.43 SD in the low sodium group compared with 2.53 ± 0.43 SD in standard sodium group, (P=0.001). Mean systolic blood pressure was 147.5 mmHg ± 7.9 SD in the low sodium group compared with 157.5 mmHg ± 8.2 SD in standard sodium group, (P=0.001). Low sodium tends to lower down the systolic pressure when compared to high sodium. Mean diastolic blood pressure was 99.5 mmHg ± 5.9 SD in the low sodium group compared with 101.2 mmHg ± 6.6 SD in standard sodium group, no significant difference was observed in diastolic blood pressure in both the groups at six months (P=0.06). Mean LVMI was 121.8 g/m^2 ± 13.5 SD in low sodium group while it was 131.8 g/m^2 ± 14.6 SD in standard sodium group (p=0.003).

Conclusion: Mean interdialyctic weight gain was significantly lesser and mean LVMI was significantly lower in low sodium group compared to standard sodium group. Low sodium tends to lower down the systolic pressure when compared with standard sodium group at six months.

Key Words: Dialysis, Dialysate, Sodium.

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INTRODUCTION

Dialysis is most commonly used modality of renal replacement therapy across the glob[1]. Unfortunately left ventricular hypertrophy (LVH) is considered as a main risk factor for sudden cardiac death in dialysis patients. Regression of LVH by any intervention can reduce cardiac mortality in these patients.[2] Regression of LVH can be achieved by removal of dialysis sodium along with better blood pressure control in these patients.[3]

The balance of sodium in dialysis patients mainly depends on intake of dietary salt and removal of sodium during dialysis. Volume overload is triggered by intake of salt.[4] Negative sodium gradient is when the dialysate sodium is lower than the patient's plasma sodium at the start of hemodialysis.[5] In chronic hemodialysis patients

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average intake of sodium intake is between 150-250 mmol/day. [6] Dialysis should therefore be optimized to remove excessive sodium, which accumulates during interdialysis period and by minimizing chronic fluid overload. [7,8] Thus, the major determinants of optimum diasyalate sodium removal are the volume of ultrafiltration during haemodialysis and the relationship between plasma levels of sodium and prescribed dialysate sodium concentration.[9]

Dialysis Outcomes and Practice Patterns Study (DOPPS) reported that about 57% of HD facilities adopt uniform Dialysate sodium prescriptions in more than ninety percent of patients. [10] Use of high Dialysate sodium may be beneficial for prevention of episodes of hypotension, but at the same time may result in to a positive sodium balance leading to an increase in BP and fluid overload. However, use of low dialysate sodium is associated with reduced thirst, BP and fluid overload but can sometime be detrimental, especially in patients who are prone to hypotension.

A panel of clinicians from fourteen large dialysis units in the USA have suggested that Dialysate sodium should not exceed 134–138 mmol/L. [11] However, researchers from DOPPS group quickly rejected this proposition and claimed that the standard range of 138–140 mmol/L should not be lowered before more evidence showing clear cut benefit is gathered.[12] With this background in mind, our aim was to perform a randomized controlled trial to analyse possible benefits of low versus standard Dialysate prescriptions in hypertensive patients on chronic hemodialysis.

MATERIALS AND METHODS

We enrolled a total of 84 patients of end stage renal disease on regular twice weekly dialysis for last 6 months with hypertension and Left ventricular Ejection fraction <40%. They were randomly divided into two groups (n=42 in each group) by coin method; an intervention (group A) and a control (group b) group. By echocardiography Left ventricular ejection fraction (LVEF), Mass of the left ventricle was measured and LVMI was calculated.

Intervention group was switched to 136 mmol/L dialysate sodium while control group dialysate sodium concentration was kept at 140 mmol/L. Interdialytic weight gain (IDWG) and BP was recorded in both groups at the time of study enrolment, at each dialysis during whole study period of 6 months. After 6 months echocardiography was repeated to see any change in LVMI along with improvement in IDWG and BP control in both groups.

RESULTS

There were 71.4% (n=30/42) males and 28.6% (n=12/42) females in low sodium group and were 57.1% (n=24/42) males and 42.9% (n=18/42) females in standard sodium group. In low sodium group, mean age was 41.2 years ± 8.8 SD, mean height was 1.64 m ± 0.06 SD and mean weight was 73.4 Kg ± 10.4 SD. In standard sodium group, mean age was 44.7 years ± 9.5 SD, mean height was 1.68 m ± 0.06 SD and mean weight was 74.2 Kg ± 9.9 SD.

In low sodium group, mean LVEF was 48.5 % ± 2.3 SD, mean interdialyctic weight gain was 2.58 Kg ± 0.43 SD, mean systolic BP was 155.2 mmHg ± 7.5 SD, mean diastolic BP was 99.5 mmHg ± 6.6 SD and mean LVMI was 123.6 g/m^2 ± 13.5 SD. In standard sodium group, mean LVEF was 49.1 % ± 2.6 SD, mean interdialyctic weight gain was 2.53 Kg ± 0.44 SD, mean systolic BP was 156.1 mmHg ± 7.9 SD, mean diastolic BP was 101.2 mmHg ± 6.6 SD and mean LVMI was 123.3 g/m^2 ± 14.6 SD (table 1).

At six months, mean interdialyctic weight gain was 2.02 Kg ± 0.43 SD in the low sodium group compared with 2.53 ± 0.43 SD in standard sodium group, (P=0.001, table 2). Mean interdialyctic weight gain was significantly lesser in low sodium group compared to standard sodium group.

Table No.1: Baseline patient characteristics in both groups

Variables	Groups	Mean	SD	P-value T-test
LVEF (%)	Low Sodium diasylate	48.5	2.3	0.377
	Standard sodiumdiasylate	49.1	2.6	
Interdialyctic Weight gain (kg)	Low Sodium diasylate	2.58	0.43	0.617
	Standard sodiumdiasylate	2.53	0.44	
Systolic bp (mmhg)	Low Sodium diasylate	155.2	7.5	0.622
	Standard sodiumdiasylate	156.1	7.9	
Diastolic bp (mmhg)	Low Sodium diasylate	99.5	5.9	0.227
	Standard sodiumdiasylate	101.2	6.6	
Lvmi (g/m^2)	Low Sodium diasylate	123.6	13.5	0.665
	Standard sodiumdiasylate	122.3	14.6	

Mean systolic BP was 147.5 mmHg ± 7.9 SD in the low sodium group compared with 157.5 mmHg ± 8.2 SD in standard sodium group, (P=0.001). Low sodium tends to lower down the systolic pressure when compared to

high sodium. Mean diastolic blood pressure was 99.5mmHg ± 5.9 SD in the low sodium group compared with 101.2 mmHg ± 6.6 SD in standard sodium group, No significant difference was observed in diastolic blood pressure in both the groups at six months (P=0.06) .

Mean LVMI was 121.8 g/m^2 ± 13.5 SD in low sodium group while it was 131.8 g/m^2± 14.6 SDin standard sodium group (p=0.003). Mean LVMI was significantly lower in low sodium group compared to standard sodium group at six months.

Table No.2: Outcomes in both groups at six months

Variables	Groups	Mean	Sd	P-value T-test
Interdialyctic Weight gain (kg)	Low Sodium diasylate	2.02	0.43	0.001
	Standard sodiumdiasylate	2.53	0.44	
Systolic bp (mmhg)	Low Sodium diasylate	147.5	7.9	0.001
	Standard sodiumdiasylate	157.5	8.2	
Diastolic bp (mmhg)	Low Sodium diasylate	97.5	5.9	0.06
	Standard sodiumdiasylate	100.2	6.6	
Lvmi (g/m^2)	Low Sodium diasylate	121.8	13.5	0.003
	Standard sodiumdiasylate	131.1	14.6	

DISCUSSION

Currently available clinical evidence supports a significant role of LVH in sudden cardiac death among dialysis patients. In one study, LVH was found to be associated with higher risk of mortality even after adjustment for age, known CAD, DM and BP.[13] It has been observed that in patients who or on dialysis with conventional technique, persistent elevation in BP and positive salt-water balance resulting in extra-cellular fluid overload significantly contribute to on-going LVH.[14-16]

It has been demonstrated that both BP and IDWG was increased when sodium was overloaded either by excessive dietary intake or by excessive diffusion via dialysate.[17] In addition, elevated sodium plasma levels may induce hypertension, which is independent of ECF volume. A number of observational studies as well as small uncontrolled clinical studies have shown that lower dialysate [Na+] associates with less thirst,[18-20] lower IDWG, lower ECF volume and lower BP, with only a minority of studies being completely negative.[21-27] A previous research by Solid trial team demonstrated that a decrease in dialysate [Na+] by 3 mM in 52 facility based patients was well tolerated and reduced systolic and diastolic BP by 4–5 and 2–3 mmHg, respectively.[28] The observation of improvement in intermediary outcomes such as BP suggest that lower dialysate [Na+] could be beneficial for improving LVH as well. There are at least two studies that examined the effect of lower dialysate sodium on structure and function of left ventricle.[29,30] One of the studies demonstrated a decrease in volumes of left ventricle associated with lower diasylate levels.[29] However, both the studies were not long enough to evaluate changes in mass of left ventricle.

Dunlop JL in a very recent systematic reviewed randomized controlled trials of low (< 138 mM) versus neutral (138 to 140 mM) or high (> 140 mM) dialysate [Na+] for maintenance HD patients. They demonstrated that low diasylate reduced the interdialytic weight gain compared to neutral or high dialysate [Na+]; probably reduced predialysis mean arterial BP; probably reduced post dialysis means arterial BP and could reduce consumption of antihypertensive medication. However, lower sodium diasylate was associated with increased events of hypotension when compared with neutral or high dialysate [Na+]. Whether lower sodium diasylate changed LV mass is uncertain due to low quality of evidence.[31]

Whether lower sodium diasylate influences the serum sodium levels is another concern for clinicians. Pre-dialysis serum [Na+] did change in several small prospective clinical trials after changes to dialysate [Na+], although often after a lag of several months. Several other studies have shown an association between low serum [Na+] and mortality in patients with kidney disease and authors suggested that an intervention that might potentially lower serum [Na+] needs stringent and careful scrutiny.[32-33]

CONCLUSION

In conclusion, this study shows that low sodium dialysate is an effective measure in decreasing left ventricular mass index and is especially recommended in patients with uncontrolled hypertension and excessive interdialytic weight gain.

Author's Contribution:

Concept & Design of Study:	Adnan Akhtar
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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