

*Original Article***The effect of sodium and ultra filtration profile combination and cold dialysate on hypotension during hemodialysis and its symptoms***Nahid Shahgholian**, *Mansoor Ghafourifard***, *Faranak Shafiei******Abstract**

BACKGROUND: One of the most prevalent side effects of hemodialysis is intradialytic hypotension and its symptoms. Using sodium profiles 3 and ultra filtration profile 3 and cold dialysate are the ways to overcome this problem. Since none of these methods can control this complication lonely, this study was to investigate the effect of combination of both methods on intradialytic hypotension.

METHODS: This study was a crossover clinical trial in which 24 patients experiencing frequent intradialytic hypotension, underwent three different methods of treatments during 9 successive hemodialysis sessions. Group 1 used sodium profile 3 and ultra filtration profile 3, group 2 underwent hemodialysis with cold dialysate, and group 3 received combination of both methods. Blood pressure was controlled before, during (3 times) and after hemodialysis. Data were analyzed via SPSS₁₅, by χ^2 and ANOVA tests.

RESULTS: Findings showed that although there was no significant difference concerning intradialytic hypotension and its symptoms in two groups of sodium profile 3 and ultra filtration profile 3 and cold dialysate and the combination group ($p > 0.05$), there was a significant difference concerning the mean blood pressure in three groups ($p < 0.05$). In combination group, drop of systolic and diastolic blood pressures were less than groups with each of the methods.

CONCLUSIONS: Concerning the decreased rate of hypotension with combination method, nurses can use this method to decrease intradialytic hypotension and help the patients undergo hemodialysis for enough time and improve their quality of life.

KEY WORDS: Hypotension, complications during hemodialysis, hemodialysis, patient.

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Hemodialysis is the most frequent choice for the treatment of end stage renal disease patients in Iran and the world¹ and although it is a safe procedure but it has adverse complications.² Intradialytic hypotension is a common complication during hemodialysis³ and occurs in about 20% of hemodialysis sessions⁴, even in some patients it has been reported up to 50%.⁵ It is characterized by dizziness, headache, weakness, nausea, vomiting, cramp, dim sight and fatigue.^{4,6} Intradialytic hypotension makes the patients to be greatly bored and not only limits removing excessive fluid during hemodialysis but also caus-

es vascular complications including brain infarction, mesenteric, and cardiac ischemia⁷. In one hand, more nursing care is needed⁸, the staff would spend more time to control and treat this complication via checking blood pressure frequently, administrating solutions and medicines for increasing blood pressure, oxygen therapy, positioning, decreasing ultra filtration or stopping dialysis before the standard time. It also will reduce the dialysis efficiency and has negative effect on patients' quality of life⁹, therefore one of challenges of nursing staffs is how to prevent intradialytic hypotension and its accompanying complication. Hap-

* MSc, Department of Internal Surgery, School of Nursing and Midwifery, Isfahan University of Medical Sciences, Isfahan, Iran.

** MSc in Nursing Education, Department of Medical Surgical Nursing, Instructor of Nursing and Midwifery, Isfahan University of Medical Sciences, Isfahan, Iran.

*** MSc, Educational Supervisor, Educational and Treatment Centers of Nour and Hazrat Ali-Asghar, Isfahan University of Medical Sciences, Isfahan, Iran.

Correspondence to: Nahid Shahgholian, MSc.

Email: shahgholian@nm.mui.ac.ir

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pening of intradialytic hypotension is due to the reduction of circulating blood volume of the patient followed by ultra filtration. The decreased volume is the result of osmolality reduction from extracellular space after removing active particles specially sodium.^{2,6} Reduced osmolality causes the fluid to transfer from extracellular to intracellular space, leading to an increase in the volume of intracellular fluid and a decrease in extracellular fluid.² Hypotension will occur when compensatory mechanism fails following removal of much fluid.¹⁰ Since during dialysis, reduction of plasma osmolality is related to reduction of plasma sodium, changing sodium concentration of dialysate will prevent the reduction of plasma osmolality. Studies showed that sodium concentration of dialysate which is equal or more than plasma sodium concentration prevented extracellular osmolality reduction and reabsorbed water into the cell and facilitated fluid transmission into vessels.¹¹ But hypernatremic solutions cause complications such as gaining weight and blood pressure between dialysis sessions², regulation of sodium profiles has been suggested in order to reduce these complications.⁶ Regulation of these profiles will modify active level of plasma sodium by changing concentration of dialysate.¹² Regulating sodium profile, hypernatremic dialysate is used at the beginning of dialysis, and during treatment the amount of sodium will be decreased in order to remove additional sodium transferred from patient's blood during hypernatremic period.^{6,13} Another preventive way of hypotension is ultra filtration profile. By regulating ultra filtration profile, dialysis machine set such that at the beginning of dialysis, much fluid and in final stages little fluid will be removed from patient's blood. Reducing rate of ultra filtration in the end stages of dialysis can prevent hypotension.¹³ Removing fluid from inside of vessels during ultra filtration profile causes increase of oncotic pressure inside the vessels and reduction of hydrostatic pressure in venous system.

These mechanisms led to increase return of fluids from extra vascular space to intravascular and decrease hypotension during dialysis.¹⁰ In sodium and ultra filtration profiles, amount of removing water and sodium may rise or fall

alternatively or it may only reduce gradually.^{9,14} Several studies suggested combination of sodium and ultra filtration profiles in order to reduce the complication during dialysis^{15,9,6} and in some studies; the emphasis is on more effective sodium profile 3 and ultra filtration profile 3 in comparison with other profiles.^{6,16,17} On the other hand, some studies offered reduction of intradialytic hypotension using cold dialysate as an inexpensive, simple and effective method and believed that using hemodialysate with temperature between 34-35.5 centigrade makes hemodynamic status stable during dialysis^{3,7,18}, reduces the number of blood pressure drops, improves dialysis quality. But both groups showed that the method applied by them could not prevent blood pressure drop during hemodialysis. Concerning its significance and according to suggestion of Dheen and Henrich¹⁹ and Rezki et al¹⁷, we designed a study to compare hypotension incidence and its related symptoms in each method separately and compare it with the combination method in patients with frequent intradialytic hypotension.

Methods

This study was a cross over clinical trial. The studied population of this study was patients with end stage renal disease undergoing hemodialysis Aliasghar hospital, Isfahan, at 2008. The patients (n = 24) were between 18-75 years old and they have experienced intradialytic hypotension in 20 percent of sessions during last month. Intradialytic hypotension was defined as reduction of more than 30 percent of systolic blood pressure compared with the status before dialysis or systolic blood pressure less than 60 ml of mercury. The patients underwent dialysis using bicarbonate solution, three times a week via permanent venous access for more than three months. Patients with cardiac or hepatic diseases, active bleeding, peripheral vascular disease, thrombosis of deep veins, defective vessels or having body temperature higher than normal during sampling (37.5°C) were excluded. The subjects underwent hemodialysis using cold dialysate for three sessions, ultra filtration and sodium profiles 3 for another three sessions and at last using combination of cold dialysate and ultra filtration and sodium profiles 3 in

three sessions. Data was collected using a two part check list. The first part was composed of demographic characteristics of the patients. The second part included information about hemodialysis such as beginning time, terminal time, blood pressure (before, the first hour, second hour, third hour and after dialysis), symptoms following hypotension (cramp, nausea, vomiting, headache and dizziness) and medicines consumed by patient. In order to obtain scientific validity of gathered information, all subjects underwent hemodialysis using Ferznioz 4008 machine, made in Germany. A standard mercury indicator was used in all subjects to measure blood pressure. (a checklist does not need to be validated). Data was analyzed by Chi Square and variance analysis using SPSS. A p-value under 0.05 was considered to be significant.

Results

Results showed that a significant difference in hypotension rate was present using ultra filtration and sodium profiles 3, cool dialysate, and combination method ($p < 0.05$) but it did not show any significant difference in symptoms following hypotension while using ultra filtration and sodium profiles 3, cool dialysate and combination method ($p > 0.05$). There was a significant difference in frequency of dizziness while undergoing dialysis with cool dialysate and combination of the two methods ($p < 0.05$) but there was not any significant difference in other symptoms following hypotension between these two groups. In spite of insignificant difference among above mentioned items, in the group received combination method, hypotension and its symptoms was less experienced than in each method separately. Frequent measurements of variance analysis showed that there was a significant difference between average of systolic and diastolic blood pressures before, within and after dialysis in three methods ($p < 0.05$). In the combination approach, the rate of drop in systolic and diastolic blood pressure was less than it in each individual method.

Discussion

In the present study, two different methods were used to reduce hypotension episodes dur-

ing hemodialysis and the effect of each method was compared with the combination of two methods. Results showed that there was no significant difference in happening of hypotension between the group used sodium profile 3 and ultra filtration profile 3 and the combination of these methods and also in the group received sodium profile 3 and ultra filtration profile 3 and cold dialysate. These findings suggested that both methods are appropriate in reducing hypotension. But in the group that combination method was used, the frequency of hypotension was less than the groups used each method but the differences were not statistically significant. Rezki et al. concluded that symptoms and number of intradialytic hypotension incidences reduced significantly in hemodialysis group with sodium profile and cold dialysate and also in hemodialysis group with sodium profile compared with control group.¹⁷

Our results did not show any significant difference considering hypotension symptoms (muscular cramp, nausea, vomiting, headache and dizziness) between combination group and each individual method and. But for all complications, number of sessions that patients experienced them was less than those who did experience it. But in combination method, number of sessions that patients experienced adverse symptoms was less than those who received each method separately. Oliver et al. showed that using sodium and ultra filtration profiles not only reduced hypotension during dialysis, but also decreased its symptoms.²⁰ Ayoub and Finlayson found that cold dialysate increased patients' resistance against reduction of blood pressure and caused increase of ultra filtration and maintenance of hemodynamic stability within and after hemodialysis.¹⁸ The mean of systolic blood pressure before hemodialysis was not different among three groups while a significant difference was present in the mean of systolic blood pressure in the first, second and the third hours and after dialysis. Systolic blood pressure of patients during hemodialysis decreased gradually in all groups and these changes were expected due to reduction of intravascular fluid volume but these changes were at minimum rate while using combination method, cold dialysate users were in the second order and patients received

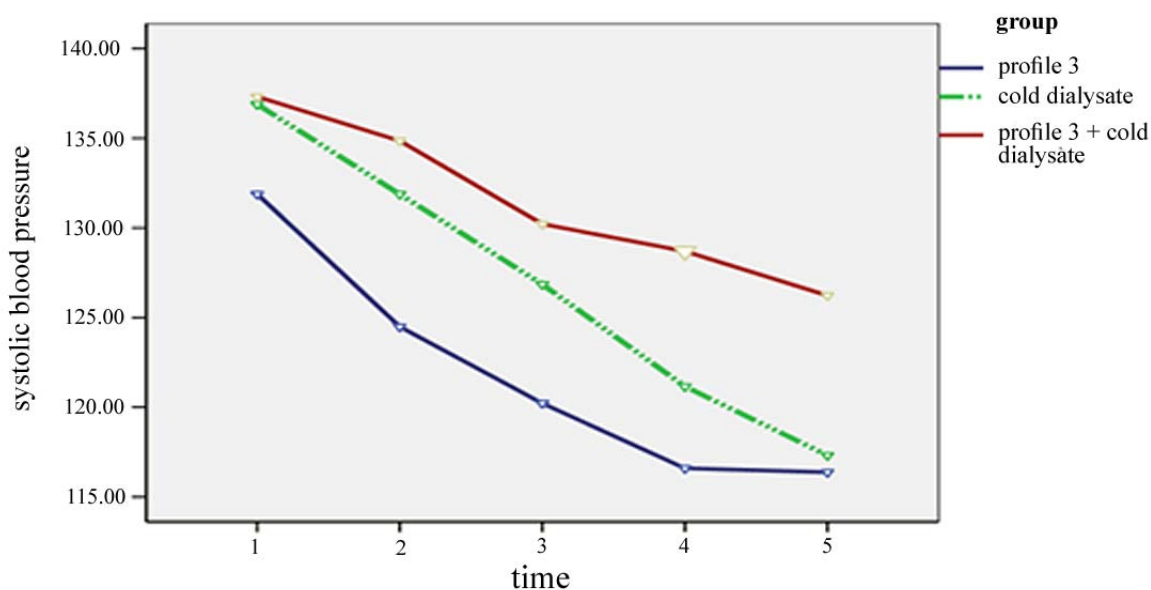


Figure 1. Frequent measurements of variance analysis showed that the mean systolic blood pressure did not show any significant difference before hemodialysis in three groups ($p = 0.07$) while the mean systolic blood pressure showed significant differences in the first, second and third hours and after dialysis ($p < 0.05$).

sodium and ultra filtration experienced the most changes in systolic blood pressure comparing two other methods (Figure 1).

The difference between systolic blood pressure changes was not significant between cold dialysate method and the profiles groups but this difference was significant between these two groups and the combination one.

Shahgholian et al. concluded that changes of systolic blood pressure while using sodium and ultra filtration profiles were less than control group.¹⁶ Frequent measurements of variance analysis showed that the mean of systolic blood pressure was significantly different in the first, second, third hours and before dialysis among three groups.

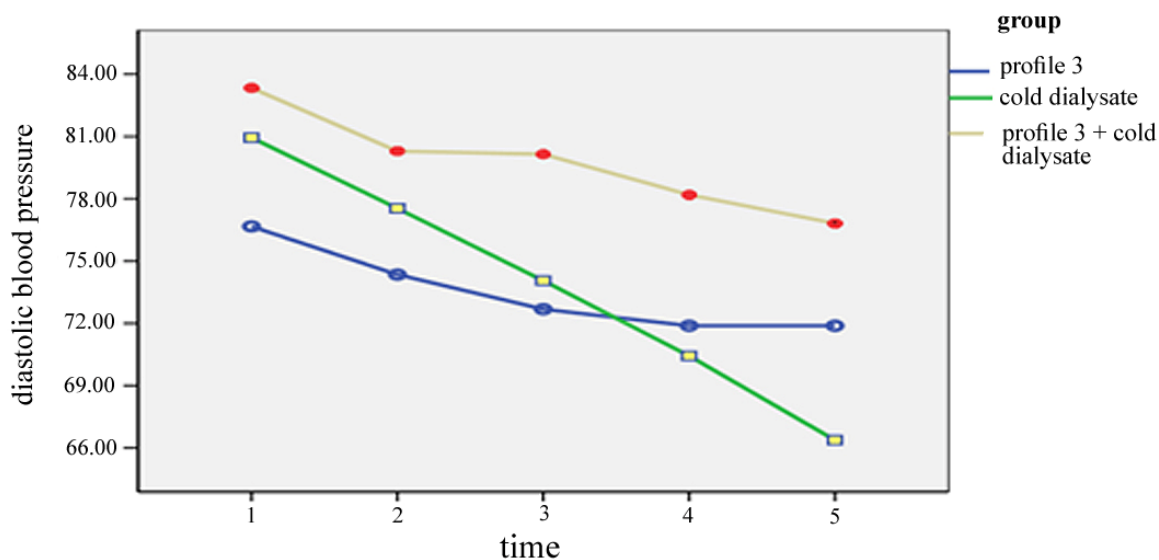


Figure 2. Frequent measurements of variance analysis showed that the mean diastolic blood pressure did not show any significant difference before dialysis, in the first, second and the third hours and after dialysis in three groups ($p = 0.02$).

Several study results including Shahgholian et al. and Moattari et al. agreed with this conclusion.^{3,16} Results showed that patients while using combination method had the least changes in the mean of diastolic blood pressure, cold dialysate group were in the second place and patients received sodium and ultra filtration experienced the most changes in diastolic

blood pressure (Figure 2). Therefore according to the results obtained from this study, it is recommended to use combination of sodium profile 3 and ultra filtration profile 3 and cold dialysate in patients suffered from hypotension during hemodialysis.

The authors declare no conflict of interest in this study.

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