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*Original Article*

# Impact of two types of sodium and ultra filtration profiles on Intradialytic hypotension in hemodialysis patients

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## Abstract

**BACKGROUND:** Intradialytic hypotension is the most common complication of haemodialysis (HD) and the main cause for patient's dissatisfaction. One of the new preventive methods for it is the use of sodium profile and ultrafiltration (UF) profile. This study was designed to evaluate the effect of two types of sodium and UF profile on intradialytic hypotension.

**METHODS:** In this cross-sectional study, 26 stable HD patients from two dialysis center in Isfahan city, underwent three treatments in 3 dialysis sessions: 1. control, constant dialysate sodium concentration of 138 mmol/l with constant UF; 2. linear sodium profile + UF profile (type 1), a linearly decreasing dialysate sodium concentration (138–146 mmol/l) combination with a linearly decreasing UF rate; and 3. stepwise sodium profile + UF profile (type 2), a stepwise decreasing dialysate sodium concentration (138–146 mmol/l) combination with a stepwise decreasing UF rate. Data were analyzed via SPSS-14 by using $\chi 2$ test.

**RESULTS:** In this study a total of 26 patients were participated with the mean age of 46.8 ± 19 years. In each group, 78 dialysis sessions and a total of 234 dialysis sessions were analyzed. The incidence of intradialytic hypotension was significantly reduced during two type of profiles compared with control ($p < 0.05$). But there was no significant difference between profiles ($p > 0.05$).

**DISCUSSION:** Sodium and UF profile is simple and cost effective methods that modulates the dialysate sodium and ultrafiltration rate, and preserve the homodynamic status of patients during dialysis. This method can reduce the incidence of intradialytic hypotension.

**KEY WORDS:** Intradialytic hypotension (IHD), sodium profile, ultrafiltration profile, hemodialysis patients (HD).

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Chronic Renal Failure (CRF) is a pathophysiologic process with multiple etiologies, that leads to the irreversible reduction of renal function and End Stage Renal Disease (ESRD). Life expectancy and avoiding from life-threatening complications in ESRD Patients depends on Renal Replacement Therapy (RRT), dialysis or transpalantation.[1]

Hemodialysis is a common treatment for ESRD worldwide.[2] Although, hemodialysis is a safe procedure, but it can cause some complications.[3] Intradialytic Hypotension (IDH) is a common complication during the dialysis[4,5] and occurs in 20-33% of hemodialysis patients,[6] although it has been reported in up to 50% of patients in some studies.[7] Intradialytic Hypotension is defined as decreases in systolic blood pressure more than 30% or decrease in diastolic pressure less than 60 mmHg. Absolute systolic blood pressure < 100 mmHg dur-

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ing dialysis IDH is characterized with muscle cramps, dizziness, nausea, vomiting, headache, weakness, blurred visionand fatigue during haemodialysis.[8, 9]

IDH widely increases the morbidity of dialysis.[10] Moreover it increases the need for nursing cares[11] and has negative effect on patients' quality of life.[12] Therefore, IHD preventing, is one of the main challenges for nursing staffs.[13]

One of the new preventive methods is the use of sodium profile and ultrafiltration (UF) profile. Sodium profile is mainly applied with a higher dialysate sodium concentration during the early period of the session, when the blood urea concentration and urea removal is high. This tends to reduce the inevitable decrease in plasma osmolality due to urea removal, reduce the resultant shift of fluids from the outside to the inside of the cell, and then avoid sodium accumulation with a lower-dialysate sodium concentration during the remainder of the dialysis session and remove the excessive sodium delivered during the early period. The benefit of this maneuver is that using of hypernatremic dialysate during the early period, facilitates fluids shifting from intercellular space to intravascular space, so decreases intradialytic complications such as IDH and other side effects.

Ultrafiltration (UF) profile is another maneuver for IHD prevention. UF profile is designed to extract the major part of the total UF volume in the first part of the session when the patient is overhydrated, to induce elevation of plasma oncotic pressure and to provide a greater driving force for vascular refilling, and it removes the lower amount of the total UF volume in the end part of the session. This maneuver prevents intradialytic hypotension.[14] Recent studies recommend UF profile for preventing of IDH.[15]

Since, sodium profile and UF profile do not apply for all the patients who experience intradialytic hypotension at hemodialysis centers in hospitals affiliated to Isfahan University of Medical Sciences, or these profiles are adjusted manually, some of the patients suffer from IDH. Moreover there is controversy about the safety and efficacy of these profiles, as a routine procedure according to the previous studies,[16] also no study in this field has been conducted in Iran. So this study was designed to evaluate and compare the effects of combination of linear decreasing sodium and linear decreasing ultrafiltration (UF) profile (profile 1), stepwise decreasing sodium and stepwise decreasing ultrafiltration (UF) profile (profile 3) and routine method (constant sodium dialysate and constant ultrafiltration) on intradialytic hypotension.

## Methods

This study was a prospective cross-sectional study. Twenty six HD patients were enrolled in this study according to the convenience sampling method. All patients were recruited from two dialysis centers (Ali Asghar and Al-Zahra Hospitals) of Isfahan University of Medical Sciences from April 2008 to June 2008.

Inclusion criteria were: age 18-75 years, ESRD, on hemodialysis, frequent episodes of hypotension (in more than 20% of sessions during the past month) during hemodialysis, three sessions of hemodialysis per week in more than three months, and hemodialysis with bicarbonate containing dialysate.

Exclusion criteris were: antihypertensive medications excessive food consumption befor hemodialysis, blood transfusion and albumin infusion during hemodialysis.

We used a two-part checklist for data collecting. Part 1 included demographic data such as age, gender, duration of hemodialysisand vascular access. Part 2 was related to dialysis process and included the time of beginning and ending of sessions, pre and post dialysis weight, blood pressure (predialysis, first hour, second hour, third hour, and postdialysis). This checklist was completed by researchers in each session.

For sampling, researchers extracted the contextual demographic data in patients' medical records and selected patients with IDH in > 20% of sessions during the past month. Informed consent was obtained from all patients.

**Hemodialysis methods:** The patients were randomly allocated to one of two sequences: sequence 1, control (routine). sodium + UF profile (type 1) sodium + UF profile (type 3); sequence 2. sodium + UF profile (type 3) + sodium + UF profile (type 1) control (routine). Patients were divided into two groups. Thirteen patients underwent sequence 1 and the other thirteen patients underwent sequence 2. There was no wash-out period between the three types of treatments.[9] It is notable that each patient was considered as his/her control in this study.

Each treatment was applied in 3 dialysis sessions. The following three different treatments were applied to the patients: (i) control, constant sodium concentration of 138 mmol/l with constant UF; (ii) linear sodium profile + linear UF profile (type 1), a linearly decreasing sodium concentration, the initial sodium concentration was always set at 146 mmol/l which resulted in the sodium concentration falling to 138 mmol/l at the end of dialysis, with linear decreasing UF; (iii) stepwise sodium profile + stepwise UF profile (type 2), a stepwise decreasing sodium concentration, the initial sodium concentration was always set at 146 mmol/l which resulted in the sodium concentration falling to 138 mmol/l at the end of dialysis, with stepwise decreasing UF.[9, 15]

All treatments were performed using FMC 4008S (Fresenius Medical Care AG, Bad Homberg, Germany) and polysulfone hollow-fibre dialyzer F5 (Fresenius Medical Care AG), bicarbonate buffered dialysate. Dialysate temperature was 37°C. Blood flow rate was individualized from 200 to 300 ml/min. Dialysate flow rate was 500 ml/min. FMC 4008S made it possible to apply automatically controlled UF and sodium concentration profiles. Patients' blood pressure was measured in supine position with mercury sphygmomanometer.[8]

We used a standard scale (Seca) for measuring patients' weight, and the scale was calibrated each session. For accurate measurement, the blood pressure of ten patients was measured by researcher and contributors, and then regression coefficient was calculated for these blood pressures. It was 0.93 between researcher and first contributor and 0.89 between researcher and second contributor. So the same standard mercury sphygmomanometer was used for blood pressure measurement in all patients. We used content validity for check list validity.

In this study, each patient was dialyzed for three methods and three sessions was analyzed in each method. So, 78 sessions were analyzed in each method and a total number of 234 sessions were analyzed in this study. Data were analyzed via SPSS-14 using $\chi^2$ test.

## Results

All 26 patients (14 mals and 12 females) completed the study. The mean age of the patients was 46.8 ± 19 years, and the mean duration of dialysis was 53 months. Vascular access of all patients was arteriovenous fistula. Diabetes mellitus was the etiology of ESRD in 34.5% of patients.

The results of this study showed that intradialytic hypotension was occurred at 44 sessions of 78 sessions in routine group, 17 sessions of 78 sessions in sodium + UF profile (type 1) group, and 14 sessions of 78 sessions in sodium + UF profile (type 3) group. $\chi^2$ test showed, the incidence of intradialytic hypotension was significantly reduced during the profile 1, compared with routine group ($p < 0.05$) ( Figure 1).

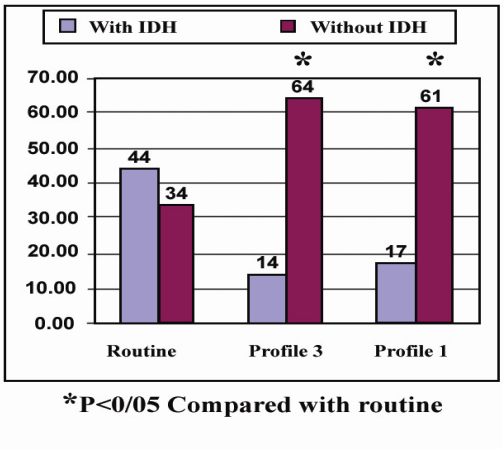


**Figure 1.** Frequency of the patients with or without intradialytic hypotension with the use of three treatments

Also, the results demonstrated that incidence of intradialytic hypotension was significantly reduced during the profile 3, compared with routine group ($p < 0.05$). The incidence of hypotension during the profile 1 was similar to the profile 3 ($p < 0.05$); although there was a trend towards decrease of incidence in profile 3.

## Discussion

Although hemodialysis is a safe and useful procedure and increases patients' life expectancy, it has some complications. Intradialytic hypotension is the main complication during hemodialysis.[3]

In this study, using of sodium + UF profile (type 1 and 3) decreased incidence of intradialytic hypotension and $\chi 2$ test showed significant differences between profile 1 and 3 compared with routine group, but there was no significant differences between profile 1 compared with profile 3.

Tang et al (2006) reported 62% reduction in the frequency of hypotension with the linearly decreasing sodium profile in 13 patients.[8]

Zhou et al (2006) evaluated the effect of Na + UF profile (profile 1) in 8 patients. The results of their study have showed a significant reduction of IDH in profile 1 group compared with conventional hemodialysis ($p < 0.05$). Intradialytic hypotension was occurred in 16 sessions of 80 sessions during conventional hemodialysis (control) while it was occurred in 7 sessions of 80 sessions during profiled hemodialysis. These researchers believe that using of sodium and ultrafiltration profiles changes the concentration of sodium dialysate and removal of fluids, so it improves the vascular refilling rate and increases dialysis tolerances in patients. Therefore, these methods prevent of IDH.[9]

Song et al (2005) reported that using of stepwise decreasing Na + UF profile (profile 3) in 11 patients have decreased the incidence of IDH. In this study, intradialytic complications was occured in 18 sessions of 33 sessions (54.5%) in control group and in 9 sessions of 33 sessions (27.3%) in profile group ($p < 0.05$).[12]

Al-Hillali et al (2005) evaluated the effect of combination of sodium and ultrafiltration profiles on intradialytic symptoms. The results of their study support our findings. In their study, intradialytic symptoms was reported in 29 patients (72.5%) before applying profiles, but these symptoms was reported in 21 patients (52.5%) after using profiles ($p < 0.05$).[15]

In conclusion, sodium and ultrafiltration profiles are simple and cost effective methods which improve the homodynamic stability with modulating the sodium dialysate and removal of fluids, so decreases the incidence of IDH. Therefore using of sodium and ultrafiltration profiles (profile 1 and profile 3) is recommended for IDH prevention.

The researchers declare that they had no conflict of interest in this study and it was done under the research ethics.

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