Test Your Knowledge: Optimal Sodium Bath for Hemodialysis

Fluid overload in patients undergoing hemodialysis (HD) contributes to cardiovascular morbidity, and is a major cause of hospitalizations. Does the dialysate sodium bath assist in fluid removal in the HD patient? A review by Mendoza et al in *AJKD* attempts to summarize the current evidence for individualized dialysate sodium prescriptions based on patients' volume status, co-morbid conditions, plasma sodium level, and hemodynamic response to dialysis therapy. The following questions based on the article will test your knowledge on this topic:

1. What is the most accurate technique to measure dialysate sodium to help assist in getting an accurate plasma sodium level during HD?
    A. Flame photometry
    B. Direct ion-selective electrode
    C. Indirect ion-selective electrode

2. Blood pressure control without use of antihypertensive medications in HD patient that was achieved in Tassin, France was done through all of the following interventions ***except***?
    A. Long dialysis therapy
    B. Dietary salt restrictions
    C. Dialysate sodium concentration of 135-138 mEq/L
    D. Restriction of dietary calories and protein

3. What is the concentration of dialysate sodium associated with highest IDWG (interdialytic weight gain) in the DOPPS (Dialysis Outcome and Practice Pattern Study) data?
    A. 138 mEq/L
    B. 140 mEq/L
    C. 142 mEq/L
    D. 145 mEq/L

4. Most studies done on low dialysate sodium, including recent ones by Arramreddy and Mendoza et al, have shown the most improvement in which of the following parameters?
    A. Interdialytic weight gain
    B. Intradialytic hypotension
    C. Pre-dialysis systolic blood pressure
    D. Post-dialysis blood pressure

Post Prepared by Jyotsana Thakkar, MD, Nephrology fellow, Hofstra NSLIJ School of Medicine, and Kenar D. Jhaveri, MD, AJKD Blog Editor.

Solutions to AJKD Blog's Test Your Knowledge: Optimal Sodium Bath for Hemodialysis

Based on Mendoza et al AJKD review

1. C: Two methods of ion-selective electrodes (ISE) are currently in use within clinical laboratories. In *direct* ISE methods, the specimen is brought to the electrode surface without dilution. In *indirect* ISE methods, the specimen is diluted with high ionic strength buffer in order to control activity coefficient and keep it virtually constant. Although the electrode will respond to the activity, when signal is transformed, indirect ISE yields a very accurate estimate of serum sodium. Sodium values for plasma water are 6% higher for indirect ISE than direct ISE because not all sodium in plasma in present in ionized form. As explained by Mendoza et al, with dialysis, the difference is compensated by the Gibbs-Donnan effect that occurs in HD because of negatively charged non-diffusable proteins trapped over the dialysis membrane attract and decrease the sodium by ~5%. Therefore, using the indirect ISE to measure dialysate sodium could provide a way to accurately assess the patient's plasma sodium.

2. D: In Tassin, France, longer HD session (5-8 h) three times a week has been practiced since 1968. In long dialysis, no diet restrictions were requested of patients except for sodium restriction. On the contrary, they are asked to eat a large amount of calories and proteins. Mean NaCl intake was 5-6 g per day, allowing for a reasonable interdialytic weight gain of 1.7 kg, i.e., less than 3% of average body weight. The dialysate sodium used was between 135-138 mmol/L. With longer duration of HD, dietary sodium restriction, and dialysate sodium prescription between 135-138, blood pressure control in patients was achieved without the use of antihypertensive medications.

3. C: The DOPPS (Dialysis Outcomes and Practice pattern) has shown that the prevalence of hypertension in HD patients is greatest in the US (83.2%), compared with Europe (72.7%) and Japan (55.9%) (Mendoza et al). A global study including almost 30,000 patients, DOPPS showed that dialysate sodium concentration 142 mEq/L was associated with the highest IDWG. IDWG increased by 0.17% of post-dialysis body weight per 2 mEq/L higher dialysate sodium concentration, independent of plasma sodium level. However, finding of this study showed high dialysate sodium was not associated with higher risk for hospitalization or death. The pathophysiology is nicely explained in Figure 2 of the article in *AJKD*. High dialysate sodium concentration leads to a high post-dialysis plasma sodium that stimulates thirst and water balance, leading to increased weight gain and hypertension.

4. A: Arramreddy et al described a series of 13 patients undergoing conventional, thrice-weekly in-center hemodialysis with an individualized dialysate Na^+ prescription. In this study, individualized dialysate Na^+ was achieved through a stepwise weekly reduction of the standard dialysate Na^+ prescription (140 mEq/L) by 2-3 mEq/L until reaching a Na^+ gradient of −2 mEq/L (dialysate Na^+ minus average plasma Na^+ over the preceding 3

months). When switched from the standard to the individualized dialysate Na^+ concentration, IDWG decreased. There was no significant change in the proportion of treatments with cramps, intradialytic hypotension (drop in SBP>30), or intradialytic hypotension requiring an intervention. Once individualized reduction of dialysate Na^+ was achieved, there was a reduction of IDWG without significantly increasing the frequency of cramps or hypotension. The study by Mendoza et al showed that when a similar strategy was used, there was a change in IDWG and pre-dialysis systolic blood pressure. No differences in pre-dialysis diastolic, mean arterial, or post-dialysis blood pressures were found in the intervention arm.