kidney and dialysis

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Opinion

Opinion on the (Hemo)dialysate Sodium Prescription: Dialysate Sodium Prescription Should Not Be Considered in Isolation

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Abstract: With advances in hemodialysis technology and the desire to achieve cardiovascular stability during dialysis, prescribed dialysate sodium concentration has gradually increased over the years. Short-term trials suggest low dialysate sodium (<138 mEq/L) is beneficial in reducing interdialytic weight gain, pre- and post-dialysis BP, and predialysis serum sodium; but it increases intradialytic hypotensive episodes. We believe dialysate sodium prescription cannot be considered in isolation. Our approach is to use patient symptoms, meticulous fluid volume management and low temperature dialysate in conjunction with neutral dialysate sodium in managing our dialysis patients. Long-term trials are needed to inform optimum dialysate sodium prescription.

Keywords: dialysate; sodium; hemodialysis; blood pressure; intradialytic hypotension; fluid volume

Citation: Ng, K.P.; Dasgupta, I. Opinion on the (Hemo)dialysate Sodium Prescription: Dialysate Sodium Prescription Should Not Be Considered in Isolation. *Kidney Dial.* **2021**, *1*, 154–156. https://doi.org/10.3390/kidneydial1020021

Academic Editors: Manfred Hecking, Peter Kotanko and Jochen G. Raimann

Received: 18 November 2021
Accepted: 30 November 2021
Published: 2 December 2021

In the past five decades, there has been a steady rise in prescribed dialysate sodium from the concentration of 126 mEq/L prescribed by Dr William Kolff to the current, most commonly prescribed fixed concentration of 140 mEq/L [1]. While the sodium setpoint might vary among individuals [2], it is useful to note that the average serum sodium among hemodialysis patients is 138 mEq/L [3]. The progressive paradigm shift to a higher dialysate sodium concentration is driven by both advances in hemodialysis technology and the desire to enhance cardiovascular stability during dialysis [1]. However, a fixed dialysate sodium concentration of 140 mEq/L has been shown to increase post-dialysis sodium by 2.3 ± 3.6 mEq/L [4] and lead to higher skin sodium storage [5]. Though convection plays a key role in sodium removal during dialysis [3], due to Gibbs–Donnan effect, ultrafiltrate is hypotonic, and has less sodium activity than the source plasma water [4]. Hence, in order to achieve isonatric dialysis there should be minimal blood–dialysate sodium gradient [6].

A recent Cochrane review of twelve mainly short-term randomized controlled trials found that low dialysate sodium (<138 mEq/L) reduced interdialytic weight gain (−0.35 kg, 95% CI −0.18 to −0.51), pre-dialysis and post-dialysis mean arterial blood pressure and antihypertensive medication, but increased intradialytic hypotension events (risk ratio [RR] 1.56, 95% 1.17–2.07) and intradialytic cramps when compared to neutral (138–140 mEq/L) or high dialysate sodium (>140 mEq/L). There was no effect on intradialytic or interdialytic blood pressure and dietary salt intake [7]. Similarly, individualized dialysate sodium concentration to match to patients' average pre-dialysis plasma sodium has shown to reduce interdialytic weight gain and blood pressure in small, short-term cohort studies [8–11].

Without long-term studies examining patient reported outcomes, cardiovascular morbidities and mortality, it is difficult to justify the blanket use of lower dialysate sodium for the prevalent hemodialysis population. Nevertheless, it is not unreasonable to aim for neutral sodium balance and avoid net sodium gain. While a precise individualized approach, aligning dialysate sodium level to each person's 'osmolar set point' might not be a feasible for most hemodialysis facilities; attentive dialysate sodium prescription could be made for selected groups of patients.

Blood pressure and volume management in hemodialysis populations requires multiple clinical considerations which are interlinked [12]. Intradialytic hypotension and dialysis discomfort symptoms are often due to excessive ultrafiltration and should prompt relevant clinical assessment to guide target weight review and hemodialysis prescription. On the other hand, over-hydration which results in persistent hypertension, cardiac remodeling and symptoms of fluid overload, can often improve with a reduction in target weight [13]. Therefore, the fundamental value of target weight establishment cannot be over-emphasized within the context of determining the optimal dialysate sodium concentration.

In addition to regular assessment of appropriate target weight and the use of lower temperature dialysate (36 °C) [14], our approach is to set a maximum dialysate sodium concentration of 138 mEq/L; except for patients who have recurrent intradialytic hypotension or dialysis discomfort despite optimization of their target weight, ultrafiltration rate, and lowering of the dialysate temperature to 35 °C. For such patients, judicious gradual increment of dialysate sodium up to a concentration of 142 mEq/L, may be considered with careful monitoring of response to treatment and interdialytic weight gain. Conversely, for those who are struggling to adhere to salt and fluid restrictions, with high persistent interdialytic weight gain or chronic hypertension, we aim to gradually reduce the dialysate sodium down to a concentration of 136 mEq/L and cautiously observe for any intradialytic hypotension or symptoms.

We believe prescription and adjustment of dialysate sodium should not be considered in isolation. Restoring fluid and sodium balance while achieving 'adequate' dialysis clearance are the key clinical aims of each hemodialysis session. With the increasing use of technologies such as biofeedback software systems to individualize dialysate sodium prescription, and bio-impedance spectroscopy or lung water ultrasound for fluid volume assessment, we are likely to see further advances in the near future which will help to fine-tune not only dialysate sodium concentration, but multiple aspects of dialysis prescription, with the ultimate aim of positively improving patients' experience and outcomes. Until then, taking note of patient-reported symptoms, diligent regular fluid volume assessment, judicious use of low temperature dialysis, and shared-decision making should remain the foundations which guide dialysate sodium prescription while we await long-term outcome data on this understudied topic.

Author Contributions: Both K.P.N. and I.D. drafted, critically reviewed. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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