

## ARTICLE OF THE MONTH

Verbeek TA, Saner FH, Bezinover D. Hyponatremia and Liver Transplantation: A Narrative Review. *Journal of cardiothoracic and vascular anesthesia* 2022;36(5):1458-1466. DOI: <https://doi.org/10.1053/j.jvca.2021.05.027>.

### Abstract:

Hyponatremia is a common electrolyte disorder in patients with end-stage liver disease (ESLD) and is associated with increased mortality on the liver transplantation (LT) waiting list. The impact of hyponatremia on outcomes after LT is unclear. Ninety-day and one-year mortality may be increased, but the data are conflicting. Hyponatremic patients have an increased rate of complications and longer hospital stays after transplant. Although rare, osmotic demyelination syndrome (ODS) is a feared complication after LT in the hyponatremic patient. The condition may occur when the serum sodium (sNa) concentration increases excessively during or after LT. This increase in sNa concentration correlates with the degree of preoperative hyponatremia, the amount of intraoperative blood loss, and the volume of intravenous fluid administration. The risk of developing ODS after LT can be mitigated by avoiding large perioperative increases in sNa concentration. This can be achieved through measures such as carefully increasing the sNa pretransplant, and by limiting the intravenous intra- and postoperative amounts of sodium infused. sNa concentrations should be monitored regularly throughout the entire perioperative period.

Comments made by Cale Kassel M.D., FASA

### Summary:

Anesthesiologists encounter hyponatremia in LT patients frequently. This review outlines the multiple factors that contribute to the development and management of hyponatremia.<sup>1</sup> While the risk of hyponatremia is well-known for patients on the waiting list, the effect on post-operative outcomes remains unclear. A few early studies on hyponatremia in LT showed increased 90-day mortality but more recent studies listed show no difference. However, some research does show increased ICU length of stay and morbidity. Of note, one study of over 40,000 patients did show increased mortality for patients with serum sodium less than 120 mmol/L indicating perhaps severe or profound hyponatremia may carry more risk.

Osmotic demyelination syndrome (ODS) is the biggest concern with rapid serum sodium correction. This potentially lethal condition can occur when serum sodium is increased more than 8 mmol/L in 24

hours. Incidence of ODS is 0.8-1.4% in LT patients compared to 0.6% in the general population and carries a higher risk of morbidity and mortality (77% for LT patients vs. 45% for non-LT patients).

Perioperative management of hyponatremia requires attention from the pre-operative evaluation through the post-operative period. While time is often limited pre-LT, there are a few options to increase serum sodium. Holding loop diuretics, free-water restriction, and high-concentration albumin (25%) can be used. Consulting with the nephrology team can be of great value as well.

Intra-operative management certainly can be challenging. Close monitoring is essential and understanding the sodium concentration of the fluids, medications, and blood products use can guide your treatment. The use of viscoelastic testing should be considered to limit the use of blood products such as plasma (with a sodium concentration of 172 mmol/L). The use of CRRT can typically uses a dialysate solution with 140 mmol/L of sodium so in patients with hyponatremia, discussion with the nephrologists is needed to explore ways to decrease sodium concentration. The authors cite a suggestion that adds sterile water (in predefined amounts) to create hyponatremic dialysate solutions.

Many solutions and blood products we administer contain significant sodium concentrations. The authors provide a great table with the recommended amount of D5W you can add to reduce the sodium concentration to 125 mmol/L. For example, a liter of normal saline would require the addition of 232 mL of D5W. In lieu of fresh frozen plasma or cryoprecipitate, the use of factor concentrates can help improve the coagulation profile without significant increases in sodium concentration.

Post-operatively, continued monitoring is important as the fluid shifts can continue despite the new graft. Again, limiting the increase of serum sodium to less than 4-6 mmol/L per 24 hours is important as is monitoring for signs of ODS.

Overall, this review was a great summary of the current state of knowledge while also providing several useful clinical suggestions for anesthesiologists.

## **References:**

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<sup>1</sup> Verbeek TA, Saner FH, Bezinover D. Hyponatremia and Liver Transplantation: A Narrative Review. *Journal of cardiothoracic and vascular anesthesia* 2022;36(5):1458-1466. DOI: <https://doi.org/10.1053/j.jvca.2021.05.027>.