Successful management & Early Recovery of a patient with Acute Liver Failure with timely Liver Transplant, aided by Peri-Operative monitoring of Optic Nerve Sheath Diameter and Early initiation of Renal replacement therapy – A Case Report
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A 32-year-old female patient was admitted in our hospital with a diagnosis of Hepatitis E induced acute liver failure. She was immediately intubated and mechanically ventilated due to a high grade of hepatic encephalopathy. ONSD measured on admission was suggestive of raised ICP. She was initiated on CRRT along with other anti-edema measures. She underwent LDLT on the third day of admission. ONSD was monitored at regular intervals to identify cerebral edema and CRRT was continued intra operatively with the aim of preventing cerebral edema. We were able to extubate the patient within 18 hours of the surgery. The patient had a fast post-operative recovery and we were able to discharge her on the 12th post-operative day.

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In the ICU acidosis was corrected overnight, isotopic support was weaned off, CRRT was discontinued since ONSD was within the normal range. She was extubated after 18 hours. Graft function improved satisfactorily, immunosuppression and antibiotics were continued as per protocol. She was shifted out of the ICU on post-operative day 5 and discharged on the 11th postoperative day. Her postoperative investigations are given in Table 2.

### Discussion

Prevention, early identification, and treatment of cerebral edema are of paramount importance in improving outcomes in acute liver failure. Traditional monitors of ICP carry a high risk of bleeding and infection. Raised ICP is transmitted to the optic sheath through the subarachnoid space. The mechanism is like the development of papilledema. However, unlike papilledema, the optic nerve sheath distention occurs within a matter of seconds which makes ONSD a valuable tool to diagnose acute elevations in ICP [5,10,11]. The largest study co-relating ONSD readings with simultaneous ICP measurements were performed by Rajajee et al [5] in 65 patients and demonstrated that an ONSD of > 0.48 cm corresponded to an ICP > 20 mm Hg.

In our patient an elevated ONSD on admission prompted us to initiate anti-edema measures in the form of CRRT, mannitol, hypertonic saline, etc immediately. Intraoperative ICH has also been demonstrated during OLT especially in the anhepatic phase and reperfusion even in patients who did not exhibit raised ICP pre-operatively [12]. Hence, we continued monitoring ONSD at hourly intervals during the intraoperative period as well and noticed a spike in ONSD measurements during the anhepatic phase and reperfusion.

Various forms of RRT have been used to treat inborn errors of metabolism in neonates and children. A recent review article on the treatment of liver failure proposed that ammonia clearance could be achieved by using conventional continuous hemofiltration, with higher rates of clearance.
correlating with higher rates of hemofiltration [14]. The authors cited a study by Slack et al. [15], who conducted one of the first studies evaluating Continuous venovenous hemodiafiltration (CVVHD) in adult patients with liver failure and hyperammonemia. In this prospective cohort study, the investigators examined that there was a meaningful decline in arterial ammonia concentrations with ultrafiltration. The low molecular weight and low plasma protein binding properties of ammonia make it more amenable to dialysis. Even though there isn’t any consensus as to when to initiate CRRT in ALF, we believe it should be implemented early in the progression to hyperammonemia and before the development of AKI, so that the concentration of ammonia will not rise to clinically significant levels. Surges in intracranial pressure could happen during the intraoperative phase also owing to the massive fluid and electrolyte shifts during liver transplantation. So, we decided to continue CRRT during the intraoperative phase too.

Conclusion
We were able to extubate the patient within 18 hours and discharge the patient on the 11th post-operative day. In our scenario use of ONSD pre-operatively & intra-operatively to identify raised ICP followed by rapid initiation of CRRT which was continued throughout the intra-operative period helped us in treating cerebral edema secondary to hyperammonemia perioperatively. We would like to point out that ONSD which has an easier learning curve might be a usual adjunct to non-invasively track cerebral edema in patients with acute liver failure...

References