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Abstract Categories: 20. M1) Extracorporeal dialysis: techniques and adequacy

Keywords: haemodialysis: technique, liver, calcium, haemodialysis: outcome

Title: Citrate Dialysate in Advanced Liver Failure

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INTRODUCTION AND AIMS: Citrate dialysate (CD) has been safely used for both acute and chronic dialysis. It has also been reported to be safe for use in both traditional intermittent and Slow Low Efficiency Diffusion Dialysis (SLEDD) in acutely ill patients. However, since the liver is a major site of citrate metabolism the safety of CD in liver failure patients needs to be evaluated. At University of Washington CD is routinely used for heparin free dialysis. The aim of this study was to assess the safety and efficacy of CD used for SLEDD in the presence of severe liver failure.

METHODS: CD was used in 23 patients (average age 53.6 $\pm$ 13.6 years, 14 male and 9 females) with advanced liver failure requiring heparin free SLEDD. The average pre-SLEDD INR and total bilirubin levels were 2.8 $\pm$ 1.2 and 26.3 $\pm$ 17.2 mg/dl, respectively. The patients underwent a total of 77 SLEDD treatments; the average blood and dialysate flows were 201 $\pm$ 70 and 269 $\pm$ 139 ml/min. (mean $\pm$ SD), respectively. The average duration of SLEDD was 9.5 $\pm$ 4.4 hours and ranged between 2 and 24 hours. Vascular access was through central venous catheters. Anion gap (increases with citrate accumulation) as well as the ratio of ionized calcium (iCa) to total calcium (tCa) were both used to assess the accumulation of citrate in blood; the latter has been reported to be a sensitive measure for citrate accumulation, the ratio declining as citrate increases.

RESULTS: Heparin free SLEDD was well tolerated by all patients and no complications related to CD were observed. Clot free treatments were completed for >4, >6, >8 and >12 hours for 98%, 94%, 64% and 25% of the treatments, respectively. Pre-SLEDD iCa and tCa and iCa to tCa ratios were 1.15 $\pm$ 0.13, 9.2 $\pm$

1.2 (mg/dl), and 0.12 ± 0.01, respectively and remained unchanged. Post-SLEDD values were 1.16 ± 1.1, 9.3 ± 1.1, and 0.12 ± 0.007, respectively (mean ± SD, p=ns). Similarly the anion gap decreased from pre-SLEDD to post-SLEDD, 14.8 to 12.6, respectively (p=0.007).

CONCLUSIONS: Long slow dialysis using CD was successfully completed in 94% of the treatments for at least 6 hours without clots despite using no heparin. CD used for extended SLEDD treatments of as long as 24 hours duration was safe without any evidence of citrate accumulation or development of hypocalcemia in hepatic failure. Thus CD in SLEDD is safe and effective in presence of severe liver dysfunction.