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THE IMPACT OF THE INTRAOPERATIVE ADMINISTRATION OF LACTATED RINGER'S SOLUTION ON SERUM POTASSIUM LEVELS DURING RENAL TRANPLANTATION

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Background: 0.9% NaCl (normal saline, NS) is administered for intraoperative fluid replacement in over 80% of centers performing renal transplantation in the United States.(1) The most commonly cited reason for the use of NS is the avoidance of intraoperative hyperkalemia that may theoretically occur with the administration of potassium (K^+) containing fluids such as lactated Ringer's solution (LR).(1) We are not aware of any published evidence to suggest that LR causes hyperkalemia in renal transplant recipients. We are currently conducting a prospective, randomized, double blind trial (N=200) of the effects of the intraoperative administration of NS and LR on postoperative graft function in renal transplant recipients. To optimize patient safety during this study, serum K^+ levels are measured at regular intervals during surgery. We present preliminary data regarding intraoperative serum K^+ levels from this ongoing study.

Methods: After IRB approval and written informed consent were obtained, 51 adult patients were randomized to receive NS or LR for intraoperative fluid therapy during living donor kidney transplantation. Patients with a serum K^+ level greater than 5.5 mEq/liter before commencement of surgery were excluded. Serum K^+ levels were recorded at 30 minute intervals intraoperatively. The clinicians caring for the patients were informed if the serum K^+ level exceeded 6.5 mEq/l. Treatment for hyperkalemia was at the discretion of the attending anesthesiologist caring for each patient.

Results: 3 patients were excluded from the study after randomization, prior to administration of study fluids, due to a K^+ level greater than 5.5 mEq/l. 48 patients completed the study. 23 patients received LR and 25 patients received NS. Patients in the NS group and the LR group received similar volumes of study fluid intraoperatively. There were no differences in preoperative, peak intraoperative or end of surgery serum K^+ levels between groups. In 5 patients in the NS group the K^+ level exceeded 6.0 mEq/l. In the LR group K^+ did not exceed 6.0 mEq/l in any patient. No patients in the LR group required treatment for intraoperative hyperkalemia while 5 patients in the NS group needed treatment (p=0.05) (Table 1).

Discussion: NS rather than LR is used for intraoperative intravenous fluid therapy in renal transplant recipients on the basis that K^+ containing fluids may cause hyperkalemia in these patients. According to these preliminary safety data from a prospective, randomized, double-blind clinical trial of NS and LR in renal transplant recipients, the administration of large volumes of LR was not associated with hyperkalemia. Furthermore, only patients who received NS required treatment for an elevated serum potassium level during surgery. We postulate that hyperkalemia secondary to NS administration may occur as a result of NS induced metabolic acidosis.

Conclusion: These preliminary data do not support the practice of the administration of NS rather than LR for the purpose of avoiding hyperkalemia during kidney transplantation. It should be recognized, however, that the study sample size is too small at this stage to absolutely rule out the possibility of hyperkalemia secondary to LR administration.

Table 1.

	LR (n=23)	NS (n=25)	p value
Age (years)	45 ± 11	44 ± 13	0.8
Sex (% male)	61	64	0.9
Total volume of study fluid administered (liters)	5.5 ± 1.4	6.1 ± 1.2	0.3
Preoperative K^+	4.5 ± 0.5	4.2 ± 0.7	0.2
Peak intraoperative K^+	5.1 ± 0.6	5.1 ± 1.1	0.8
End of surgery K^+	4.7 ± 0.5	4.6 ± 0.8	0.6
Peak intraoperative K^+> 6 mEq/l (n (%))	0 (0)	5 (20)	0.05
Treatment for intraoperative hyperkalemia (n (%))	0 (0)	5 (20)	0.05

Data are mean±SD unless otherwise stated.

1. O'Malley CMN, Frumento RJ, Bennett-Guerrero E. Intravenous Fluid Therapy in Renal Transplant Recipients: Results of a US Survey. Transplantation Proceedings 2002 *(in press)*.