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Hyperkalaemia in prevalent kidney transplant recipients

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Background:
Hyperkalaemia is a common and life-threatening medical emergency present in up to 10% of acute hospital admissions. End-stage Kidney Disease (ESKD) patients undergoing transplantation are at increased risk of hyperkalaemia, a potentially life-threatening medical emergency. Although the prevalence of hyperkalaemia in ESKD is well described, few studies have assessed the incidence and associations of hyperkalaemia in kidney transplant recipients. We evaluated post-transplant hyperkalaemia in a single centre using a large electronic health record dataset of emergency admissions.

Methods:
Prevalent kidney transplant recipients were identified using ICD-10 codes from a complete Electronic Health Records database of all emergency admissions to Addenbrooke's Hospital, Cambridge between April 2015 and August 2018. We abstracted demographics, comorbidities, concomitant medications, biochemistry results including all blood potassium values, in-hospital prescribing and admission and discharge dates. Data were summarised as frequency (%), mean ± standard deviation (SD) or median with interquartile range (IQR) as appropriate. Categorical variables were compared by Chi-squared test and continuous variables by Student's t-test or Mann–Whitney U-test based on their distribution. Factors associated with developing hyperkalaemia were explored using mixed-effects logistic regression and odds ratios (OR) are reported.

Results:
421 prevalent kidney transplant recipients were admitted a total of 1,065 times via the Emergency Department and a further 475 times direct to the Transplant ward. 324 (77%) were deceased-donor recipients with 83 (20%) living-donor recipients and 14 (3%) simultaneous pancreas kidney (SPK) recipients. Median age of admitted recipients was 56 (IQR 44-65) years and 87% were of white ethnic origin. Mean serum potassium was 4.56±0.72 mmol/L compared to 4.21±0.61 mmol/L amongst the 170,913 non-kidney transplant patients admitted over the same time period (p<0.001). 376 (89%) recipients were prescribed a calcineurin inhibitor.
Hyperkalaemia >5.5mmol/L occurred in 282 (67%) of 421 prevalent kidney transplant recipients with 203 (48%) patients including all SPK recipients experiencing moderate-severe hyperkalaemia (K >=6.0mmol/L). Of these, 110 (39%) received emergency treatment with insulin/dextrose. Potassium concentration immediately (≤ 60 min) pre-treatment was 6.26±0.76 mmol/L. The mean reduction in potassium at 4-hours post treatment was 0.89±0.90 mmol/L. Twenty-five of 110 (23%) patients developed hypoglycaemia (glucose <4mmol/L) within 6 hours of treatment and 37/110 (34%) required retreatment with insulin/dextrose within 24 hours.
Kidney transplant recipients were at significantly increased risk of developing hyperkalaemia (OR 19.8, 95% Confidence Interval (CI) 16.2-24.4, p<0.001) compared with all admitted patients and this risk persisted after adjustment for age, sex and co-morbidity (OR 3.6, 2.9-4.5, p<0.001). Associations with hyperkalaemia amongst transplant recipients included receiving a deceased-donor kidney (OR 1.96, 1.13-3.40, p=0.017) and exposure to beta-blockers (OR 2.26, 1.36-3.59, p=0.001) and calcineurin inhibitors (OR 6.39, 2.81-14.5, p<0.001).

Conclusion:

Kidney transplant recipients are at greatly increased risk of developing hyperkalaemia. Recipients who become hyperkalaemic are more likely to have received a deceased-donor transplant and be prescribed beta-blockers and calcineurin inhibitors than those who do not. Insulin/dextrose for hyperkalaemia is associated with hypoglycaemia in almost 1 in 4 recipients treated and re-treatment is required in one third of recipients.