One-third of diabetes patients with hyperkalaemia during acute admission have renin-aldosterone angiotensin system (RAAS) antagonists discontinued by hospital discharge

Hugh Logan Ellis[1], Claire Sharpe[1], Philip Kelly[1], Mohammad Al-Agil[1], Anthony Shek[2], James Teo[1], Martin Whyte[1]

[1] King's College Hospital, London UK
[2] King's College London, London UK

King's College Hospital NHS Foundation Trust

Introduction & Methods

Antagonists of the Renin-Angiotension-Aldosterone system may cause hyperkalaemia & are often stopped on admission to hospital.

We analysed (acute) admission & discharge prescriptions for RAAS & β-blocker use, across eGFR thresholds (with & without hyperkalaemia) of patients with diabetes. We determined proportions of drugs stopped or reduced by discharge.

Data used was from 1st Janurary 2017 to 31st January 2020. Inclusion criteria: electronic record of medication at admission & discharge, potassium & age >15. Total daily dose of cardioprotective medication was compared between admission & discharge. Peak potassium of each admission was identified. Frailty was determined by Fi-Lab; by calcuating the proportion of 26 common laboratory blood tests which were out of reference ranges per patient.

Binomial regression was used to evaluate the odds ratio of medication cessation or reduction by known risk factors (standardised prior to model creation) (**Figure 1**).

Results

In 37 months, there were 434,244 visits by 250,307 unique patients to the Emergency department. Of these, 175,374 had at least one blood test & were >15 years old. The characteristics of these patients are shown in **Table 1**.

Table 1

Characteristic	Overall, N = 175,374[1]	FALSE, N = 163,706[1]	TRUE, N = 11,668[1]
Age	49 (21)	47 (20)	68 (16)
Gender			
Female	93,797 (53%)	88,168 (54%)	5,629 (48%)
Male	81,550 (47%)	75,511 (46%)	6,039 (52%)
Unrecorded	27 (<0.1%)	27 (<0.1%)	0 (0%)
Filab	23 (15, 34)	21 (14, 31)	34 (24, 44)
First Potassium (mmol/l)	4.24 (0.52)	4.22 (0.49)	4.41 (0.69)
Admission eGFR mls/min/1.73m^2	82 (63, 90)	84 (66, 90)	59 (39, 81)
Max Potassium (mmol/l)	4.39 (0.59)	4.34 (0.53)	4.77 (0.78)
Drug History complete	39,650 (23%)	27,982 (17%)	11,668 (100%)
Length of Stay (days)	0.2 (0.1, 1.3)	0.2 (0.1, 0.8)	5.3 (2.5, 12.6)
Diabetic	27,937 (16%)	16,269 (9.9%)	11,668 (100%)
Prescribed ACEi on admission	7,370 (17%)	4,009 (13%)	3,361 (29%)
Prescribed ARB on admission	3,337 (7.7%)	1,724 (5.4%)	1,613 (14%)
Prescribed Mineralocorticoid Receptor Antagonist on admission	1,363 (3.1%)	823 (2.6%)	540 (4.6%)
Prescribed β-Blocker on admission	8,374 (19%)	4,782 (15%)	3,592 (31%)

[1] Mean (SD); n (%); Median (IQR)

Table 2

Max K+	n	% ACEi[1] on Admit	% ACEi[1] Ceased	% ARB[1] on Admit	% ARB[1] Ceased	% MRA[1] on Admit	% MRA[1] Ceased	% β Blocker on Admit	% β Blocker Ceased
<15 mls/min/1.73m^2									
≤5mmol/l	265	19	44	12	52	5	38	51	19
>5mmol/l	566	26	47	16	43	4	50	52	20
15-29 mls/min/1.73m^2									
≤5mmol/l	558	25	41	19	37	5	29	41	15
>5mmol/l	577	24	57	18	55	8	62	42	20
30-44 mls/min/1.73m^2									
≤5mmol/l	1162	33	29	19	29	5	40	38	15
>5mmol/l	693	33	45	17	37	8	43	41	18
45-59 mls/min/1.73m^2									
≤5mmol/l	1674	31	22	17	23	4	20	32	13
>5mmol/l	553	38	26	16	38	7	48	36	18
>60 mls/min/1.73m^2									
≤5mmol/l	4732	27	20	11	23	3	20	23	13
>5mmol/l	864	30	25	9	32	6	24	24	10
Missing									
≤5mmol/l	21	0	NA	0	NA	0	NA	0	NA
>5mmol/l	3	0	NA	0	NA	0	NA	0	NA

[1] ACEi = Angiotensin-Converting Enzyme inhibitor, ARB = Angiotensin Receptor Blocker, MRA= Mineralocorticoid Receptor Antagonist

Table 2 Shows the proportion of patients prescribed each class of medication on admission, and of those the proportion whose medication was ceased and not restarted by discharge.

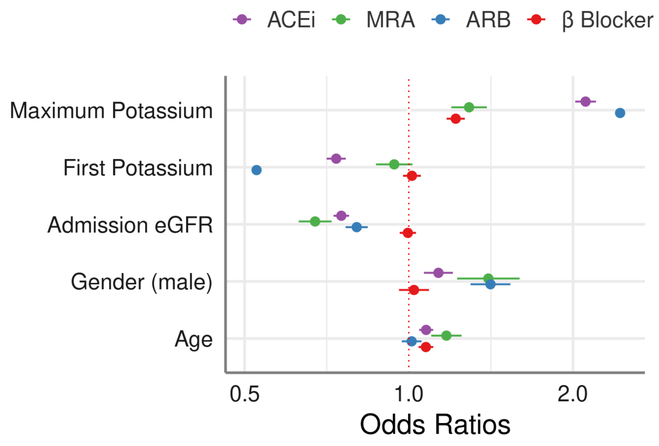

Figure 1: Forest Plot of Binomial models

Figure 1 plots the OR for the risk factors we evaluated. High maximum potassium & age, & low eGFR & admission potassium were associated with dose reduction.

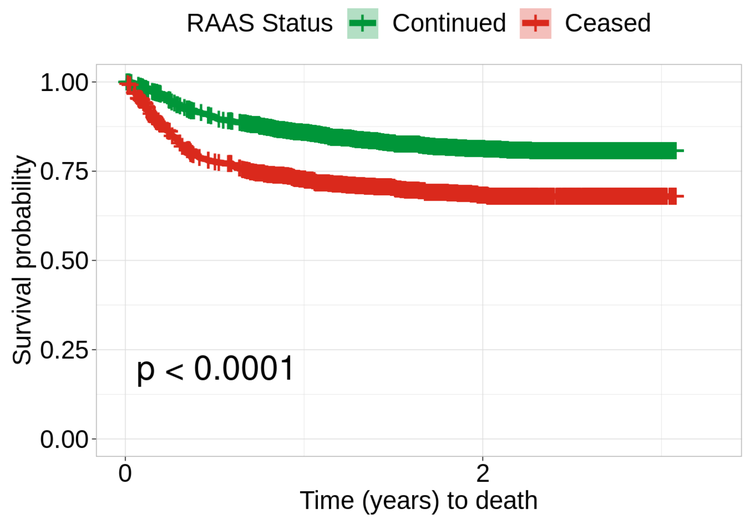

Figure 2: Kaplan Meier Plot of deaths following discharge

Figure 2 is a Kaplan Meier plot showing a significantly increased risk of death in patients who had RAAS antagonists ceased at hospital discharge.

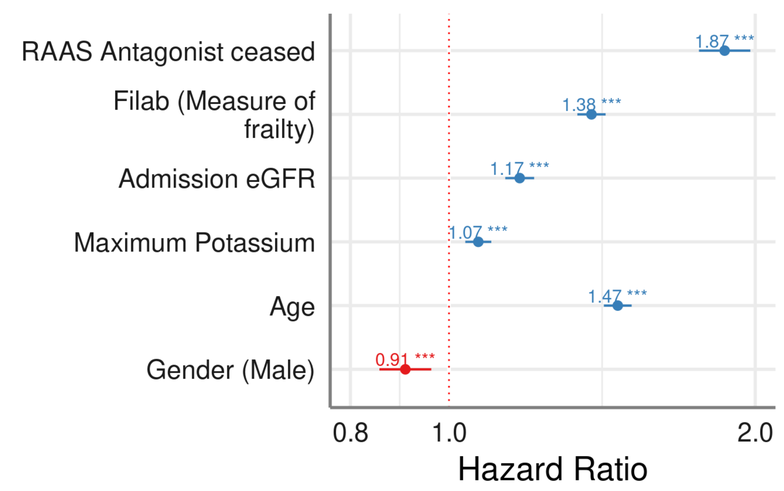

Figure 3: Forest Plot of Cox Proportional Hazards model for death following discharge

Cessation of RAAS antagonists was associated with increased hazard of death when included in a multivariate cox model (covariates scaled prior to analysis).

Conclusion

Hyperkalaemia is independently associated with reduction &/or discontinuation of RAAS drugs for acutely hospitalised patients with diabetes. Patients with diabetes who have RAAS inhibitors ceased at discharge had a greater hazard of death over the subsequent 2 years, even when controlling for possible confounding covariates.