Auditing the performance of RCPath critical communication guidance on potassium results ≥6.5 mmol/L with an eGFR of ≥90 ml/min/1.73m²

Thomas G Morris[1], Ellen Bealing[2], Daniel Lundqvist[2], Sally Stock[2] & Mehdi Mirzazadeh[3]

1. Blood Sciences, South West London Pathology, Epsom and St Helier University Hospitals NHS Trust, London   2. Clinical Biochemistry, East Kent Hospitals University NHS Foundation Trust, Kent 3. Chemical Pathology, Epsom and St Helier University Hospitals NHS Trust, London

Introduction

Hyperkalaemia is a potentially life-threatening disorder that can require immediate medical intervention. Common causes of true hyperkalaemia are impaired renal function and the redistribution of potassium. Another common cause that cannot be overlooked is pseudohyperkalaemia, which is an *in vitro* increase in potassium. Pseudohyperkalaemia is seen with haemolysis, blood cell dyscrasias, EDTA contamination, delay in sample processing and seasonal cold temperatures. The distinction between true and pseudohyperkalaemia is critical and especially important for GP samples in order to avoid unnecessary patient distress, out-of-hours phone calls and emergency department admission.

Aims of the audit

The Royal College of Pathologists (RCPath) guidance states that all potassium results ≥6.5 mmol/L should be communicated to primary care within 2 hours of the result becoming available, including out-of-hours, when common causes of pseudohyperkalaemia have been ruled-out (haemolysis, EDTA and old samples)[1].

Our aim was to investigate if this is appropriate for GP samples with an eGFR of ≥90 ml/min/1.73m², as anecdotally, the results are more likely to be pseudohyperkalaemia, rather than true hyperkalaemia[2].

Methods

All GP potassium results ≥6.5 mmol/L from adults (>18 year old) over a 12 month period were extracted from 2 NHS Trusts. For the entry to be included in the dataset a repeat potassium had to have been taken within 7 days of the original sample.

The results were then classified as below:
- Repeat outside the reference interval (>5.3 mmol/L) – **True hyperkalaemia**
- Repeat within the reference interval (≤5.3 mmol/L) – **Pseudohyperkalaemia**

If the initial potassium results was accompanied by a full blood count (FBC), it was classified as 'normal' if the white cell count was ≤50 x 10^9/L, platelets ≤500 x 10^9/L and haemoglobin ≤145 g/L if female or ≤170 g/L if male.

Demographic data

Table 1. Patient demographic data for all entries included in the final dataset. When only patients with a 'normal' FBC were included, 65 entries were classed as true hyperkalaemia and 53 as pseudohyperkalaemia.

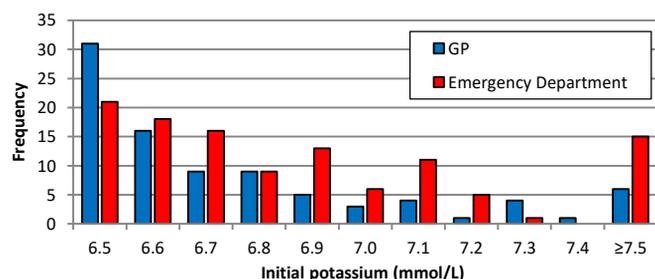|	True hyperkalaemia	Pseudohyperkalaemia
Incidence	107	100
Sex distribution		
Male	69	50
Female	38	50
Pearson's Chi squared test	*p* = 0.03514	
Age distribution		
Median (95% CI)	75.0 (73.0-80.0)	68.0 (63.0-72.0)
Interquartile range	69.0-84.8	54.0-78.6
Shapiro-Wilk p value	0.024	0.056
Mann-Whitney U test	*p* = <0.0001	

Figure 2. Location of repeat potassium. Of the 207 potassium ≥6.5 mmol/L, 89 had a repeat sample taken via a GP request and 115 by attending an emergency department.
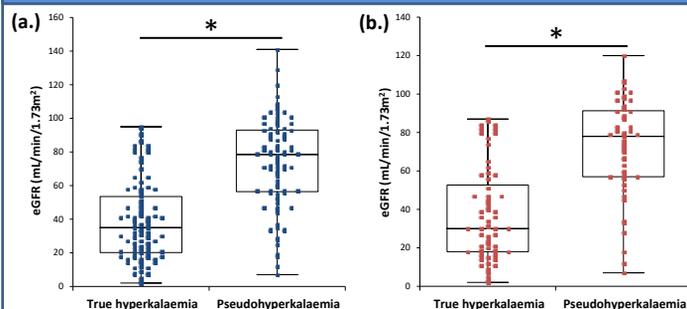
Results

Figure 2. eGFR distribution and ROC curves in patients classified as true hyperkalaemia or pseudohyperkalaemia. eGFR distribution in **(a.)** All results (blue dots) & **(b.)** 'normal' FBC results (red dots). * indicates a statistically significant difference, *p* = <0.05. **(c.)** eGFR ROC curves for all results (blue triangles) and 'normal' FBC results (red squares). Area under the curves were 0.83 (95% CI: 0.76-0.91) and 0.83 (95% CI: 0.77-0.88), respectively, with no significant difference between the curves.
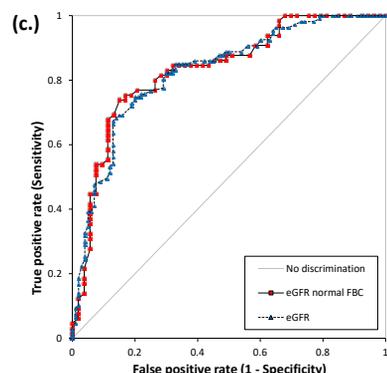
Table 2. Performance of the eGFR in classifying true and pseudohyperkalaemia

All results

eGFR (ml/min/1.73m²)	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
15	13.1% (7.3-21.0%)	98.0% (93.0-99.8%)	87.5% (62.0-96.8%)	51.3% (49.3-53.3%)
30	41.1% (31.7-51.1%)	93.0% (86.1-97.4%)	86.3% (74.8-93.0%)	59.6% (55.5-63.6%)
45	68.2% (58.5-76.9%)	86.0% (77.6-92.1%)	83.9% (75.9-89.6%)	71.7% (65.5-77.2%)
60	82.2% (73.7-89.0%)	70.0% (60.0-78.8%)	74.6% (68.2-80.0%)	78.7% (70.6-85.0%)
90	96.3% (90.7-99.0%)	31.0% (22.1-41.0%)	59.9% (56.6-63.1%)	88.6% (73.9-95.5%)

'Normal' FBC results

eGFR (ml/min/1.73m²)	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
15	16.9% (8.8-28.3%)	96.2% (87.0-99.5%)	84.6% (56.0-96.0%)	48.6% (45.5-51.6%)
30	44.6% (32.3-57.5%)	92.5% (81.8-97.9%)	87.9% (73.1-95.1%)	57.7% (51.9-63.2%)
45	67.7% (55.0-78.8%)	88.7% (77.0-95.7%)	88.0% (77.2-94.1%)	69.1% (60.9-76.3%)
60	81.5% (70.0-90.1%)	71.7% (57.7-83.2%)	77.9% (69.4-84.6%)	76.0% (64.9-84.4%)
90	100.0% (94.5-100.0%)	28.3% (16.8-42.4%)	63.1% (59.1-67.0%)	100.0%

Conclusions

- ~50% of results ≥6.5 mmol/L were classified pseudohyperkalaemia.
- For a potassium results ≥6.5 mmol/L, approximately 55% of patients went to an emergency department for a repeat sample.
- For those with a normal FBC, not a single patient with a potassium of ≥6.5 mmol/L and an eGFR of ≥90 ml/min/1.73m² was classified as having true hyperkalaemia.

Recommendation

We suggest that when a potassium of ≥6.5 mmol/L is encountered out-of-hours with an eGFR of ≥90 ml/min/1.73m² and a normal FBC, it should not be phoned urgently. Instead, we propose that is should be phoned within normal working hours. This will avoid unnecessary phone calls to out-of-hours services and reduce the number of patients attending emergency departments with pseudohyperkalaemia. However, before this can be implemented, further data will be required to corroborate our findings.

References: 1. The Royal College of Pathologists – The communication of critical and unexpected pathology results (2017).   2.Smelie WS (2007). Spurious hyperkalaemia. *BMJ.* **334,** 693-695.