Assessment of laboratory handling of low level haemolysis interference in cases of hypokalaemia

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Introduction

Potassium is one of the most frequently measured Clinical Biochemistry analytes and is also one of the analytes whose measurement is most severely impacted by haemolysis. Abnormal potassium results are life threatening and require urgent action – however the artefactual elevation in potassium in a haemolysed sample may mask low potassium (hypokalaemia). The Royal College of Pathologists recommends taking urgent action when potassium concentration is lower than 2.5 mmol/L.

The UK NEQAS for Serum Indices EQA Scheme assesses the measurement of Haemolytic (H), Icteric (I) and Lipaemic (L) indices. There are over 700 participants currently in the scheme. Participants are also asked to report the concentration of a particular analyte that varies with each distribution, which we call "Analyte X", and asked whether they would report the result when the HIL indices are taken into consideration. In Distribution 177 (September 2023), Analyte X was potassium. By gathering data from participants about their handling of low potassium results in haemolysed samples, Birmingham Quality can drive improvement by helping laboratories to become more consistent in their practice.

Methods

Three pools of human serum - from a base pool with a potassium concentration of 2.4 mmol/L - were spiked with haemolysate to produce haemoglobin concentrations of 0.6 g/L, 0.8 g/L and 1.0 g/L. These were distributed to participants in the UK NEQAS for Serum Indices EQA scheme in Distribution 177 as specimens 177A, 177B and 177C respectively. Participants were required to analyse the specimens for HIL indices and for potassium. They were also asked as to whether they would report potassium based on the indices results and, finally, answer questions relating to the source of HIL cut-offs in their laboratory, and actions that they would take based on the results.

Results

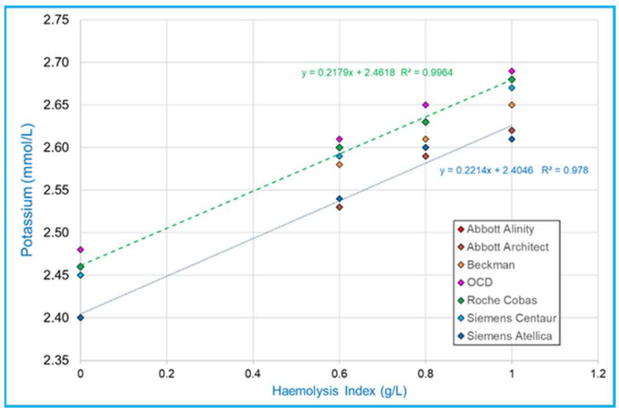

Figure 1. Increase in potassium concentration with increasing haemolysis

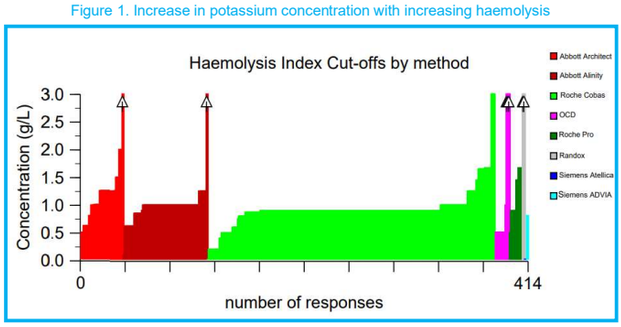

Figure 2. Haemolysis Index Cut-off values for Potassium by method.

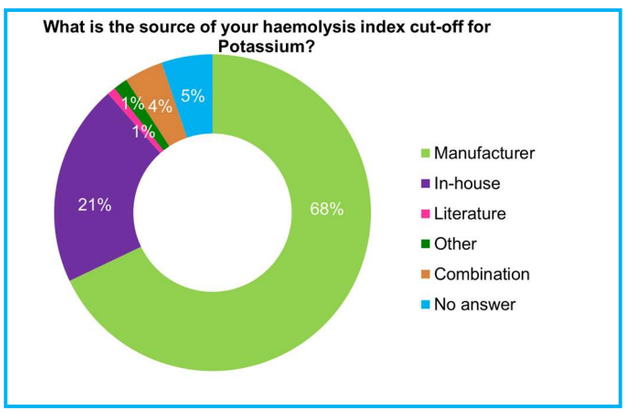

Figure 3: Sources of haemolysis index cut-offs.

Potassium concentrations increased as the base pool became more haemolysed (figure 1). The H index cut-offs used by laboratories for taking action on potassium results based on haemolysis interference varied widely, even among participants using the same manufacturer (figure 2). At a mean H index of 0.97 g/L, 48% of participants would not have reported the potassium result.

The response rate to the Q&A was 68% of participants in the scheme. The majority of these use their manufacturer's recommended H index cut-off for potassium (figure 3). For those using cut-offs that had not been derived in their own laboratory, only 21% of respondents had verified them.

With regard to action taken on potassium results when the Haemolysis cut-off is exceeded:

- 72% of respondents would not report the result
- 12% would report the result, but comment on the degree of haemolysis and likely falsely elevated potassium concentration
- 12% stated that the action they would take would depend on either the degree of haemolysis, or the potassium concentration – some reported the result with a comment when potassium concentration was low
- 3% would report all potassium results without comment.

Participants were asked if their rules differed depending on the requesting location. A frequently received answer to this question was in Paediatric and Neonatal patients. Other responses received included Endocrinology, Nephrology and results from Primary Care.

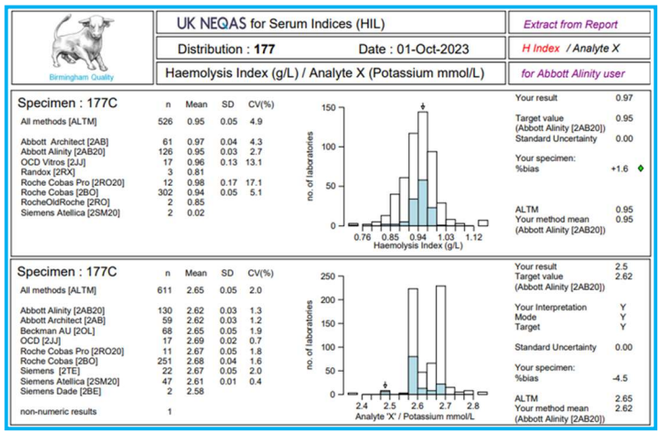

Figure 4: Results for specimen 177C for Haemolysis Index and potassium.

Conclusions

Practice around the handling of potassium results in haemolysed samples varies widely among participants in the UK NEQAS for Serum Indices scheme, both in the action that laboratories take, and in the H index cut-offs used. This has a particularly significant impact at lower potassium concentrations, where haemolysis may mask hypokalaemia – where potassium is low, in a haemolysed sample, the true result is likely to be even lower. Hypokalaemia can lead to sudden cardiac death if not treated, therefore not reporting a result or waiting for confirmation on a repeat sample could cause delays in the treatment of patients with hypokalaemia, which is significant risk.

It is interesting that some participants had specific rules for neonatal and paediatric patients. Venepuncture is more difficult in this patient group for a variety of reasons - blood samples are more likely to be haemolysed, but repeat collection is avoided wherever possible. Therefore, results are often reported with comments regarding the degree of haemolysis.

It is clear that participants struggle to verify their HIL cut-offs because of the scale of the work involved. By collecting data from the large participant base routinely as part of scheme participation, Birmingham Quality aims to build a bank of cut-offs for different analytes, and assist our participants in doing this, thereby improving the quality of their laboratory results and with it, patient care.

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