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NHS Bolton NHS Foundation Trust

Detecting haemolysis with a new POCT blood gas analyser

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1. Introduction

Even moderate deviations above and below the potassium (K+) reference range can cause changes to cardiac rhythms. Therefore, abnormal results are monitored closely and treated promptly. The local K+ reference range for the blood gas analyser (BGA) is 3.5-5.1mmol/L.

Haemolysis is a common cause of falsely elevated K+ results from Point of Care Testing (POCT) BGAs. This can cause clinical confusion and patient safety incidents as falsely elevated K+ results may be inappropriately treated, may mask a genuine hypokalaemia or cause treatment delays as confirmatory laboratory samples are checked for haemolysis.

A new BGA, the Werfen GEM 7000, incorporates on-board haemolysis detection and was evaluated in the Emergency Department (ED) at Royal Bolton Hospital. A technical evaluation against the existing BGA and laboratory analyser system was undertaken. Feedback was also obtained from the ED Team on the perceived impact for patient safety and patient flow.

2. Methodology

The study used residual samples from routine analysis on the existing Werfen GEM 5000 in ED. There was no preselection of samples based on patient condition, acuity, sample types or Health Care Professionals (HCPs) drawing the samples.

83 samples routinely processed on an existing GEM 5000 in ED had sufficient sample remaining to process on the Werfen GEM 7000 co-located next to a GEM 5000. Of these 83 samples, 64 had sufficient residual sample for centrifugation, plasma extraction and analysis on the laboratory Roche cobas 8000 analyser for electrolytes and haemolysis.

3a. Results and Discussion

a) Haemolysis detection on the GEM 7000

The GEM7000 provides semi-quantitative assessment of haemolysis indices (HI): grossly, moderately, mildly and none.

From the 83 samples processed on the GEM 7000, 12 (14%) samples were flagged as haemolysed: 4 grossly, 2 moderately and 6 mildly.

The K+ values of the haemolysed samples, as measured on the GEM 7000 ranged from 4.5 to 11.9mmol/L. 10 samples had a clinically feasible K+ value with the possibility of inappropriate treatment pending a laboratory result.

HI	K+ (mmol/L)
Grossly	10.3
Grossly	11.9
Grossly	7.4
Grossly	7.3
Moderate	6.2
Moderate	6.9
Mildly	4.8
Mildly	4.5
Mildly	5.4
Mildly	5.0
Mildly	5.0
Mildly	4.5

3b-c. Results and Discussion

b) Haemolysis detection compared with Laboratory

In the local laboratory, samples are classed as haemolysed and K+ not reported when the HI is ≥90.

55/64 (86%) of the sample cohort were classed as not haemolysed on the GEM 7000. All produced a HI <90 on the laboratory analyser.

GEM 7000	Lab HI
Grossly	1016
Grossly	666
Mildly	187
None	137
Mildly	126
None	104
None	103
None	99
None	90

9/64 (14%) of the cohort produced a HI ≥90 on the laboratory analyser:

- 4 of the 9 samples were reported as haemolysed on the GEM 7000 (grossly or mildly).
- 5 of the 9 samples were reported as not haemolysed on the GEM 7000. These tended to be the more borderline HI values on the laboratory analyser.

The GEM 7000 exhibited excellent specificity but sensitivity less reliable. However, the haemolysis settings are customer definable so can be adjusted from those used in this evaluation.

c) Method comparisons

There was excellent agreement between all test parameters measured on the GEM 7000 compared with the GEM 5000 (pH, pCO2, pO2, Na+ , K+ , iCa2+, glucose and lactate) (same methodology/same sample type). There was also good agreement between test parameters measured on the GEM 7000 compared with the Roche cobas 8000 (Na+, K+, glucose and lactate) (different methodology/sample type).

4. ED Feedback

The GEM 7000 was positively received by ED staff. Some quotes received during the 5 day trial:

“that patient was easy to bleed, I really didn’t think the sample would be haemolysed”.

“we had a clinical incident earlier in the year which would have been avoided if we had this analyser then”.

“this will ensure we can treat high K+ promptly without waiting for a laboratory result”.

“we often have GP patient’s referred in due to anomalous K+ results – this will allow us to discharge these patients far more quickly”.

5. Conclusions

The GEM 7000 haemolysis detection is reliable, although local assessment of the customer definable ranges is recommended.

The GEM 7000 helps prevent inappropriate treatment/accelerates treatment of K+ anomalies so improving patient safety and patient flow. This additional functionality is valued by ED staff.

References

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