POCT Haemoglobin Measurement

Barbara De la Salle
Scheme Manager and Deputy Director
UK NEQAS General Haematology
‘Inappropriate or unnecessary transfusion’

All point of care testing devices for Hb estimation must be fully validated and internal quality control and participation in external quality assurance schemes must be ensured. (See also recommendation on page 74.) Currently this is not the case for calculated Hb estimates from blood gas analysers. A study to evaluate the utility of these devices for Hb measurement should be undertaken and guidance and recommendations issued.

**Action: NBTCs, NEQAS, SHOT**

Blood gas machines must not be used for Hb estimation unless they are designed and calibrated to produce accurate, reproducible results with external quality assessment in place. (See also recommendation on page 54.)

**Action: POCT teams, manufacturers**
UK NEQAS (H)

Lead centre for all aspects of General Haematology EQA

- Automated Counting Suite
- Blood & BM Morphology Suite
- Haemoglobinopathies Suite

- FULL BLOOD COUNT
- HAEMOGLOBIN ONLY
- AUTOMATED DIFFERENTIAL COUNTING
- RETICULOCYTE COUNT
To evaluate the performance of haemoglobin results obtained by blood gas analysers against:

- HemoCue instruments,
- Automated haematology analysers,
- ICSH reference haemoglobin method

To determine the feasibility of operating a pilot EQA scheme
Compared to the ICSH reference Hb method:

- Automated haematology analysers closest
- Blood gas analysers and HemoCue instruments overestimated Hb value by 1.8%- 3.9%
- Greatest variation in range of results returned was seen with the blood gas analysers
2011 Exercise: Specimen 1

ICSH Ref. Value

- blood gas analysers
- automated haem analyser
- HemoCue
Blood Gases – Radiometer ABL 700 Series

Radiometer ABL 700 blood gas analysers are situated in the Neonatal Medical Unit, SMH, Neonatal Surgical Unit, SMH and Accident & Emergency Department, MRI. Blood Gas (also known as Critical Care) analysers are one of the most sophisticated POCT instruments. The analysers measure blood levels of various combinations from pH, pCO2, pO2, standard bicarbonate, base excess, total haemoglobin, oxygen saturation, oxyhaemoglobin, carboxyhaemoglobin, deoxyhaemoglobin, methaemoglobin, sodium, potassium, ionised calcium, chloride, glucose, lactate and bilirubin, dependent on the clinical setting they are used in.

The analysers perform an automatic Quality Control check every six hours. All the analysers require a password which is issued to staff at training. Further information about training sessions can be accessed via the Training Sessions link below.
14% not registered in EQA for Hb
5% use no IQC for Hb
10% do not check abnormal results with the laboratory
20% don’t have a reference range for Hb
10% don’t have an SOP
40% don’t do background checks before analysis for Hb
2012 Pilot Exercises

- UK NEQAS (H) Hb only option established 2012
- Initially only open to HemoCue instruments
- 3 exercises opened to blood gas analysers on a pilot basis: Sept - Nov 2012
- 6 specimen pools distributed to 265 HemoCue 201 instruments and 140 blood gas analysers
- Referee values from automated analysers and ICSH reference Hb method
**HemoQue Analysers**

<table>
<thead>
<tr>
<th>Survey material pool</th>
<th>N</th>
<th>MEDIAN Hb (g/L)</th>
<th>SD'</th>
<th>CV%</th>
<th>RANGE (g/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1209HB1</td>
<td>262</td>
<td>63</td>
<td>1.483</td>
<td>2.4</td>
<td>51-144</td>
</tr>
<tr>
<td>1209HB2</td>
<td>262</td>
<td>139</td>
<td>2.965</td>
<td>2.1</td>
<td>60-166</td>
</tr>
<tr>
<td>1210HB1</td>
<td>262</td>
<td>59</td>
<td>0.741</td>
<td>1.3</td>
<td>54-129</td>
</tr>
<tr>
<td>1210HB2</td>
<td>262</td>
<td>128</td>
<td>2.224</td>
<td>1.7</td>
<td>54-166</td>
</tr>
<tr>
<td>1211HB1</td>
<td>253</td>
<td>63</td>
<td>1.483</td>
<td>2.4</td>
<td>59-72</td>
</tr>
<tr>
<td>1211HB2</td>
<td>253</td>
<td>81</td>
<td>1.483</td>
<td>1.8</td>
<td>72-92</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>1554</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Blood Gas Analysers**

<table>
<thead>
<tr>
<th>Survey material pool</th>
<th>N</th>
<th>MEDIAN Hb (g/L)</th>
<th>SD'</th>
<th>CV%</th>
<th>RANGE (g/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1209HB1</td>
<td>126</td>
<td>65</td>
<td>1.483</td>
<td>2.3</td>
<td>59-89</td>
</tr>
<tr>
<td>1209HB2</td>
<td>126</td>
<td>143</td>
<td>2.965</td>
<td>2.1</td>
<td>135-186</td>
</tr>
<tr>
<td>1210HB1</td>
<td>144</td>
<td>60</td>
<td>2.965</td>
<td>4.9</td>
<td>55-79</td>
</tr>
<tr>
<td>1210HB2</td>
<td>144</td>
<td>132</td>
<td>2.965</td>
<td>2.2</td>
<td>120-140</td>
</tr>
<tr>
<td>1211HB1</td>
<td>143</td>
<td>65</td>
<td>2.224</td>
<td>3.4</td>
<td>60-81</td>
</tr>
<tr>
<td>1211HB2</td>
<td>143</td>
<td>84</td>
<td>2.224</td>
<td>2.6</td>
<td>76-95</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>826</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 2012: Bias compared to referee value

<table>
<thead>
<tr>
<th>Survey material pool</th>
<th>HemoCue Group</th>
<th>Blood Gas Analyser Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1209HB1</td>
<td>-0.63%</td>
<td>2.52%</td>
</tr>
<tr>
<td>1209HB2</td>
<td>0.09%</td>
<td>2.97%</td>
</tr>
<tr>
<td>1210HB1</td>
<td>0.00%</td>
<td>1.69%</td>
</tr>
<tr>
<td>1210HB2</td>
<td>-0.39%</td>
<td>2.72%</td>
</tr>
<tr>
<td>1211HB1</td>
<td>0.00%</td>
<td>3.17%</td>
</tr>
<tr>
<td>1211HB2</td>
<td>0.00%</td>
<td>3.70%</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>-0.16%</strong></td>
<td><strong>2.80%</strong></td>
</tr>
</tbody>
</table>
Performance assessment 1

Performance limit of ±4% range of target

Blood Gas Analyser Group

HemoCue – 24/1554 (1.5%) >±10% of target
Blood Gas Analysers – 11/826 (1.3%) >±10% of target
Specimen 1209HB1

Target value with performance limits
Specimen 1210HB1

Target value with performance limits
Performance assessment 2

- Deviation Index (DI) – indicates distance of individual result from target
- More than $\pm 3$ DI is unsatisfactory

- HemoCue group
  - $61/1554$ results (3.9%) had a DI $> \pm 3$

- Blood Gas Analyser group
  - $15/826$ results (1.8%) had a DI $> \pm 3$
Conclusions

- The 3 2012 pilot exercises are consistent with the observations of the 2011 project
- BGA analyser performance may have improved – Influence of taking part in earlier exercises
- Blood gas analysers and HemoCue B/201 instruments provided clinically appropriate haemoglobin results
- Some results are very out of consensus – probably related to blunders in the use of instruments

“All NPT equipment must be fully quality assured for any test undertaken and all staff appropriately trained and competency assessed” (SHOT 2009)
“For (blood gas) analysers that use spectrophotometric/co-oximetry to measure Hb, results have been demonstrated to compare well with the laboratory*, but these instruments should only be used if there is appropriate IQC and EQA available.”

Further information

haem@ukneqas.org.uk