Letter to the Editor

Hyperleukocytosis: pseudohyperkalaemia and other biochemical abnormalities in hyperleukocytosis

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A 66-year-old woman, recently diagnosed with T cell prolymphocytic leukaemia (PLL) was admitted for cytotoxic therapy, with a potassium (K⁺) of 5.5 mmol/L on admission as measured on a lithium heparin plasma sample (Beckman DxC800; Beckman Coulter Diagnostics, Fullerton, CA, USA). The sample was analysed within 70 min of collection. The white blood cell count (WBC) was 460 x 10⁹/L (Sysmex XE-5000; Sysmex, Kobe, Japan). The full biochemistry results excluded acidosis, renal failure, tumour lysis syndrome, IV contamination, haemolysis, or EDTA. The elevated K⁺ result led to commencement of reso- niuim to lower the K⁺, and this continued until day 2. Resonium (A) is a cation-exchange resin which lowers the blood potassium level by exchanging potassium for sodium in the intestine. On day 2, a K⁺ of 9.0 mmol/L was obtained, and the result was immediately phoned to the clinical unit. The medical staff were appropriately notified that this result was prob- ably artefactual and the resonium was ceased after a presumably artefactual and the resonium was ceased after a

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highly elevated WBCs, serum provides more accu- rate estimate of K⁺, LDH and AST. A likely reason is increased release of K⁺ from myocytes, prior to analysis will result in significant chang- es to the K⁺, LDH and glucose concentrations. The glucose on the blood gas analyser indicated the pres- ence of interfering substances. The patient had received paracetamol which is documented as an interfering substance in the analyser manual.

It is well known that K⁺ is higher in serum due to platelet release as a result of platelet rupture during the clotting process (9). For this reason, plasma is the pre- ferred sample for the determination of K⁺ concentra- tion (9). As demonstrated by our data, in samples with markedly elevated WBCs, serum provides more accu- rate estimate of K⁺, LDH and AST. A likely reason is the clotting process locks the WBCs in the clot, eliminates cell movement during mechanical stress pro- cesses and minimises lysis. Although others have postulated the converse: that the clotting process increases rupture of fragile leukocytes and results in increased release of K⁺ (10).

In summary, in patients with hyperleukocytosis, serum and venous blood gas samples may provide more accurate estimates of K⁺ and other analytes, compared to lithium heparin plasma. Tubes containing gel separator may be preferred to minimise cellular contact with plasma post centrifugation. Samples must be analysed with minimal delay, and pneu- matic transport systems should not be used to transport samples. High K⁺ results should be urgently rechecked, taking into account the above specimen requirements before potentially misguided K⁺ lowering therapy is instituted. Finally, as these data were obtained from a single patient, the results may not be valid for all patients. Laboratories should consider completing studies on their own patients using their
Table 1  Results of samples collected on different days, plus samples transported by different modes and collection devices.

<table>
<thead>
<tr>
<th>Analyte</th>
<th>On admission</th>
<th>Day 2</th>
<th>Day 2 – venous blood gas interval (2.5 h later)</th>
<th>Day 8 – sample comparison of collection, A, B and C analysed within 45 min</th>
<th>Reference interval</th>
<th>Reference</th>
<th>Analyzed within 15 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na⁺</td>
<td>138</td>
<td>139</td>
<td>140</td>
<td>141</td>
<td>135−145 mmol/L</td>
<td>Reference</td>
<td>Own collection tubes under their own particular preanalytical conditions to determine the effects.</td>
</tr>
<tr>
<td>K⁺</td>
<td>5.6</td>
<td>9.0</td>
<td>4.0</td>
<td>3.6</td>
<td>3.5–4.5 mmol/L</td>
<td>Serum</td>
<td>Own collection tubes under their own particular preanalytical conditions to determine the effects.</td>
</tr>
<tr>
<td>Glucose</td>
<td>106</td>
<td>108</td>
<td>107</td>
<td>108</td>
<td>100–110 mmol/L</td>
<td>Serum</td>
<td>Own collection tubes under their own particular preanalytical conditions to determine the effects.</td>
</tr>
<tr>
<td>AST</td>
<td>29</td>
<td>50</td>
<td>21</td>
<td>3.1</td>
<td>70–110 U/L</td>
<td>Serum</td>
<td>Own collection tubes under their own particular preanalytical conditions to determine the effects.</td>
</tr>
<tr>
<td>LDH</td>
<td>818</td>
<td>947</td>
<td>2.64</td>
<td>10.41</td>
<td>10–200 U/L</td>
<td>Serum</td>
<td>Own collection tubes under their own particular preanalytical conditions to determine the effects.</td>
</tr>
<tr>
<td>RBC</td>
<td>2.72</td>
<td>4.63</td>
<td>4.03</td>
<td>14.27</td>
<td>4.0–6.0 × 10⁹/L</td>
<td>Serum</td>
<td>Own collection tubes under their own particular preanalytical conditions to determine the effects.</td>
</tr>
<tr>
<td>Platelet</td>
<td>25</td>
<td>27</td>
<td>440</td>
<td>15</td>
<td>140–400 × 10⁹/L</td>
<td>Serum</td>
<td>Own collection tubes under their own particular preanalytical conditions to determine the effects.</td>
</tr>
</tbody>
</table>

References