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Measurement of Whole-Blood Potassium—is It Clinically Safe?

To the Editor:
Potassium measurement in whole-blood specimens is fast and convenient and is increasingly offered as an adjunct to blood gas analysis. However, the presence of hemolysis in whole-blood samples cannot be determined by such analytical systems at present. There thus is a risk of reporting misleadingly increased whole-blood potassium for unrecognized hemolyzed samples, with potential for subsequent patient misdiagnosis and mistreatment. The real importance of this theoretical concern is unclear. This study describes the prevalence of hemolysis in blood-gas specimens and assesses the subsequent misreporting of whole-blood potassium as a result of hemolysis. It also assesses the importance of low sample volume, age, and gender as risk factors for sample hemolysis.

For 10 days, whole-blood potassium was measured with an AVL Omni 6 blood gas analyzer (Roche Diagnostics) in all arterial blood-gas specimens received by the laboratory. The manufacturer’s suggested reference interval for whole-blood potassium is 3.5–4.5 mmol/L. All blood-gas specimens are collected with BD Preset 3-mL draw, dry lithium heparinized syringes (Becton, Dickinson and Company) designed for pH/blood gas and electrolyte determinations. The sample volume and the patient’s age and sex were recorded. The specimen was then transferred to a plastic tube and centrifuged at 2000g for 10 min, and the hemolysis (H) index was measured on the supernatant with a 917 clinical chemistry analyzer (Roche Diagnostics). A mean potassium/hemoglobin (K/Hb) ratio of 0.284 mmol/g (with 95% population limits of 0.21 and 0.345 mmol/g) was used to estimate falsely increased potassium measurement attributable to hemolysis (1). [Note that the K/Hb values of 28.4 and so forth used in Ref. (1) are incorrect by a factor of 100.] Multiple logistic regression analysis was performed using SPSS, Ver. 11 (SPSS Corporation).

We received 610 samples for blood-gas analysis, of which 60 were ≤0.2 mL in volume and were insufficient for H index measurement. Of the remainder, 18% had a H index >1 g/L, indicating at least mild hemolysis (14% with a H index of 1–2.5 g/L; 36% with a H index of 2.5–5 g/L; 0.4% with a H index >5 g/L). On the basis of the mean K/Hb ratio (95% population limits) from above, the whole-blood potassium measurement error attributable to hemolysis was 0.5 mmol/L in 8% (4–10%) of samples. Table 1 shows the effect of hemolysis on classification of results based on the mean K/Hb ratio. After estimation of the hemolysis effect, 22% (15–24%) of normokalemic samples were downgraded to hypokalemic, and 14% (14–14%) of hyperkalemic samples were similarly downgraded [8% (6–

Table 1. Effect of hemolysis on classification of whole-blood potassium results.

| Whole-blood potassium corrected for hemolysis, mmol/L | Measured whole-blood potassium, mmol/L |
|-------------------------------------------------------|----------------------------------------|
| <3.5                                                  | <3.5                                   |
| <3.5                                                  | 3.5–4.5                                 |
| >4.5                                                  | >4.5                                   |
| <3.5                                                  | 150                                    |
| 3.5–4.5                                               | 72                                     |
| >4.5                                                  | 4                                      |
| 3.5–4.5                                               | 256                                    |
| >4.5                                                  | 62                                     |

* Data represent the number of samples in each classification.