Reviewer's report

Title: Use of a blood gas analyzer and a laboratory autoanalyzer in routine practice to measure electrolytes in intensive care unit patients

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Reviewer: volkher scharnhorst

Reviewer's report:

Budak and colleagues present a well prepared and clearly written manuscript on the agreement of electrolyte measurements on an ABG vs. central laboratory results. However, there are several major issues that need to be addressed (see below). While the manuscript now focuses on unacceptable differences between AA and ABG the focus should shifts towards explanation of these differences and how to overcome them in order to be able to use both types of instruments in parallel.

- Major Compulsory Revisions

1. Cl- is not mentioned in the manuscript but should preferentially be included as it is important for assessment of electrolyte and acid-base status of patients.

2. The ABG measures –on average- 5 mmol/L lower Na than the AA. No explanation for that observation is suggested. The AA is traceable to flame photometry. Nothing is stated about calibration of ABG. It’s probably calibrated with a NIST standard which leads to lower results. Furthermore, different types of heparin in blood gas syringes may introduce different negative biases in the measurement of positively charged ions. What is known about the syringe used here? The authors need to elaborate on both points.

3. The difference in K between ABG and AA is due to different materials used: whole blood vs. clotted blot. Taken together with point 2, the differences observed are due to differences in standardization and material analyzed. When corrected for those effects, ABG and AA probably do yield comparable results and the conclusion of the manuscript should be altered accordingly.

4. The imprecision and accuracy data in the manuscript do not serve their purpose well. Your key point is (lack of) agreement between two methods. Imprecision and accuracy are only relevant in whether they explain the differences observed between the methods (they don’t). Furthermore you do not present external accuracy data for the ABG. Therefore, for accuracy I suggest you state in the discussion section that the AA performs well in external QC schemes (and that you do not have that data on the ABG). Thereby the focus is more on agreement rather than on accuracy (which you didn’t investigate).

Minor Essential Revisions

5. Section ‘study population’: the authors mention 1,105 tests. What is meant by
tests? Both electrolytes together, number of blood gas samples analyzed? Sum of all tests in all samples included. Please clarify.

6. The part ‘Analytical imprecision of Na en K determinations’ of the manuscript also deals with the accuracy of the lab analyzers. That should be reflected in the title of that part. I suggest that the part dealing with the accuracy of the lab analyzer in the external quality control scheme should be presented in a more compact way.

7. Paragraph ‘statistical method’: It is of no practical consequence here, but taking a p value <0.001 as statistically significant is very strict.

Results section:

8. Did you assess whether Na en K values are normally distributed; if not median values end percentiles should be used instead of mean and SD.

9. Is a difference of 0.2 mmol/L clinically relevant when relevance is based on intra-individual variation? Please state that in the manuscript.

Discussion section

10. ‘reliability’ should be replaced by accuracy.

11. You should add a section stating that in every institution agreement between central and POC analyzers should be assessed before installation of POCs instrument and clinically relevant differences may not exist.

Table and figures

12. Table 1: Why do you state between-run and not-overall CV? It is the last CV that determines whether imprecision may explain the differences between AA and ABG.

   Why do you state the target (I guess derived from the package insert)? The table presents data on imprecision?

   The %CV of AA and ABG are equal on all controls? I guess that is an error?!

13. Figures

   Figure 1. Data are presented with mmol intervals, why is that?

   Figure 2 and 4. Identity lines (y=x) should be added so the reader can easily see whether the regression lines lie above or below the identity lines.

Level of interest: An article whose findings are important to those with closely related research interests

Quality of written English: Needs some language corrections before being published

Statistical review: No, the manuscript does not need to be seen by a statistician.
Declaration of competing interests:

I declare that I have no competing interests