Differences in blood gas results between POCT Neonatal Intensive Care Unit and Emergency laboratory

L. A. Bautista, P. Oliver, M.J. Alcaide, P. Fernández-Calle, A. Buno.
Emergency Laboratory. Department of Laboratory Medicine. La Paz University Hospital, Madrid, Spain

Background

Point-of-Care Testing (POCT) has shown many advantages in Intensive Care Units, though the interchangeability with laboratory measurements is still a subject of debate.
In our hospital, before implementing a blood gas analyzer in a healthcare setting, a method comparison is performed by the laboratory to ensure the interchangeability of the measurements based on biological variation criteria with other POCT blood gas analyzers located in the hospital and laboratory methods. On the other hand, all POCT operators are trained and certified as competent before using any blood gas analyzer.
In this study, the aim was to evaluate the interchangeability of the results obtained in clinical practice in POCT blood gas analyzer and laboratory during a 15 month period after installation.

Material and methods

We extracted paired POCT and Emergency laboratory (EL) measurements from laboratory information system (January 2015 to March 2016). Paired data were established by patient and time (time of POCT measurement and time of samples reception in EL, allowing 30 minutes as the maximum difference). We studied 3926 pairs for the evaluation of the differences observed in sodium, potassium, chloride, glucose and hemoglobin measured in Neonatal Intensive Care Unit (ABL90 Flex; Radiometer) and EL (CellDyn Sapphire; Abbott and Dimension Vista 1500; Siemens). Internal quality control was within allowable limits during the study period. The comparison of each measurand was performed using Passing-Bablok regression and relative Bland-Altman analysis. The allowable difference criteria were based on biological variation (total error).

Results

Measurand	**Paired samples (n)**	**r**	**Passing-Bablok regression**			**Bland Altman**		**Total error (%)**	**Pairs outside total error (n; %)**
			Intercept (95%CI)	Slope (95%CI)	Residual standard deviation	95% Limits of agreement (%)	Mean (%)		
Sodium mEq/L	665	**0.923**	**20.25** (16.20 to 24.18)	**0.87** (0.84 to 0.9)	1.73	-1.73 to 5.63	**1.95***	1.1	472; 70.9
Potassium mEq/L	634	**0.940**	**0.1** (0.1 to 0.1)	1.0 (1.0 to 1.0)	0.20	-9.37 to 14.70	**2.66***	8.4	98; 15.5
Chloride mEq/L	583	**0.970**	**7.28** (2.00 to 9.68)	0.944 (0.92 to 1.00)	1.38	-2.27 to 5.52	**1.63***	2.2	211; 36.9
Hemoglobin g/dL	1495	**0.984**	**0.31** (0.10 to 0.42)	0.98 (0.97 to 1.0)	0.4	-7.24 to 8.64	**0.70***	2.2	134; 9.0
Glucose mg/dL	549	**0.985**	**-3.51** (-4.87 to -2.03)	**1.04** (1.02 to 1.05)	7.33	-17.08 to 17.00	-0.04	5.55	203; 36.9

*Statistically significant.

The difference in number of pairs between measurands can be attributed to punctual unavailability of POCT value or lack of EL analytical request.
Passing-Bablok regression and Bland-Altman results revealed a positive constant bias for Potassium, Chloride and Hemoglobin, being the EL measurements higher than POCT. In sodium and glucose both constant and proportional positive bias was observed.
Relevant percentages of pairs outside total error have been found, particularly in sodium (71%).

Conclusions

We have detected statistically significant differences between POCT and Emergency laboratory results. Also in some patients, these differences are higher than total allowable error based on biological variation in measurands like sodium. This finding could have a potential impact in clinical outcomes. Other less strict criteria could be considered in future studies.
Although the interchangeability of the results was verified previously in the initial method comparison, this study revealed that there are other factors, probably regarding preanalytical phase, which could be influencing the results. Therefore, it is strongly recommended to investigate these factors and periodically monitor the interchangeability in clinical practice.