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ORIGINAL RESEARCH

Assessment of electrolytes by point-of-care testing

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ABSTRACT

Background: Electrolyte abnormalities can precipitate life-threatening events. In such situations, rapid and accurate assessment of electrolyte abnormalities may enable the institution of focused therapies. The present study was conducted to determine efficacy of electrolytes assessed by point-of-care testing.

Materials & Methods: 60 patients of both genders were selected and from each patient, paired sample of arterial blood and venous blood were collected at the same time. Whole blood electrolytes were analyzed using a point-of-care blood gas analyzer and serum electrolytes were analyzed in the central laboratory.

Results: Out of 60 patients, males were 35 and females were 25. ElectrolytesABG value (mmol/L) and serum value (mmol/L) of Sodium < 130 was 127.6 and 129.3, sodium 130–145 was 134.2 and 138.5 and sodium > 145 was 150.7 and 149.3, potassium < 3 was 1.8 and 2.5, potassium 3-4 was 3.5 and 3.8, potassium >4 was 4.6 and 4.8 and potassium >5 was 6.7 and 6.0 respectively. The difference was significant (P< 0.05).

Conclusion: Practitioners should be aware of the difference between whole blood and serum electrolytes, particularly when urgent samples are tested at point of care and routine follow-up electrolytes are sent to the central laboratory.

Key words: electrolytes, sodium, potassium

INTRODUCTION

Electrolyte abnormalities can precipitate life-threatening events. In such situations, rapid and accurate assessment of electrolyte abnormalities may enable the institution of focused therapies.[1] The rapidity of such assessment, particularly in developing countries, is often limited by the delay in transporting samples to the central laboratory, either due to lack of sufficient numbers of human couriers or the absence of rapid transit systems (RTS).[2]

Point-of-care testing (POCT) is one of the formidable concept introduce in the field of critical care settings to deliver decentralized, patient-centric health care to the patients. Rapid provision of blood measurements, particularly blood gases and electrolytes, may translate into improved clinical outcomes.[3] Studies shows that POCT carries advantages of providing reduced therapeutic turnaround time (TTAT), shorter door-to-clinical-decision time, rapid data availability, reduced preanalytic and postanalytic testing errors, self-contained user-friendly instruments, small sample volume requirements, and frequent serial whole-blood testing.[4]

Conflicting results from various studies, probably due to the use of different devices, add to these concerns.[5] Whilst some studies concluded that results differed significantly for plasma sodium and chloride concentrations, others also found significant differences in potassium values. Thus, it is not uncommon to find clinicians using the POCT results to act in an emergent situation (particularly where extremes of electrolyte values are obtained) whilst sending an additional sample to the central laboratory to "confirm" the POCT values.[6] The present study was conducted to determine efficacy of electrolytes assessed by point-of-care testing.

MATERIALS & METHODS

The present study comprised of 60 patients of both genders. All gave their written consent for the participation in the study.

Data such as name, age, gender etc. was recorded. From each patient, paired samples,one arterial blood and one venous sample in plain tube were collected at the same time. The first sample of 1.6 mL was collected from the arterial line in commercially available plastic ABG syringes coated with lithium-heparin. The second sample was collected in a BD vacutainer for serum in a non-additive silicone coated tube, and sent to the central laboratory through the pneumatic system for serum electrolytes' estimation. The ABG (whole blood) electrolytes were estimated on-site immediately after collection, using a GEM 3000 ABG analyzer. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Total- 60		
Gender	**Males**	**Females**
Number	35	25

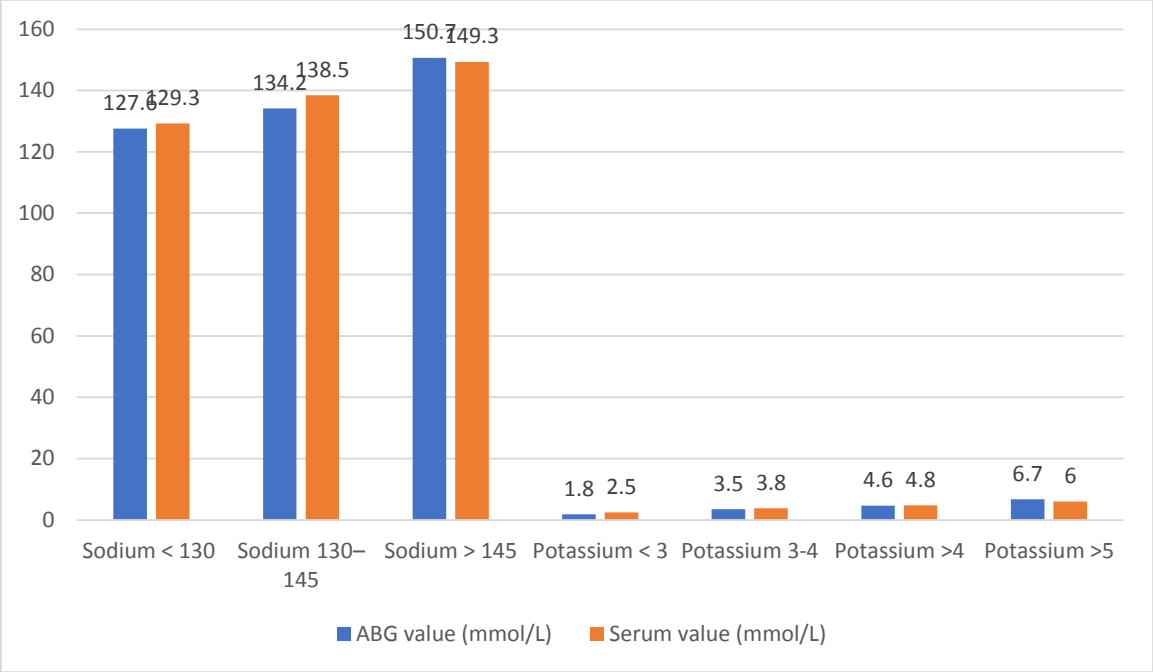
Table I shows that out of 60 patients, males were 35 and females were 25.

Table II Comparison between arterial blood gas and serum electrolyte values

Electrolytes	ABG value (mmol/L)	Serum value (mmol/L)	P value
Sodium < 130	127.6	129.3	0.05
Sodium 130–145	134.2	138.5	0.01
Sodium > 145	150.7	149.3	0.04
Potassium < 3	1.8	2.5	0.01
Potassium 3-4	3.5	3.8	0.04
Potassium>4	4.6	4.8	0.05
Potassium>5	6.7	6.0	0.03

Table II, graph I shows that electrolytes ABG value (mmol/L) and serum value (mmol/L) of Sodium < 130 was 127.6 and 129.3, sodium 130–145 was 134.2 and 138.5 and sodium > 145 was 150.7 and 149.3, potassium < 3 was 1.8 and 2.5, potassium 3-4 was 3.5 and 3.8, potassium >4 was 4.6 and 4.8 and potassium >5 was 6.7 and 6.0 respectively. The difference was significant (P< 0.05).

Graph I Comparison between arterial blood gas and serum electrolyte values



DISCUSSION

Point-of-care testing enables clinicians to initiate appropriate treatment for emergent conditions, thereby benefitting the patient both clinically and economically.[7]Electrolyte values are conventionally measured for all critical patients who present to the emergency department, for patients receiving fluid therapy, and for patients admitted to intensive care units (ICU).[8]Routinely, all electrolytes are measured from serum by the auto-analyzers (AA) available in central laboratories of hospitals; however, this is time-consuming.[9] Typically, a turnaround time of about 15 min is noted on average in acute care laboratories of most tertiary care hospitals for the above.[10] Quick decisions that need to be made depending on electrolyte values hence are often made either blindly or are delayed. Point-of-care testing for electrolytes is available from specialized equipment such as ABO 80 analyzers.[11]The present study was conducted to determine efficacy of electrolytes assessed by point-of-care testing.

We found that out of 60 patients, males were 35 and females were 25. Jain et al[12] in their study a total of 200 paired samples were analyzed. The mean ABG sodium value was 131.28 and the mean AA sodium value was 136.45. The mean ABG potassium value was 3.74 (SD 1.92), and the mean AA potassium value was 3.896. Authors found no significant difference between the potassium values measured by the blood gas machine and the auto-analyzer. However, the difference between the measured sodium was found to be significant.

We observed that electrolytesABG value (mmol/L) and serum value (mmol/L) of Sodium < 130 was 127.6 and 129.3, sodium 130–145 was 134.2 and 138.5 and sodium > 145 was 150.7 and 149.3, potassium < 3 was 1.8 and 2.5, potassium 3-4 was 3.5 and 3.8, potassium >4 was 4.6 and 4.8 and potassium >5 was 6.7 and 6.0 respectively. Chacko et al[13] found that there was a significant difference in the mean (±standard deviation) sodium value between whole blood and serum samples (135.8 ± 5.7 mmol/L vs. 139.9 ± 5.4 mmol/L, P < 0.001), with the agreement being modest (p(c) = 0.71; mean difference -4.0; 95% LOA -8.78 to 0.65). Although the agreement between whole blood and serum potassium was good (p(c) = 0.96), and the average difference small (-0.3; 95% LOA -0.72 to 0.13), individual differences were clinically significant, particularly at lower potassium values. For potassium values <3.0 mmol/L, the concordance was low (p(c) = 0.53) and the LOA was wide (1.0 to -0.13). The

concordance for potassium was good (p(c) = 0.96) for values ≥3.0 (mean difference -0.2; 95% LOA -0.48 to 0.06).

Fermann et al[14] reviewed nearly 100 articles which distinctly assert that POC technology is effective and reliable in ED settings and provide improved patient care. There is fair evidence that POC blood gas testing leads to reduced TTAT when compared with central laboratory testing (CLT), resulting in improved clinical outcomes.Barquist et al[15] on 116 non-intubated adult blunt-trauma patients in ER, advocated that ABG analysis should be instituted in all blunt-trauma patients as it may be of huge help in triage of those patients who require early mechanical ventilation. Studies have found that rapid result obtained by POC blood gas testing leads to faster decision time when compared to CLT and subsequent change in appropriate management strategies, hence reducing the overall morbidity.

The limitation the study is small sample size.

CONCLUSION

Authors found that practitioners should be aware of the difference between whole blood and serum electrolytes, particularly when urgent samples are tested at point of care and routine follow-up electrolytes are sent to the central laboratory.

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