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# Comparison of Plasma and Serum Electrolyte Levels In Patients Attending Emergency Out Patient Department of a Tertiary Health Care Level Institute of North India

KEYWORDS: Electrolyte, Serum, Plasma

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**ABSTRACT**

**Background:** Electrolytes are important parameter for clinical decision making and are measured by electrolyte analyser.Almost all metabolic processes are mediated by electrolytes ,so variation in electrolyte concentration can cause variety of disorders. Electrolytes are measured in serum and plasma and it is important to compare them for correct diagnosis and treatment.

**Objective:** To compare sodium and potassium levels in serum and plasma.

**Materials and Methods:** Hundred patients attending emergency OPD of PGMIS Rohtak were enrolled in this study. Venous and arterial blood samples were taken for serum and plasma measurement of sodium and potassium and samples were analysed in combiline blood gas analyser.

**Results:** Mean serum concentrations of sodium (140.79± 9.31) and potassium (4.84± 0.87) were higher than plasma concentrations of sodium (135.62±10.00) and potassium (3.69± 0.85) ($p<0.05$). A positive correlation was also found with the serum and plasma values of both the electrolytes.

**Conclusion:** Serum concentrations of sodium and potassium were higher than plasma level. Conventionally, electrolyte analysis is performed on serum, so studies should be conducted in critical care centres and a correction factor need to be established which helps in determining accurate electrolyte concentration.

**Introduction:**

Electrolyte abnormalities are one of the common reversible causes of morbidity. Inaccurate sodium results can lead to inappropriate fluid administration which can result in hypernatremia and abnormal levels of potassium can cause bradycardia, asystole and cardiac arrest. Fluctuation in potassium levels is also well-documented during the course of cardiac resuscitation.[1] Accurate estimation of electrolytes has gained additional importance in diagnosis of etiology of various pathologies, because it is used to calculate anion gap. The turnaround time for electrolytes should be low, so that early management of electrolyte abnormalities can be done. In routine manner, electrolytes are measured in serum obtained from venous blood which is analysed by an electrolyte analyser.[1]

The limitation of electrolyte measurement in serum is more turnaround time which is around 20 to 30 minutes, which is for clot formation. To overcome this limitation of serum electrolyte measurement in electrolyte analyser, arterial blood gas analysers can be used to measure electrolytes in arterial blood where display results within 5 minute, thus decreasing the turnaround time. Hazards of frequent blood sampling for ABG,electrolyte and other laboratory investigations include increased infection rate, pain, stress response and patient's discomfort.[2] The purpose of the present study was to compare sodium and potassium concentrations between serum and plasma.

**Materials and Methods:**

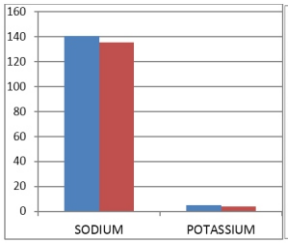
Hundred patients attending emergency OPD of PGMIS Rohtak were enrolled in this study. The study was conducted from September 2015 to October 2015. Patients having low blood pressure were excluded from the study.serum and plasma blood samples were analysed at the same time.Heparinised syringe is used to obtain plasma and red colour vaccutainer were taken to obtain serum and samples were analysed in combiline blood gas autoanalyser, which measure the analyte by using the principle of ion selective electrode. SPSS version 18 is used for statistical analysis. Independent t-test is used to compare mean and pearson's coefficient of correlation was used to observe the correlation between parameters.

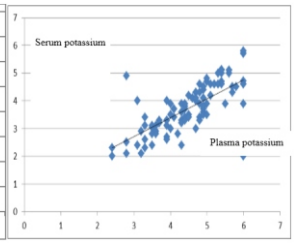
**Results:**

In the present study mean concentrations of sodium (140.79± 9.31) and potassium (4.84± 0.87) were higher in serum than plasma sodium (135.62±10.00) and potassium (3.69±0.85) ($p<0.001$). A positive correlation was also found between serum and plasma values of both the electrolytes, the values of correlations are found to be r=+0.63 and r=+ 0.70 in sodium and potassium respectively.

Table No. 1 Serum and plasma level distribution of electrolytes-

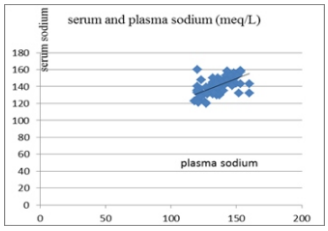
| parameter | plasma (mean±) | serum(mean±) | P value |
|---|---|---|---|
| Sodium | 135.62±10.00 | 140.79± 9.31 | <0.05 |
| potassium | 3.69± 0.85 | 4.84±0.87 | <0.05 |




**1. Bar diagram**

**2. Correlation b/w serum potassium and plasma potassium**




**3.** Correlation b/w serum sodium and plasma sodium

**Discussion:**

In the present study, the mean values of serum sodium and potassium were found to be higher than plasma sodium and potassium. In vitro release of potassium from cells and platelets during clotting increases serum potassium and lower plasma electrolyte values could be explained by dilutional effect of heparin.According to Jain A et al the cause for lower values of electrolytes in plasma is because of binding of heparin to electrolytes.[3] Chhapola V et al observed that arterial blood gas analysers underestimate sodium and potassium levels if arterial samples are collected in liquid heparinized containers.[4] Costello et al

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reported equality of sodium concentrations in arterial and venous samples.[4] The effect of the addition of sodium heparin and passage of time can result in alterations of electrolyte concentrations. Delay of more than 30 minutes between drawing blood and performing the test renders plasma potassium measurements unreliable.[5] Mehta and Lumalso reported higher levels of potassium in serum samples.[6,7] Present study is also comparable with the study conducted by Razavi S et al.[8] In this study we also found a positive correlation between plasma and serum concentrations of sodium and potassium. Wongyingsinn M et al also observed a good correlation between arterial and venous potassium and they stated that arterial potassium can replace measurement of venous potassium.[9]Johnston and Murphy reported higher levels of arterial potassium compared with venous samples in patients with cardiac arrest.[10] Serum concentration of these electrolytes could be calculated based on plasma values and it can beconsider useful to use arterial sample for sodium and potassium measurements in order to avoid frequent sampling.

**Conclusion:**

In conclusion a good correlation between plasma and serum concentrations of sodiumand potassium was observed in the present study. Serum concentration of these electrolytes could be calculated based on plasma values and it is advocated to use arterial sampling. Conventionally, electrolyte analysis is performed on serum, so studies should be conducted in critical care centres and a correction factor need to be established which helps in determining accurate electrolyte concentration.

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