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Electrolyte disturbances in elderly population of coastal Karnataka

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Abstract:
Introduction: *Various anatomical and physiological changes have been reported in renal system with advancing age. These changes might lead to electrolyte disturbances in elderly even in the absence of kidney diseases, which are responsible for high morbidity and mortality . Electrolyte disorders in elderly are least explored in India. So we aim to conduct a retrospective comparison of serum electrolytes in elderly and young adults as well as to study the correlation between age and serum electrolytes.*
Methodology: *A retrospective study was conducted in patients attending teaching hospital attached to Karwar Institute of Medical Sciences. Total 227 patients' data was studied after excluding conditions affecting electrlytes, out of which 70 were elderly and 157 were young adults.Serum electrolytes were measured in biochemistry laboratory using an electrolyte analyzer which works on the principle of ion selective electrodes.*
Results: *We observed significantly low sodium levels (P=0.0385) and high potassium levels (P=0.0009) in elderly patients compared to controls. Linear regression analysis showed an extremely significant negative correlation (P=0.0002) between age and sodium, correlation coefficient r= -0.2449,* $R^2 = 0.060$.
Conclusion: *We didn't find derangement of electrolytes in elderly, but we observed lowered sodium and high potassium in geriatric population as compared to young adults. This demands better care and awareness of electrolyte imbalances which might lead to high morbidity and mortality if neglected. It necessitates immediate treatment options to avoid further complications in elderly.*
Keywords: *elderly population, serum electrolytes, imbalances*

I. Introduction

In geriatric age group people are more susceptible to dehydration and electrolyte abnormalities. The causes are multifactorial which include physical disability restricting access to adequate fluid intake ,iatrogenic causes like use of diuretics and various drugs (1,2). Lower socioeconomic backgrounds, livingalone, pre-existing comorbidities, multiple drugs intake, physical and mental decline make elderly population more susceptible to dehydration and electrolyte disturbances which are associated with high morbidity and mortality (3).Structural and functional changes in the kidneys contribute significantly to electrolyte derangements in elderly.

Glomerular changes, altered tubular functions, variations in GFR and renal plasma flow,lowered capacity of kidney to conserve sodium, deprivation of water due to impaired thirst mechanisms, decline in hormonal actions (antidiuretic hormone, renin-angiotensin system, atrial natriuretic peptide) lead to electrolyte disturbances.

The reports are available which study electrolyte abnormalities in elderly patients .Study by Hawkins suggests that age isan independent risk factor for electrolyte disturbances(4).Electrolyte disturbances are well studied in European countries (5-8) , but least studied in our set up.We aim to study the same in the city of Karwar , situated in coastal Karnataka.

The objective of the present study was i.to compare serum electrolytes in geriatric patients with that of young adults ii.find the correlation between age and electrolytes in our study population.

II. Material and methods

The retrospective study was conducted in Karwar institute of Medical Sciences, Karwar. The approval of institutional ethics committee was obtained. Data of serum electrolytes and demographic profiles of 227 patients was collected from clinical biochemistry laboratory in the year 2015. 36.6% (83 in no) of the data was of female patients and 63.4 % (144 in no) of the data was of male patients.These patients had attended the teaching hospital due to various illnesses. We divided the number of patients in to two groups;

Group I: contained 70 geriatric patients with mean age of 71.21±0.85 years

Group II : contained 157 patientswith mean age 42.54±0.99 years

We excluded cases of renal disorders, diarrhea, dehydration, vomiting, endocrine disorders, brain injuries, diabetes mellitus and those on diuretics and drugs affecting electrolytes.

Data was obtained from our clinical biochemistry laboratory attached to the 400 bedded teaching hospital.Serum electrolytes were measured by using Roche electrolyte analyzer which works on the principle of ion selective electrodes. Statistical analysis was carried out by using Graph pad InStatsoftware.Mann Whitney U test was used to compare the serum electrolytes between the groups.Linear regression analysis was done to find the correlation between age and electrolytes.

III. Results

Extremely significantly high potassium and low sodium were observed in group I(elderly population) as compared to group II (young adults). Serum electrolytes in both the groups are represented in the Table 1.

Table 1: Comparison of serum electrolytes in two groups

Electrolytes (mEq/L)	Group I (n=70) Mean±SEM	Group II (n=157) Mean±SEM	P value
Sodium	136.31±0.8	138.44±0.43	0.0385*
Potassium	4.41±0.067	4.21±0.049	0.009**
Chloride	101.71±0.89	103.84±0.48	Not significant

*significant
**extremely significant

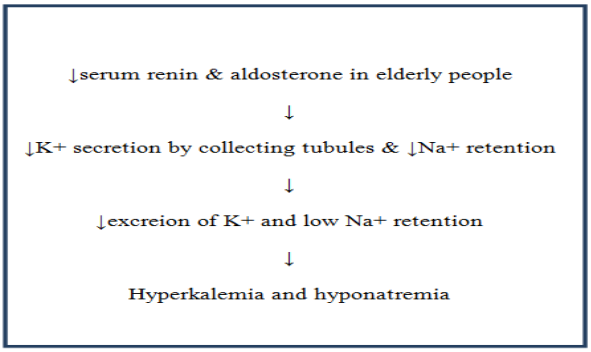
Linear regression analysis was carried out to find out the correlation between age and electrolyte levels in the entire study population (n=227).We found an extremely significant negative correlation (P=0.0002) between age and sodium, correlation coefficient r= -0.2449, R^2 = 0.060. Age and potassium were positively correlated but statistically it was insignificant.
We didn't find any gender differences in serum electrolytes.

IV. Discussion

We found 1.5% decline in serum sodium and 4.75% elevation in potassium levels in elderly as compared to controls. Chloride was also high in elderly but wasn't statistically significant.Our results are in agreement with the meta-analysis report by Ahmed et al which explains the pathophysiology of fluid and electrolyte imbalance in elderly surgical patients (9).According to the study, susceptibility of geriatric patients to electrolyte disturbance is due to inability to access water due to their physical and mental decline, physiological stress etc. Another study by Kirstenet al also reported hyponatremia in elderly patients with fractures (10). Miller M reported hyponatremia in 11% of ambulatory geriatric population ((11).On the contrary hypernatremia was reported in 1% of hospitalized elderly population by Snyder et al (12).This fact suggests that the electrolyte levels depend on the population studied, that is patients in nursing homes, hospitals or community dwelling. Study by Snyder et al also reports higher sodium levels in elderly females compared to elderly male (12) which is contradictory to our result, where we didn't find any gender differences in electrolytes. Electrolyte disturbances seen in elderly could be attributed to the structural and functional changes in kidneys due to ageing. Degenerative changes occur in kidneys resulting in reduction in their size and weight, which in turn leads to increased cortical glomerulosclerosis (13).These changes are accompanied by decline in functioning of glomeruli and number offunctioning tubules, reduced GFR and renal plasma flow (14) because of which elderly people will have inability to dilute urine (15)leading to hyponatremia (11).

Reduced functioning of distal convoluted tubules with ageing contribute to disturbances in hormone actions,namely aldosterone .Low sodium and elevated potassium levels observed in our study can be explained in the following figure;

Figure: Summary of pathophysiology of electrolyte imbalances in elderly



Musso et al reported a lowered excretion of K+ load in geriatric patients as compared to young adults (16).These findings support comparatively high potassium levels observed in our study.

V. Conclusion

Eventhough electrolytes were in normal reference interval, sodium levels were low and potassium was high as compared to young adults' groupin our study. In geriatric age group, irrespective of the causes, electrolyte imbalances need to be treated.Electrolyte disturbances observed in elderly demands better care and awareness as they may lead to high morbidity and mortality if neglected.It necessitates immediate broad treatment options to avoid further complications in elderly.

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