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ELECTROLYTE CHANGES IN PATIENTS OF ACUTE MYOCARDIAL INFARCTION

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ABSTRACT
Myocardial infarction is now considered part of a spectrum referred to as acute coronary syndrome. This refers to a spectrum of acute myocardial ischemia that also includes unstable angina and non-ST segment elevation myocardial infarction (NSTEMI). Acute myocardial infarction (AMI) is one of the leading causes of morbidity and mortality across the world. Serum electrolytes changes in AMI have not been studied extensively and there is paucity of information in the literature in this regard. Scanty information is available in the literature about prognostic value of serum electrolytes in ischaemic heart disease. This study was undertaken to study any changes in the serum electrolytes with special reference to serum sodium and potassium in cases of AMI and study the correlation of serum sodium and potassium in the severity and outcome of AMI. 120 people were included in study divided equally in study and control groups. Study group comprised confirmed diagnosis of recent onset of AMI. The blood samples of both the groups were analysed for Serum electrolytes (Na+, K+) by ion sensitive electrode analyser. There was statistically significant decrease in sodium and potassium levels in across all age groups as compared to control group. Significant high level of sodium was observed in AMI patients who are smokers and AMI patients with Diabetes whereas the level was low in AMI patients with hypertension. Potassium levels were low in AMI patients with Diabetes whereas the change was insignificant in association with smoking and hypertension. Decrease in sodium level was due to hypoxia and ischaemia, which increase the permeability of sarcolemma to sodium whereas decrease in potassium level was influenced by the catecholamine levels which are elevated in early acute myocardial infarction.

KEYWORDS: Electrolytes, MI, Sodium, Potassium

INTRODUCTION

Coronary heart disease (CHD) is the most common cause of death in the UK. CHD is responsible for the deaths of approximately one in five men and one in six women. The average incidence of myocardial infarction for those aged between 30 and 69 years is about 600 per 100,000 for men, and 200 per 100,000 for women. Cardiovascular disease is one of the leading causes of morbidity and mortality across the world. World Health Organization (WHO) has declared cardiovascular disease as a modern epidemic. AMI is one of the manifestations of coronary heart disease leading to morbidity and mortality. Several systemic metabolic changes occur in AMI[1]. These changes include increased plasma concentrations of catecholamines, free fatty acids, glucose, glycerol, cortisol and cyclic-AMP. There is decreased triglycerides concentration and an initial fall in plasma insulin concentration, followed by an early return to normal value[2]. In India, the prevalence of ischemic heart disease among adults (based on clinical and ECG criteria) was estimated at 96.7 per 1000 population in the urban and 27.1 percent in rural areas [3]. Serum electrolytes changes in AMI have not been studied extensively and there is paucity of information in the literature in this regard. Scanty information is available in the literature about prognostic value of serum electrolytes in ischaemic heart disease.

MATERIALS & METHODS

The study was carried out on 60 patients with recent onset of acute myocardial infarction according to European Society of Cardiology (ESC), the American College of Cardiology (ACC), the American Heart Association (AHA) and the World Heart Federation (WHF) jointly[4], admitted in the Department of Medicine, during the period june 2014 to November 2014 at index medical college and hospital, indoor, M.P., India. The patients in study group were selected based on age, sex, duration of symptoms of AMI and any history suggestive of vascular complications with the help of physician's opinion. For the control purpose, 50 normal non-hypertensive persons without symptoms of AMI were carefully selected and examined in detail with age and sex matched, who were not obese, non predisposed and physically active. 4 ml venous blood samples was collected from both the groups on the day of admission within 12 hours from anticubital vein with all aseptic precautions in supine position in plain vacutainers for serum electrolytes, *i.e.*, Na+ & K+ Blood was allowed to clot at room temperature for half an hour and then centrifuged at 3000 rpm for 10 minutes. The serum separated was used for the estimation of Serum electrolytes (Na+, K+). Electrolytes were measured by ISE analyser along with Quality control sera.

The comparative study of serum and potassium levels was carried out between the controls and AMI, patients and AMI patients with and without history of Smoking, Hypertension and Diabetes Mellitus. Also a study was carried out to evaluate the variations in serum electrolyte levels in AMI patients of age below 50 years and above 50 years.

Inclusion criteria

a) Patients of either sex and of any age group
b) Confirm cases of MI diagnosed clinically by Physician based on Clinical examination and ECG changes

Exclusion criteria

a) Patients on diuretics
b) Patient not fitting into criteria
c) Known cases of hypothyroidism

Data analysis

The data of 60 AMI patients and 60 non-AMI persons (Control) thus collected were analysed, correlation of serum Na+ and K+ parameters expressed as cross-tabulations. The mean and standard deviations of SBP, DBP serum electrolytes (Na+, K+) were calculated and the 'cut-off' points taken for finding a normal range. Online student t-test calculator was used to calculate P-value to determine significance between two groups.

RESULTS

The AMI cases were observed in intensive cardiac care unit and their serum electrolytes value were estimated and these values were compared with normal healthy control group There was statistically significant decreased in serum sodium and potassium levels in study group across both all ages compared to normal healthy control group. A significant low level of potassium was observed in <50 years of age group patients of AMI than normal healthy controls, but there was higher level of potassium observed in > 50 years age groups of AMI cases [Table-1 and 2].

TABLE 1: Serum sodium and potassium levels in age groups (<50 years) of AMI and normal healthy subjects

parameter	Case[AMI] (n=18) Mean ± SD	Control (n=39) Mean ± SD	P-value
Sodium(meq/L)	132.6 ± 4.92	139.20± 2.57	0.0001
Potassium(meq/L)	3.6 ± 1.23	4.31± 0.92	0.01

TABLE 2: Serum sodium and potassium levels in age groups (>50 years) of AMI and normal healthy subjects

parameter	Case [AMI] (n=42) Mean ± SD	Control (n=21) Mean ± SD	P-value
Sodium(meq/L)	130.23 ± 4.53	135.34 ± 3.2	0.0001
Potassium(meq/L)	4.38 ± 0.72	4.87 ± 0.80	0.017

TABLE 3: Serum sodium and potassium levels in AMI with smokers and AMI with non-smokers of subjects

Parameter	AMI with smoking (n=21) Mean ± SD	AMI without smoking (n=43) Mean ± SD	P-value
Sodium(meq/L)	136.9 ± 2.3	129.29 ± 4.50	0.0001
Potassium(meq/L)	4.19 ± 0.88	4.23 ± 0.69	0.8524

TABLE 4: Serum sodium and potassium levels in AMI with Hypertension and AMI without hypertension of subjects

Parameter	AMI with Hypertension (n=46) Mean ± SD	AMI without Hypertension (n=14) Mean ± SD	P-value
Sodium(meq/L)	132.29 ± 4.9	134.32 ± 5.39	0.1899
Potassium(meq/L)	4.32 ± 0.81	4.29 ± 0.79	0.9033

TABLE 5: Serum sodium and potassium levels in AMI with Diabetes malitus and AMI without diabetes malitus of subjects

Parameter	AMI with Diabetes malitus (n=41) Mean ± SD	AMI without Diabetes malitus (n=19) Mean ± SD	P-value
Sodium(meq/L)	131.61 ± 5.61	130.52 ± 4.9	0.4699
Potassium(meq/L)	3.56 ± 0.92	3.92 ± 1.2	0.2064

Significantly high level of serum sodium was observed in AMI with smokers than AMI with non-smokers. No significant difference was found in the level of serum potassium in AMI with smokers and non-smokers [Table-3]. Whereas levels of serum sodium was decreased in AMI with hypertension than AMI without hypertension. No significant change was observed in serum potassium level in AMI with hypertension and AMI without hypertension [Table-4]. However this comparison was statistically insignificant. Similar statistically insignificant findings were noted in AMI with diabetes mellitus and AMI without diabetes mellitus. Serum sodium levels were higher in AMI with diabetes mellitus than AMI without diabetes mellitus. Lower value of serum potassium was observed in AMI with diabetes mellitus as compared to AMI without diabetes mellitus [Table-5].

DISCUSSION

Fall in sodium level on day of admission in AMI is similar to finding was observed by Shah *et al*.[5] who reported hyponatremia on day first. Flear and Hilton reported a progressive fall in the mean daily serum sodium concentration until day 4 and rise thereafter in all cases [6]. Significant decrease in serum sodium concentration in both sexes was also reported by Flear and Singh [7]. There were 21 cases who were smokers in which the serum sodium concentration was significantly higher than non-smokers. No support is available in literature to show the correlation of smoking and sodium concentration. The low level of serum potassium was observed in below 50 years of age groups patients than above 50 years. There was a tendency for potassium levels to increase with age [8]. Low level of serum potassium was seen in AMI cases in both the age groups. Flear and Hilton reported fall in mean daily serum potassium concentrations during first three days of AMI [6]. Serum potassium level was non-significantly higher in non-smokers than smokers. Smoking showed a strong association with serum potassium level. Higher level was reported by Wannamethee and his coworkers in normal middle aged person [7,8]. They also reported increase in mortality with increasing serum potassium levels in cardiovascular disease. The level of serum potassium was non-significantly increased in AMI with hypertension than AMI without hypertension cases. Hypokalemia is not a feature of hypertension but the plasma potassium level is invariably increased in hypertensive patients.[9]

CONCLUSION

Hyponatremia and hypokalemia are indicators of Acute mycardial infarction. Serum sodium and potassium levels are prognostic indicators, *i.e.*, rise in sodium levels after intial fall was indicative of clinical improvement. Therefore estimation of sodium and potassium level in acute MI patients can help assess their prognosis

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