Current Trends in Biotechnology and Pharmacy
Vol. 15 (5) 507-510, ISSN 0973-8916 (Print), 2230-7303 (Online)
10.5530/ctbp.2021.3s.47

A study on the Electrolytes Concentration and Lipid Profile in Cardiac and Cardiovascular defective patients

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Abstrac

Cardiovascular diseases are common all over the world, and atherosclerosis of coronary arteries is considered to be the leading cause of premature death among men. Serum electrolyte concentrations after myocardial revascularization varied within normal ranges. Magnesium sulphate infusion did not decrease the rate of postoperative atrial fibrillation during the early postoperative period in normomagnesemic patients. The main risk factors for Cardiovascular diseases are age, male sex, hypercholesterolemia [especially in case of cholesterol with low density lipoproteins (LDL)], smoking, systemic hypertension, and diabetes mellitus. The aim of the study was to compare the serum electrolytes [Na^+, K^+, Cl^- and Ca^{2+}] concentration and lipid profile[cholesterol, triglycerides, HDL, LDL, VLDL,LDL/HDL ratio and cholesterol/HDL ratio] of normal persons with cardiac and cardiovascular defective patients. Sodium concentration of cardiac and cardiovascular defective patients varied within normal ranges. Potassium concentration of cardiac and cardiovascular defective patients was very low, when compared with the normal persons. Chloride concentration of Cardiac and cardiovascular defective patients varied within the normal ranges. Calcium concentration of cardiac and cardiovascular defective patients was very high, when compared with the normal persons. Cholesterol, HDL, VLDL, LDL, LDL/HDL ratio, cholesterol/HDL ratio varied within the normal ranges. Triglycerides concentration gets fluctuated and got increased in few cardiac and cardiovascular defective patients, when compared with normal persons.

Keywords Electrolytes, Cardiac and cardiovascular disease, HDL, VLDL, LDL, HDL

Introduction

Heart failure is a key cause of cardiovascular mortality and morbidity, resulting in more than one million hospitalizations per year in the USA, and it is the most common hospital discharge diagnosis among subjects older than 65 years (Caterina Urso *et al*., 2015). Several mechanisms interact to produce electrolyte and lipid profile changes. The reduction in cardiac output leads directly to a reduction in renal blood flow, with impairment of renal excretion of water and electrolytes, and it causes the activation of several neuro-hormonal responses which affect both cardiovascular homeostasis and electrolyte balance (Dargie H J, 1990).

This study was designed to assess the changes of serum electrolytes [Na^+, K^+, Cl^- and Ca^{2+}] concentration and lipid [cholesterol, triglycerides, HDL,LDL,VLDL,LDL/HDL ratio and cholesterol/HDL ratio] profile in different cardiac and cardiovascular problems such as RHD,CHD,CAD,MR,TR,MS etc., using normal persons as control.

Materials and method

Chemicals:

All the chemicals used for these experimental protocols were obtained from Lab-Care Diagnostics (India) PVT.LTD. Mumbai.

Blood Sample:

Cardiac and cardiovascular defective patients' blood samples were collected from Sailabs # 5 to 9,Dharapuram road, Old Govt. Hospital Compound (East), Tirupur.

All the estimations were performed by the standard protocol. Estimation of calcium in serum by Colorimetric end point test method [Arsenazo III method], Estimation of chloride in serum by Colorimetric end point test method [mercurous (II) thiocyanate method], Estimation of potassium and sodium was done by colorimetric method, Estimation of Cholesterol by CHOD/PAP method[cholesterol oxidase peroxidase method], Estimation of Triglycerides by Colorimetric enzymatic test using glycerol-3-phosphate-oxidase[GPO], Estimation of High density lipoprotein-Cholesterol [HDL-C] by Clearance method, Determination of Very low density lipoprotein [VLDL], Low density lipoprotein [LDL], LDL/HDL ratio and cholesterol/HDL ratio by standard formulae.

Very low density lipoprotein [VLDL] = Triglycerides ÷ 5

Low density lipoprotein [LDL] = Cholesterol-HDL-VLDL

Cholesterol/HDL ratio = Cholesterol ÷ HDL

LDL/HDL ratio = LDL ÷ HDL

Statistical Analysis: The results were expressed as mean ± SEM and comparisons between the 2 sets of data were made by using students t – test and their significance were determined.

Result

Table-1 represents, the electrolytes such as sodium [Na^+], potassium [K^+], chloride [Cl^-] and calcium [Ca^{2+}] concentration of the cardiac and cardiovascular defective patients.

Table-2 represents, the lipid profile [cholesterol, triglycerides, HDL, VLDL, LDL, LDL/HDL ratio and cholesterol/HDL ratio] of the cardiac and cardiovascular defective patients.Table-3 represents, the electrolytes such as sodium [Na^+], potassium [K^+], chloride [Cl^-] and calcium [Ca^{2+}] concentration and lipid profile [cholesterol, triglycerides, HDL, VLDL, LDL, LDL/HDL ratio and cholesterol/HDL ratio] of both the normal persons and diseased subjects.

The cholesterol, HDL, VLDL, LDL, LDL/HDL ratio, cholesterol/HDL ratio varied within the normal ranges. Triglycerides concentration gets fluctuated and got increased in few cardiac and cardiovascular defective patients, when compared with normal persons. (Fig 2)

Discussion

A large body of research indicates that plasma cholesterol levels are important risk factors for coronary artery disease [CAD].Lifestyle modification programs are known to improve cardiovascular risk profiles through significant reductions in LDL and total cholesterol. The lifestyle intervention also was effective in improving lipoprotein profiles that contribute to coronary artery disease risk (David Decewicz *et al*., 2009).

High plasma cholesterol is known to alter the cholesterol: phospholipids ratio in the plasma membrane, which leads to increased membrane viscosity. These changes facilitate monocyte adhesion and chemotaxis that precedes the development of fatty streaks (Bhagwat *et al*., 2009).

The close temporal association between the totally reversible conduction defect and hyponatremia strongly suggests that hyponatremia played a role in the pathogenesis of the conduction defect (Pawan Suri *et al*., 2009). Most of the studies, designed to evaluate changes in electrolyte levels after CPB, find enhanced electrolyte depletion and electrolyte balance disorders (Milda Svagzdiene *et al*., 2009). Congestive heart failure subjects progress multiple acid base and electrolyte defects due to several pathophysiological mechanisms. Their incidence is often correlated with the severity of cardiac dysfunction; additionally, these imbalances are associated with a poor prognosis (Caterina Urso *et al*., 2015).

Conclusion

Comparative study of cardiac and cardiovascular defective patients with normal individuals suggests that, sodium and chloride concentration of cardiac and cardiovascular defective patients varied within the

Table 1: Electrolytes concentration in Cardiac and Cardiovascular defective·patients.

Subjects	Sex	Age(years)	Na[mEq/l]	K [mmol/l]	Cl[mEq/l]	Ca[mg/dl]
1	Female	49	123	2.70	109.80	20.32
2	Female	55	152	2.60	111.35	21.85
3	Female	07	153	0.40	102.46	22.13
4	Male	25	152	1.00	107.99	22.05
5	Female	35	153	2.50	111.12	22.12
6	Male	49	154	1.70	99.82	20.62
7	Female	44	154	2.00	103.28	21.82
8	Female	70	151	2.20	104.51	22.12
9	Female	12	130	2.60	108.32	22.06
10	Male	44	145	2.70	107.51	22.12
11	Female	25	153	1.50	102.29	22.93
12	Female	35	152	2.50	106.19	22.56
13	Male	15	155	1.80	109.79	21.67
14	Female	50	154	1.50	110.48	21.79
15	Male	50	155	2.40	112.38	22.11
16	Male	55	154	1.70	110.31	22.10
17	Male	33	154	1.10	101.03	22.60
18	Female	17	153	2.70	111.40	21.87
19	Female	32	153	1.50	111.02	21.01
20	Male	40	153	2.02	100.30	22.30
21	Female	54	150	1.90	108.50	22.00
22	Female	51	151	1.40	105.90	22.01
23	Male	50	126	2.50	108.50	21.03
24	Male	54	152	1.40	111.35	21.85
25	Female	35	154	0.06	101.50	23.10
26	Male	27	153	1.50	106.55	23.00
27	Male	37	154	2.40	112.00	23.00
28	Female	49	155.20	1.80	98.50	21.50
29	Female	51	155	2.00	104.21	22.12
30	Female	44	152	1.20	105.20	23.00
31	Female	38	152	1.90	105.20	22.50

All values represent Mean ± SEM and its significance of all the parameters in diseased condition.

Table 2 : Lipid profile in Cardiac and Cardiovascular defective patients

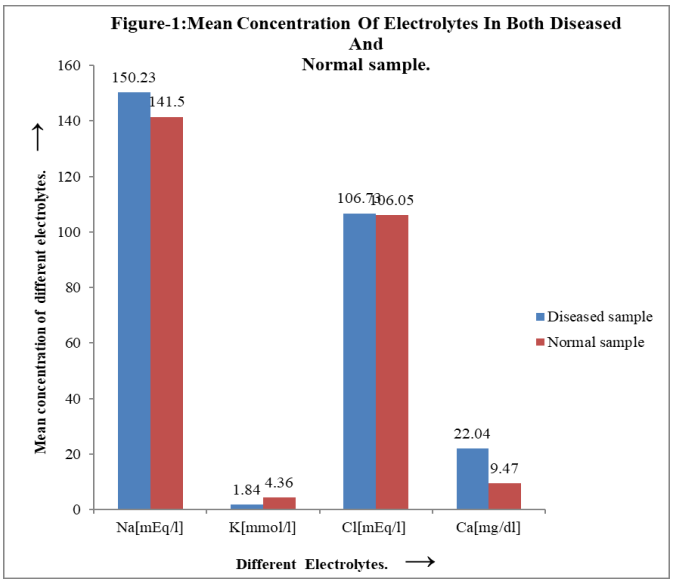
Subjects	Cholesterol [mg/dl]	Triglycerides [mg/dl]	HDL [mg/dl]	VLDL [mg/dl]	LDL [mg/dl]	LDL/HDL ratio	Cholesterol/ HDL ratio
1	151.07	87.15	42.10	17.43	91.54	2.2	3.6
2	150.91	108.43	43.16	21.69	86.06	1.9	3.5
3	226.03	91.15	42.00	18.23	165.80	3.9	5.4
4	149.83	152.21	39.16	30.44	80.23	2.0	3.8
5	158.08	109.34	44.18	21.80	92.10	2.1	3.6
6	169.28	113.91	44.10	22.80	102.38	2.3	3.8
7	182.78	182.17	48.17	36.43	98.18	2.0	3.8
8	191.15	103.98	40.16	20.79	130.20	3.2	4.75
9	161.49	151.97	39.71	30.39	91.39	2.3	4.06
10	101.23	123.00	39.18	24.60	37.45	0.96	2.60
11	163.23	162.80	42.01	32.56	88.66	2.1	3.88
12	145.42	193.75	49.12	38.75	57.55	1.2	2.96
13	252.56	460.09	68.00	92.02	92.54	1.4	3.71
14	113.44	96.23	41.81	19.25	52.38	1.3	2.71
15	128.35	188.74	38.16	37.68	52.51	1.4	3.36
16	112.23	104.15	36.12	20.83	55.28	1.5	3.11
17	139.00	157.21	41.06	31.44	66.50	1.6	3.38
18	161.15	94.13	40.18	18.83	102.14	2.5	4.01
19	111.22	103.14	40.18	20.62	50.42	1.3	2.76
20	138.00	156.30	40.05	31.26	66.69	1.7	3.45
21	250.50	458.50	67.00	91.70	91.80	1.4	3.73
22	145.00	193.50	48.12	38.70	58.18	1.2	3.01
23	152.00	86.54	43.11	17.31	91.58	2.1	3.50
24	149.50	109.00	44.17	21.80	83.53	1.9	3.38
25	225.50	92.03	50.05	18.41	157.04	3.1	4.50
26	150.50	153.03	40.01	30.61	79.88	1.9	3.76
27	159.00	108.50	45.12	21.70	92.18	2.0	3.52
28	170.12	114.50	45.20	22.90	102.02	2.3	3.76
29	183.12	182.50	49.12	36.50	97.50	1.9	3.72
30	192.20	104.10	40.50	20.82	130.88	3.2	4.75
31	195.34	104.12	42.16	20.82	132.36	3.1	4.63

All values represent Mean ± SEM and its significance of all the parameters in diseased condition.
HDL=High Density Lipoprotein; VLDL=Very Low Density Lipoprotein; LDL=Low Density Lipoprotein

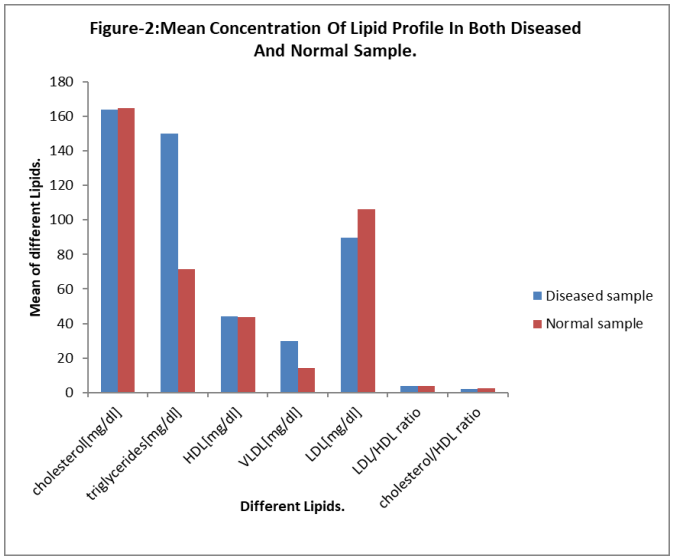
Table 3: Different Parameters In Both Diseased And Normal Samples

S.No:	Parameters	Diseased samples Mean±SEM	Normal samples mean±SEM	t-Test
1	Sodium [Na^+]	150.23 ± 1.45	141.50 ± 0.8791	P>0.05
2	Potassium [K^+]	1.84 ± 0.1177	4.36 ± 0.1125	P>0.05
3	Chloride [Cl^-]	106.73 ± 0.7227	106.05 ± 1.04	P<0.05
4	Calcium [Ca^{2+}]	22.04 ± 0.1176	9.47 ± 0.2691	P>0.05
5	Cholesterol	163.85 ± 6.66	164.60 ± 3.06	P<0.05
6	Triglycerides	149.88 ± 15.82	71.60 ± 4.45	P>0.05
7	HDL	44.30 ± 1.25	43.62 ± 1.03	P<0.05
8	VLDL	29.97 ± 3.16	14.32 ± 0.8886	P>0.05
9	LDL	89.58 ± 5.37	106.18 ± 3.48	P>0.05
10	LDL/HDL Ratio	3.69 ± 0.1111	3.77 ± 0.0445	P<0.05
11	Cholesterol/HDL Ratio	2.03 ± 0.1225	2.44 ± 0.0789	P<0.05

HDL=High Density Lipoprotein; VLDL=Very Low Density Lipoprotein; LDL=Low Density
Lipoprotein. Each value represents the mean ± SEM; n=31; Compared to control 'P' value
and its significance were represented.



normal ranges. Potassium concentration of cardiac and cardiovascular defective patients was very low and calcium concentration of cardiac and cardiovascular defective patients was very high. Cholesterol, HDL, VLDL, LDL, LDL/HDL ratio and cholesterol/HDL ratio of cardiac and cardiovascular defective patients varied within the normal ranges. Triglycerides concentrations of the cardiac and cardiovascular defective patients get fluctuated and increased slightly. Thus, this study concluded that the electrolytes concentration of



cardiac and cardiovascular defective patients varies when compared to the normal individuals. Cholesterol, HDL, VLDL, LDL, LDL/HDL ratio and cholesterol/HDL ratio do not have any change whereas triglyceride concentration of cardiac and cardiovascular defective patients increases slightly. Hence, there is a significant change in electrolytes concentration and considerable change in lipid profile of the cardiac and cardiovascular defective patients. This study can be further extended by analyzing a large number of samples with specific cardiac problems of interest.

References

1. David J. Decewicz, David M. Neatrour, Amy Burke, Marry Jane Haberkorn, Heather L. Patney, Marina N. Vernalis and Darrell L. Ellsworth: Effects of Cardiovascular lifestyle change on lipoprotein subclass profiles defined by nuclear magnetic resonance spectroscopy: Lipids in Health and disease 2009,8:26, doi:10.1186/1476-511X-8-26

2. Bhagwat V.R., Yadav A.S, Rathod I.M. Homocysteine, lipid indices and antioxidants in patients with ischaemic heart disease from Maharashtra,India. Singapore Med J 2009; 50(4): 418-424.

3. Pawan Suri .H.K., Alai M.S., Rather A.H. and Jalal S. Hyponatremia presenting as cardiac conduction defect. *JK Sci*, 2009, *11*(2), 85-86.

4. Milda Svagzdiene, Edmundas Sirvinskas, Rimantas Benetis, Laima Raliene, and Violeta Simatoniene. “Atrial fibrillation and changes in serum and urinary electrolyte levels after coronary artery bypass grafting surgery.” *Medicina* 45, 12 (2009): 960.

5. Caterina Urso, Brucculeri, S., & Caimi, G. Acid-base and electrolyte abnormalities in heart failure: pathophysiology and implications. *Heart failure reviews*, *20*(4),2015, 493–503. https://doi.org/10.1007/s10741-015-9482-y

6. Dargie H.J. Interrelation of electrolytes and renin–angiotensin system in congestive heart failure. *Am J Cardiol*. 1990;65:28E–32E. rameters in diseased condition.