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Role of metals (Cadmium and lead) in patients of hypertension and their relationship with Ischemic Heart Disease

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Abstract: Trace elements are essential for life and their concentrations in serum vary with human ecology and different pathological conditions. These elements were studied in hypertensive patients with or without associated problem of Ischemic Heart Disease. Trace elements were detected after wet digestion of serum samples by use of atomic absorption spectrophotometer. The result of study indicated that concentration of the trace metals (Cd and Pb) were elevated than the normal. The concentration of Cd metal was highest in hypertensive patients without associated problems of Ischemic Heart Disease while the concentration of lead was found to be highest in serum of hypertensive patients with associated problem of Ischemic Heart Disease. It is evident from the present study that from the assessment of serum, trace elements status may be indicative of pathological disorders such as hypertension with the simultaneous existence or non existence of Ischemic Heart Disease.

Key words: Hypertension, Ischemic Heart Disease, Pathological disorder, Assessment of Serum, Role of trace elements

INTRODUCTION

Heart diseases are common in this modern age. There are different heart diseases, some may be present from early age or from birth such as rare malformations of the structure of heart, and others take a life time to acquire such as the Angina Pectoris. It mainly affects men but women also develop it[1], the ratio of men to women is 4 to 1. The reason for this is that women up to age of menopause are partially protected by their naturally supply of hormones, mainly Oestrogen. But after late middle age, the number of women who develop coronary heart disease equals that of men. There are different risk factors to contribute to the chances of getting the disease; family pattern, weight watching, smoking tobacco, lack of exercise, diabetes, stress, high cholesterol level, and hypertension. Hypertension is a major health hazard because people with it are more prone to strokes, heart disease or kidney failure than people with low blood pressure. Hypertension is an important precursor of cardiovascular morbidity and mortality[2].

Hypertensive patients have abnormal blood clotting and have alterations of many local tissue growth factors. The common pathway of hypertension is peripheral arteriolar narrowing due to a combination of vasoconstriction and vessel wall thickening. The trace element (Cu, Co, Zn, Mn, Cd etc) which occur in body tissues and fluids have some essential activities[3,4]. These elements serve as cofactors is various functions of the body. They are present as component of nutrients and constituents of enzymes, vitamins, hormones and other processes and thus take part in growth development and maintenance of health. Deficiency or toxicity deranges life processes. The source of these elements for human is the plants and animals taken as diet. The excess of these trace elements[5] in the body is associated with different pathological conditions such as toxic cancer, malnutrition and a variety of other disorders due to the accumulation of trace elements in the body. The increasing environmental pollution, unhygienic living conditions and food consumed has given rise to concern about the accumulation of trace elements in the body.

Cadmium: It is also amongst the elements which are toxic to the body. It is present in human body at birth but accumulates with age. Cadmium intoxification becomes

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detectable when it exceeds the threshold level of 50-70 g/day. The adverse physiological effects commonly encountered to high cadmium exposure include depressed growth rate, anemia, hypertension, damage to renal tubules and poor mineralization of bones. Cadmium serum level increases in case of atherosclerosis[6].

Lead: It is one of the toxic elements that has known to biological functions[7]. The myocardial infraction patients have high level of lead than the normal ones [8]. The body contains about 120 mg of lead which is mainly present in skeleton and in smaller amount in hair and blood. It accumulates with age in bones, aorta, kidney, liver and spleen. Lead is a general protoplasmic poison that is cumulative, slow acting and subtle and produces a variety of symptoms. Tetraalkyl lead used as gasoline additive is the main source of environmental pollution in urban areas. The other sources of lead are plasters, paints, house dust and new prints. The lead absorption increases in case of protein and iron deficiency. The toxic symptoms are anemia, insomnia, headache, dizziness, irritability, weakness of muscles and kidney damage.

To study the incidence of serum Cd and Pb in hypertension with or without ischemic heart disease[9] is the objective of the present study.

MATERIALS AND METHODS

All the chemicals and reagents used in the study were of analytical grade and pure (E. Merck). Doubly distilled demineralized water was used for all the washings and preparation of solution.

Sampling: The blood samples were divided into three groups;

(a) Hypertensive Group
(b) Hypertensive Group having* some ischemic heart disease
(c) Normal Group

The blood samples for the above mentioned groups were obtained from the Punjab Institute of Cardiology, Lahore from the patients and some healthy volunteers. 05 ml of fasting blood serum was drawn from the study subjects for the estimation of various minerals by pyrogen free disposable syringe. Blood was allowed to clot for one hour and then centrifuged at 2500 RPM for 15 minutes. Serum thus obtained was refrigerated and stored in contaminant free evacuated tube. Each sample was processed within 72 hours.

Preparation of glassware: Pyrex glass was used in the study. First the glassware were thoroughly washed with detergent, and then dipped for 24 hours in chromic acid solution. After that it was thoroughly washed with tap water and then doubly distilled demineralized water. Glassware was then oven dried at 105 °C. Opening of glassware were covered with aluminum foil to avoid contamination.

Digestion of samples: Known volume of serum samples was digested with equal volume of concentrated HNO_3 in micro digestion flask. Flask was heated gently and then vigorously to obtain a clear transparent solution. Its volume was reduced to about 0.5 ml and then allowed to cool. Contents of the digestion flask were diluted to 5 ml using only double distilled demineralized water, then analysed on atomic absorption spectrophotometer.

Preparation of Standard Curve:

Cadmium: The standard solution of cadmium was prepared by dissolving 1g of cadmium in minimum volume of 1:1 nitric acid and was diluted to 1L to give 1000 ppm cadmium solution. Then for the estimation of cadmium, further dilutions/standard (0.5-2.00 ppm) were prepared from it.

Lead: The standard solution of lead was prepared by dissolving 1g of lead in 1:1 nitric acid and was diluted to 1L to give 1000 ppm lead solution. Then for the estimation of lead, further dilutions/ standard (5.0-20 ppm) were prepared from it.

Instrument used and Procedure: Cd and Pb were determined by using 1275 A A Varian, atomic absorption spectrophotometer. Working standard were prepared for each metal and then studied. A standard curve for each was worked out and amount of metal present in the sample was determined from the standard curve.

The general procedure used for the determination of metals, Cd and Pb, by atomic absorption spectrophotometer was set for metals according to conditions required which are shown in Table 1.

Standard solution of Cd ranging from 0.5-2.0 ppm and standard solution of Pb ranging from 5.0-20 ppm were used to prepare standard curves of the metals by recording their absorbance.

The absorbance of each metal was plotted against its concentration to obtain the standard curve. The amount

Table 1:

Metal	Lamp current (A)	Wave length	Width of slit	Burner height	Acetylene	Air
Cd	3.0	224.7	1mm	9	1	3.20
Pb	3.0	228.8	1mm	9	1	3.25

of Cd and Pb samples were obtained from the standard curves.

RESULTS AND DISCUSSIONS

The results obtained in the present study are in line with those of Verseik[10], and Khan[11], who examined serum of a number of patients having IHD and hypertension. The serum concentration of Cd in hypertensive patients with or without associated problem of ischemic heart disease (IHD) has been reported in Table 2. Cd is a toxic heavy metal. Its role as trace metal[12] has not yet been established. However, it is reported that Cd concentration increases with age[13]. The Cd was not detectable in the serum of normal individuals. However, its value was almost identical in hypertensive patients having the problem of IHD or not[6].

Data obtained in the present study suggested that an elevated Cd concentration lead to hypertension / IHD or it is the result of onset of disease which is resulted in the elevation of Cd. It has been also reported the possibility of atherosciersis[14] with elevated Cd concentration which may lead to hypertension. Cd has generally been reported higher in conditions associated with heart diseases[15].

Table 2: Serum concentration of Cd in hypertensive patients with or without associated problem of Ischemic heart disease (ppm).

Hypertensive patients	Hypertensive patients having Ischemic heart disease	Normal
0.15	0.12	-
0.35	0.16	-
0.25	0.17	-
0.55	0.17	-
0.30	0.20	-
0.30	0.17	-
0.19	0.22	-
0.25	0.15	-
0.23	0.16	-
0.33	0.20	-
0.23	0.22	-
0.20	0.38	-
0.36	0.19	-
0.18	0.25	-
0.38	0.34	-
0.17	0.39	-
0.39	0.24	-
0.30	0.38	-
0.26	0.43	-
0.34	0.55	-
0.22	0.29	-
0.20	0.80	-

Table 2: (Continued)

0.35	0.38	-
0.29	0.46	-
0.27	0.80	-
Mean = 0.28 SD = +- 0.09 Range = 0.15-0.55	Mean = 0.31 SD = +- 0.18 Range = 0.12–0.80	

Table 3: Serum concentration of Pb in hypertensive patients with or without associated problem of Ischemic heart disease (ppm).

Hypertensive patients	Hypertensive patients having Ischemic heart disease	Normal
0.80	2.30	0.50
0.68	1.45	0.61
1.05	0.85	0.44
0.85	0.78	0.43
0.95	0.85	0.43
0.72	1.35	0.41
0.45	2.10	0.42
0.98	1.00	0.63
0.65	1.45	0.41
0.78	1.05	0.49
0.71	2.30	0.67
0.87	1.43	0.66
0.89	0.75	0.41
0.97	1.40	0.28
0.60	0.98	0.35
0.80	1.49	0.55
0.75	2.05	0.41
0.66	0.85	0.52
0.93	1.77	0.45
0.83	1.11	0.60
0.85	2.20	0.36
0.77	2.10	-
1.00	1.55	-
0.62	1.61	-
Mean = 0.80 SD = +- 0.15 Range = 0.45-1.05	Mean = 1.45 SD = +- 0.51 Range = 0.75-2.30	Mean = 0.48 SD = +- 0.01 Range = 0.28-0.67

Serum concentration of Pb in patients with or without associated problem of IHD has been given In Table 3. The normal Pb concentration was observed much lower than the hypertensive patients with or without a ssociated problem of IHD. Results are agreed on reports[16,17] of an

elevation in blood pressure with increasing serum Pb concentration.

Conclusion: It is concluded from the foregoing results that the balance of different metals is altered in case of hypertension and IHD. A monitoring of metals in different groups of normal population may suggest some prophylactic measures which may result to make the problem less severe. No doubt the reported study is a preliminary report of its kind. However more extensive studies with better analytical tools are expected to produce better results.

REFERENCES

1. Haider, Z. and Bano, K.A., 1980. A follow up study of patients with mild and moderate hypertension. J. Pak. Med. Ass. 30: 227.
2. Kannel, W.B., 1974. Role of blood pressure in cardiovascular morbidity and mortality. Prog. cardiovasc. dis. 17: 5-24.
3. Bakos, S.N., H.K. Ahmed and T.A. Nasser, 1988. Changes in the serum copper, magnesium, zinc, calcium and potassium following acute myocardial infraction. Angiology. 39(5): 413-416.
4. He, B.P., D.Z. Zhao and L. Zhao, 1994. Trace elements in patients with heart diseases and their relationship with blood pressure and biochemical target. Chung Hua-I-Hsuch-Tsa, China. 74(8): 492-494.
5. Saltman, P., 1983. Trace elements and blood pressure. Ann Intern Med. 98(5): 823-827.
6. Bakshi, S.K., K.P. Chawla, R.N. Khandekar and R. Raghunath, 1994. Cadmium and hypertension. J. Assoc.Pyhsicians, India. 42(6): 449-450.
7. Telisman, S., A. Pizent, J. Jurasovic and P. Cvitkovic, 2004. Lead effect on blood pressure in moderately lead exposed workers. Am. J. Ind. Med. 45(5): 446-454.
8. Speich, 1982. M. Concentrations of lead, cadmium and Zinc in human heart muscle and aorta after acute myocardial infraction. J. Am. Coll. Nutrition. 1(3): 255-262.
9. Kuliczkowski, W., B. Jolda Mydlowska and W. Kosmala, 2004.W. Effect of heavy metals ions on function of vascular endothelium in patients with Ischemic heart disease. Pol. Arch. Med. Wewn. 111(6): 679-685.
10. Versieck, J., F. Barbier, A. Speicke and J. Hoste, 1975. Influence of myocardial infraction on serum Manganese, Copper and zinc concentrations. Clin. Chem. 21(4): 578-581.
11. Khan, S.N., M.A. Rahman and A. Samad, 1984. Trace elements in serum from Pakistani patients with acute and chronic ischemic heart disease and hypertension. Clin. Chem. 30(5): 644-648.
12. Wasowicz, W., J. Gromadzinska and K. Rydzynski, 2001. Blood circulation of essential trace elements and heavy metals in workers exposed to lead andcadmium. Int. J. Occup. Med. Environ. Health. 14(3): 223-229.
13. Talib, H., H. Izhar and A.K. Muhammad, 1992. Study of environmental pollutants in and around the city of Lahore, Pakistan. The Science of total Environment. 119, 169-178.
14. Alberts, T.G. and J.P. Houtman, 1985. Relationships between trace elements and atherosciersis. Sci. Environ. 43 (3):255-283.
15. Houtman, J.P., 1996. Trace elements and cardiovascular diseases. J. Cardovasc. Risk. 3(1): 18-25.
16. Meissner, D., W. Hubl and P.K. Schmidt, 1990. Trace elements harmone relations in the early course of myocardial infraction. Z. Med. Lab. Design. 31(3): 181-184.
17. Varga, M. and L.A. Zsonda, 1988. Simple method for postmortem detection of acute myocardial infraction. Forensic Sci. Int. 37(4): 259-263.