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Serum Zinc in Myocardial Infarction

by

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ABSTRACT. The pattern of change in serum zinc levels following acute myocardial infarction(MI) has been studied. On day 1 the mean serum zinc level was comparable to the mean level observed in a control group of patients hospitalised for acute bronchial asthma. On days 2 - 4 the serum zinc levels dropped, and were significantly lower than the mean level on day 1 ($p < 0.01$) and also lower than the mean serum zinc level of the controls ($p < 0.001$).

INTRODUCTION

Many researchers have reported that plasma or serum zinc levels fall during myocardial infarction (MI) (Davis, Musa and Dormandy, 1968; Halstead and Smith Jr. 1970; Ponteva, Elomaa, Backman, Hansson & Kilpio, 1979). It has also been suggested that serum/plasma zinc estimations may be of prognostic significance (Low and Ikram, 1976; Walker, Hughes, Simmons & Chandler, 1978; Lekokis and Kalofrutis, 1980). The pattern of change of serum zinc levels in Sri Lankans suffering from MI has been studied.

SUBJECTS, MATERIALS AND METHODS

The patient and control groups were drawn from those admitted to a medical unit of the General Hospital, Colombo, over a two-month period. The diagnosis of MI was based on a typical history and Q waves on the electrocardiogram (ECG) and was confirmed subsequently by typical rises in serum aspartate amino transferase (AST). Some patients, though fulfilling the first two criteria, were not included because the laboratory was not notified early enough to enable the investigation to

commence either on day 1 or 2 of the disease. Subsequently, however, those on whom the investigation could commence even on day 3 were also included in the study. The group with myocardial ischaemia had only transient T wave changes on the ECG, with no rise in AST. The control group comprised patients hospitalised for acute bronchial asthma. The MI group was investigated daily up to day 4. The ischaemic and control groups were investigated once, on day 2 or 3 of illness.

The MI group comprised 16 patients, 15 males and 1 female, of mean age 51.8yrs, range 36 - 65 yrs. The control group consisted of 7 patients, all males, with mean age 38.6, range 23-58 yrs. The ischaemic group consisted of 5 patients, all males, of mean age 58 yrs and range 42-76 yrs.

Blood samples (5 ml) were drawn at 8.00 a.m. after an overnight fast, using disposable plastic syringes. Serum was separated within one hour of collection by centrifugation (600 g, 5 min) and haemolysis-free serum samples stored at -20°C, each in two polypropylene vials. One aliquot was used for AST assay by a colorimetric method (Varley, Gowenloch and Bell, 1980), performed within a week of sample collection. Zinc estimation by atomic absorption spectroscopy was done within 4 weeks of sample collection using 1 in 5 dilutions and glycerol/water standards recommended by Smith, Butrimovitz and Purdy (1979). All vials and pipettes used in the assay were soaked in 10% nitric acid, washed thrice in deionized water and oven dried before use. Deionized water was used for preparation of reagents.

RESULTS AND DISCUSSION

Table 1 presents the serum zinc levels (mean + 1 S.D.) on days 1-4 in the MI group, in a control group of bronchial asthmatics and in a group having myocardial ischaemia. Fig. 1 presents the data in the form of a scatter diagram. The serum zinc level on day 1 of MI did not differ significantly from that of the control. On days 2-4, the serum zinc level dropped in the MI groups and was significantly lower than in the control on each day ($p < 0.001$). The levels on days 2-4 were also significantly lower than the level on day 1 ($p < 0.01$). Patients with myocardial ischaemia without infarction had serum levels which did not differ significantly from that of the control group.

TABLE 1. Serum zinc levels (mean + 1 S.D) in μM per litre on days 1-4 in cases of myocardial infarction (MI), in a control group of bronchial asthmatics, and in a group with myocardial ischaemia.

	No. of observations	Serum Zinc ($\mu M l^{-1}$) Mean	S.D.	p^*	p^{**}
MI day 1	5	10.54	1.33	> 0.05	—
MI day 2	12	7.71	1.61	< 0.001	< 0.01
MI day 3	11	7.78	1.55	< 0.001	< 0.01
MI day 4	7	7.88	0.85	< 0.001	< 0.01
Controls (acute bronchial asthma)	7	10.58	0.86	—	> 0.05
Myocardial ischaemia	5	10.31	1.58	> 0.05	> 0.05

p^*, p^{**} denote the p values when each group is compared to the control group and to MI day 1 respectively.

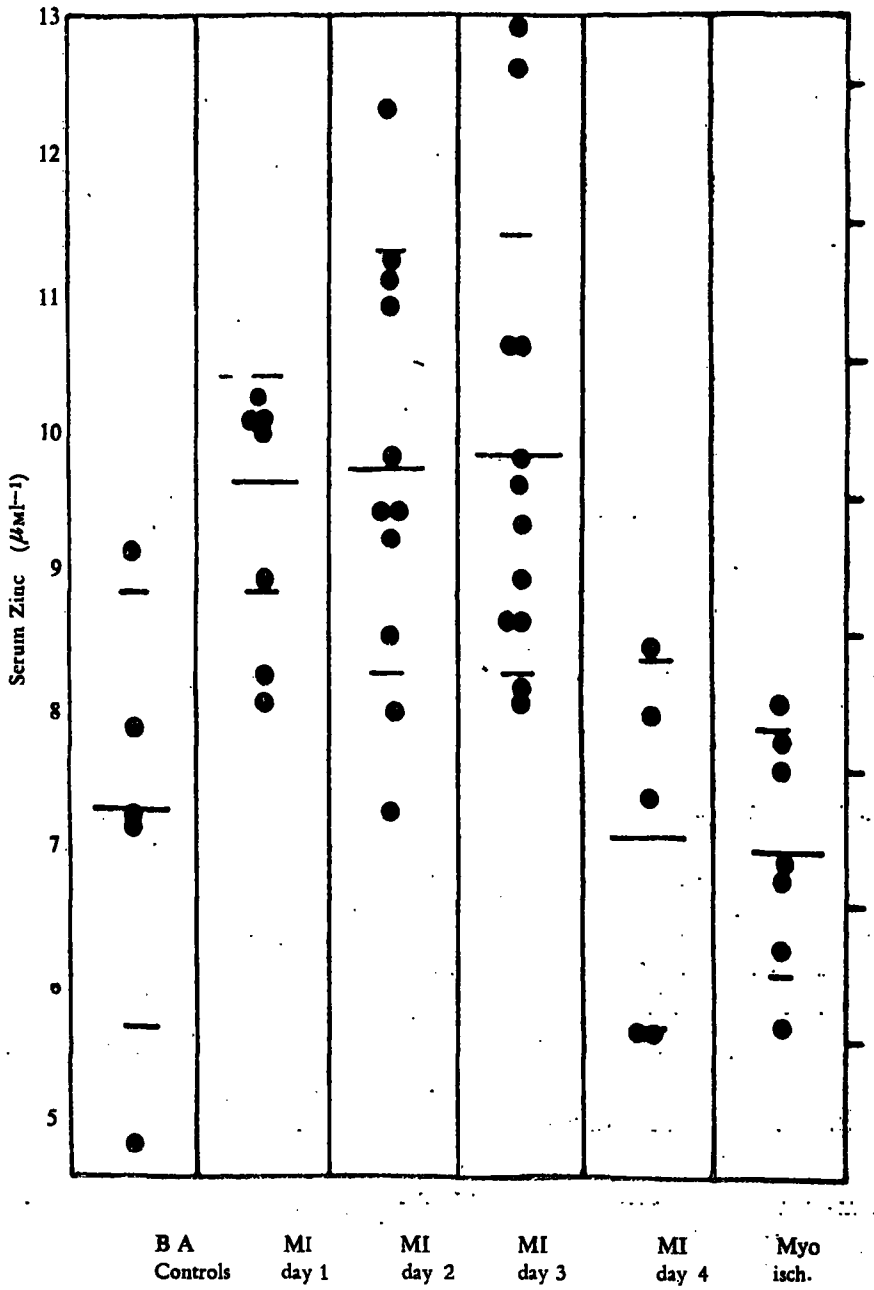

Fig. 1. Scatter diagram of serum zinc levels in acute bronchial asthma, in MI on days 1-4 and in myocardial ischaemia. The mean value + 1 S. D. is shown.

Table 2 presents the analysis of the data in the individual patients with MI. Of the 16 patients in the MI group, 11 were investigated at least twice between days 2-4. It was therefore possible in each of these 11 cases to compute the mean + 1 S. D. for serum zinc on days 2-4 of MI for comparison with the control group. In 8 cases the mean serum zinc level was significantly lower than in the controls, in 5 at 0.1%, in 2 at 1% and in 1 at the 5% level. In 3 cases the difference was not statistically significant.

TABLE - 2 Serum Zn levels (mean + 1 S.D.) in μ M per litre on days 2-4 of MI in individual patients.

Patient	Days	No. of observations	Serum Zinc (μMl^{-1})		p*	p**
			Mean	S.D.		
P.A.	2-4	3	7.74	0.49	<0.001	<0.01
J.I.	2-3	2	8.95	0.11	<0.001	<0.05
O.F.	2-4	3	6.88	0.57	<0.001	<0.01
K.A.	2, 4	2	9.04	0.69	<0.01	>0.05
M.H.	2,3	2	7.50	0.90	<0.01	<0.05
H. P.	2-4	3	6.26	1.26	<0.001	<0.05
H. D. C.	3, 4	2	7.02	0.57	<0.001	<0.05
J. R.	2, 3	2	7.29	3.01	>0.05	>0.05
N. B.	3, 4	2	9.08	0.70	<0.05	>0.05
S. U.	3, 4	2	8.91	1.95	>0.05	>0.05
L. H.	2. 3	2	8.79	1.03	>0.05	>0.05

P* and P** denote the respective p values, when the mean Zn level of each patient is compared to those in the contro group of bronchial asthmatics and to the mean value of MI day 1. The "Days" column indicates the days on which the observations were made.

The results reported here establish that the pattern of change of serum zinc levels in Sri Lankans suffering from MI is similar to that reported in the West (Davis, Musa and Dormandy, 1968; Halstead and Smith Jr 1970; Ponteva, Elomaa, Backman, Hansson and Kilpio, 1979). Low and Ikram (1976) reported a fall in plasma zinc within the first three days of infarction and a rise to normal by the 10th day. Walker, Hughes, Simmons and Chandler (1978) reported minimum plasma zinc on day 2 with normal levels being reached on day 8. Lekokis and Kalofrutis (1980) reported that the lowest serum zinc levels were observed on the 2nd and 3rd days after infarction. Due to financial constraints this study was limited to the first four days of MI.

Plasma zinc levels correlate well with the peak value of plasma enzymes (Low and Ikram, 1976) and there is a statistically significant negative linear correlation between serum zinc and AST on days 1-4 of MI (Lekokis and Kalofrutis, 1980). In the present study, however, the negative correlation ($r = 0.55$) between the minimum serum zinc level and the peak AST level was not statistically significant (Table 3).

TABLE 3 Correlation of minimum serum zinc levels in μM per litre and peak AST values in International Units (IU) in 11 cases of MI.

Patient	Days	Minimum Serum Zinc μMl^{-1}	Peak AST value (IU)	Correlation co-efficient r	t value (significance)
P.A.	2-4	7.26	85		
J.I.	2-3	8.87	124		
O.F.	2-4	6.29	105		
K.A.	2,4	8.55	275		
M.N.	2,3	6.86	151	—0.545	1.830 (NS)
N.B.	3,4	8.58	101		
H.P.	2-4	4.94	302		
H.D.C.	3,4	6.61	220		
L.H.	2,3	8.06	124		
S.U	3,4	7.53	105		
J.R.	2,3	5.16	300		

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