

Relation between Zinc Level and One Year Mortality among Elderly Patients with Heart Failure

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Abstract

Background: Zinc (Zn) deficiency in endothelial cells potentiates the inflammatory response mediated by certain lipids and cytokines, possibly via mechanisms associated with increased cellular oxidative stress.

Objectives: To assess the relation between zinc level and one year mortality among elderly patients with heart failure.

Patients and Methods: Serum zinc level was measured in 100 elderly patients with heart failure diagnosed by Criteria of New York Heart Association (NYHA). Patients were followed by telephone for one year to assess relation between Zinc level and one year mortality among elderly patients with heart failure. **Results:** Higher mortality percentage was found among patients with high level of zinc but there was no statistical significant difference. (P-value >0.05). And non significant relation was found between mean level of zinc and mortality, between age and Zn, and between Ejection Fraction (EF) and Zn. Zn level was lower among patients with EF >45 but the difference was not significant (P-value >0.05). **Conclusion:** Patients who had high level of zinc had greater risk for mortality. Zn level was lower among patients with EF >45 but the difference was not significant and the least mean of zinc was among patients with left ventricular (LV) systolic dysfunction.

Key words: Zinc, mortality, elderly patients, heart failure.

Introduction

Heart failure is a common, costly, disabling, and potentially deadly condition. In developed countries, around 2% of adults suffer from heart failure, but in those over the age of 65, this increases to 6–10 %⁽¹⁾.

In developed countries, the mean age of patients with heart failure is 75 years old. In developing countries, those 70 to 80 years old, it occurs in 20–30 percent⁽¹⁾.

Heart failure is associated with significantly reduced physical and mental health, resulting in a markedly decreased quality of life^(2,3).

Zn deficiency in endothelial cells potentiates the inflammatory response mediated by certain lipids and cytokines, possibly via mechanisms associated with increased cellular oxidative stress⁽⁴⁾.

Zn plays important roles in the protection of vascular system from oxidative stress and damage. For instance, Zn deficiency in diabetic patients was found to be associated with increased cardiovascular events⁽⁵⁾ which may be related to the increased inflammatory response in vascular system⁽⁶⁾.

The anti oxidative action of zinc prevents oxidation of LDL cholesterol and

consequently stops the main mechanism of atherogenesis. Zinc blocks calcium and its several actions on atherogenesis. Increased amounts of cytotoxic cytokines such as tumor necrosis factor (TNF)-alpha, interleukin (IL)-beta and IL-8, often produced in the elderly, are blocked by high dose zinc, low serum zinc level was an independent risk factor for CHD events⁽⁵⁾.

There is a rising question about the relation between Zn level and mortality among elderly patients with heart failure. Unfortunately no available literatures discuss this issue.

Objectives are to assess the relation between zinc level and one year mortality among elderly patients with heart failure.

Patients and methods

Design:

A prospective study was conducted.

Sample:

One hundred elderly patients with heart failure diagnosed by Criteria of New York Heart Association (NYHA)⁽⁷⁾. They recruited from the different medical wards in Ain Shams University Hospital during a 12

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months period from August 2011 to August 2012.

Methods:

Each patient subjected to:

-Complete examination including general examination with special consideration to cardiological examination.

- A venous blood samples were collected to measure serum zinc, laboratory measures was performed in central lab of Ain shams University Hospital.

- Patients were followed by telephone for one year to assess relation between zinc level and one year mortality among elderly patients with heart failure.

Results

The study was performed on 100 elderly patients with heart failure, 46 males representing 46% and 54 females representing 54%.

The age of participants ranged from 62 years old to 88 years old with mean 66.28 ± 8.9 years.

High mortality percentage among patients with high level of zinc was recorded but there was no statistical significant difference, P-value >0.05 (**Table 1**).

The least mean of zinc (89.14) was among patients with left ventricular systolic dysfunction. Although no statistical significant relation could be detected, P-value >0.05 (**Table 2**).

There was no significant correlation between age and Zn (**Table 3**), and no significant correlation between EF and Zn (**Table 4**).

Mean zinc was higher among died patients compared with living patients, although no significant difference, P-value >0.05 (**Table 5**).

Table (1): Relation between levels of Zinc and mortality

			Mortality		X ²	P value	Sig.
			Died (N=58)	Living (N=42)			
Zn	Normal	N.	52	40	1.934	0.323	NS
		%	56.5%	43.5%			
	Low	N.	3	2			
		%	60.0%	40.0%			
	high	N.	3	0			
		%	100.0%	0.0%			

Table (2): Comparison between mean of Zinc and different types of heart failure

		N	Mean	±SD	F	P value	Sig.
Zn	RT sided failure	4	90.50	7.724	0.121	0.947	NS
	Lt ventricular Diastolic dysfunction	32	90.88	11.505			
	Lt ventricular Systolic dysfunction	22	89.14	15.403			
	Lt ventricular systolic and diastolic heart failure	42	91.07	12.330			

Table (3): Correlation between age and Zinc

		Zn
Age	Pearson Correlation	0.129
	P value	0.201
	Significance	NS

Table (4): Correlation between Ejection Fraction and Zinc

		Zn
EF	Pearson Correlation	-0.051
	P value	0.612
	Significance	NS

Table (5): Relation between mortality and the level of Zinc

	Mortality	N	Mean	SD	t	P value	Sig.
Zn	Died	58	91.72	14.322	1.092	0.277	NS
	Living	42	88.95	9.471			

Discussion

The current study shows a high mortality percentage among patients with high level of zinc (**table 1**). This may be explained as one -year follow-up period may not be long enough to demonstrate the effects of inflammation on risk of death in patients with heart failure and it is possible that in participants, the effect of zinc may be obscured by the presence of other comorbidities not related to inflammation.

Soinio et al.⁽⁵⁾ compared the CHD mortality in subjects in the lowest quartile (serum zinc level $\leq 14.1 \mu\text{mol/l}$) with those in the upper three quartiles (serum zinc $>14.1 \mu\text{mol/l}$). The risk for death from CHD was higher in subjects in the lowest quartile than in those in the upper three quartiles. This was not in agreement with the current study.

On the other hand, high level of zinc may lower copper serum concentrations, which might increase incidence of aneurysms⁽⁸⁾.

Additionally, Zinc may interact with LDL, HDL lipoproteins, and triglycerides, reducing HDL cholesterol levels⁽⁹⁾.

Zn level in the current study was lower among patients with $\text{EF} > 45$ but the difference was not significant and the least mean of zinc was among patients with LV systolic dysfunction. Although no statistical significant relation could be detected. These results can be explained as the close relationship between systole and diastole as well as their interdependence as some cardio depressive mechanisms may also play a role in the diastolic phase.

On the other hand, Zn deficiency results in increased oxidative damage in multiple organs including the heart due to the decreased cardiac antioxidant capacity⁽¹⁰⁾.

Zinc participates in blood pressure regulation and in the pathogenesis of hypertension (HTN). This may explain the association between zinc deficiency and diastolic heart failure⁽¹¹⁾.

Zn deficiency can be a risk factor for the development of diabetic cardiovascular complications⁽¹²⁾.

Zinc reduces systolic and diastolic calcium, and increases diastolic sarcomere length, which is achieved by partially blocking L-type channels and decreasing ryanodine receptor phosphorylation. The

two effects combined significantly lower the high calcium content in diabetes mellitus (DM) and restore sarcomere contraction to normal. Since oxidative stress is prevalent in DM, zinc could be potentially used to treat diabetic patients with associated cardiac diastolic dysfunction ⁽¹³⁾.

Measurements of cardiac function have demonstrated that Zn is capable of improving left ventricular systolic and diastolic function. Zinc administration could be a possible long term management regimen for incomplete relaxation and diastolic dysfunction associated with diabetic cardiomyopathy ⁽¹⁴⁾.

Conclusion

The study revealed that patients who had high level of zinc had greater risk for mortality. Zn level was lower among patients with EF >45 but the difference was not significant and the least mean of zinc was among patients with LV systolic dysfunction (**table 2**).

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