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ORIGINAL ARTICLE

Plasma Ceruloplasmin in Chronic Renal Failure Patients Undergoing Haemodialysis

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ABSTRACT

Plasma ceruloplasmin levels were estimated in 42 renal failure patients undergoing haemodialysis and in 42 age and sex matched controls. Plasma ceruloplasmin levels in cases before haemodialysis (947.27 ± 458.58) was significantly increased as compared to the controls (477.95 ± 278.63). There was no statistically significant change in the plasma ceruloplasmin levels before and after haemodialysis.

Key Words: Ceruloplasmin, Renal failure, Haemodialysis

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Introduction

Chronic kidney disease is a progressive loss of renal function over a period of months or years through five stages [1]. Each stage is progressive through an abnormally low and deteriorating glomerular filtration rate. Chronic kidney disease is defined as an estimated glomerular filtration rate <60ml/minute/1.73m^2 [2].

Ceruloplasmin is a member of the highly conserved family of blue multicopper oxidase. It is an enzyme (E.C. 1.16.3.1) which is synthesized in the liver as a single polypeptide chain [3]. The physiological function(s) of ceruloplasmin is uncertain and its roles in copper transport, coagulation, angiogenesis defense against oxidative stress and iron homeostasis, have all been reported [4],[5]. The active holoprotein has its ferroxidase activity conferred through the incorporation of six copper atoms [6]. It is a copper containing ferroxidase that functions as an antioxidant.

The aim of the present study is to compare the plasma ceruloplasmin levels among patients [chronic renal failure] undergoing haemodialysis (before and after haemodialysis) and in controls (age and sex matched).

Material and Method

The present study was conducted in the Department of Biochemistry after obtaining clearance from the hospital ethical committee.

Cases

The study group consisted of 42 patients with renal failure who came to the hospital for haemodialysis.

Controls

The control group consisted of 42 age and sex matched normal healthy individuals who came to the hospital for health checkup.

Sample Collection

Blood samples were collected in heparinized tubes from the controls and the cases (before and after haemodialysis) by using aseptic precautions, after obtaining written consent. Blood samples were immediately processed to obtain plasma for the estimation of ceruloplasmin. The ceruloplasmin levels in plasma were assayed by the

colorimetric method described by Sudderman and Nomato [7].

Statistical Analysis

Plasma ceruloplasmin levels between the controls and cases were compared by the Mann-Whitney test. Plasma ceruloplasmin levels before and after haemodialysis were compared by the Wilcoxon signed rank test.

Results

The mean plasma ceruloplasmin levels in the cases (947.95 ± 458.58 mg/L) were significantly increased as compared to that of the control group (477.95 ± 278.63 mg/L) [Table/Fig 1]. The mean plasma ceruloplasmin levels were increased after haemodialysis (1083.59 ± 577.54) as compared to the plasma ceruloplasmin levels before dialysis (947.27 ± 458.58) in the cases. However, there was no statistically significant difference between the plasma ceruloplasmin levels before and after dialysis [Table /Fig 2].

(Table / Fig 1) Comparison Of Plasma Ceruloplasmin Level (Mg/L) In Cases And Controls

Group	Mean	Standard. deviation	Mann Whitney Test
Control	477.95	278.63	Z = 5.529 p= 0.000
Cases	947.27	458.58	

(Table / Fig 2) Comparison Of Plasma Ceruloplasmin Level (Mg/L) In Cases Before And After Dialysis

	Mean	Standard deviation	Wilcoxon signed rank test
Ceruloplasmin before dialysis	947.27	458.58	Z = 1.481 P= 0.138
Ceruloplasmin After dialysis	1083.59	577.54	

Discussion

Ceruloplasmin serves as a ferroxidase that converts toxic ferrous iron to nontoxic ferric ion, which binds to transferrin [9]. It acts as an antioxidant by removing the free ferrous ion which acts as a major producer of oxidants (superoxide and hydroxyl radicals) [10]. In addition to this, ceruloplasmin also acts as an antioxidant by catalyzing the destruction of oxygen radicals [11], [12], [13] and can bind to and inhibit neutrophil myeloperoxidase oxidant activity [14].

In the present study, the cases selected were undergoing frequent haemodialysis and there was an increase in their plasma ceruloplasmin levels as compared to controls. Bustamenta et al. [8] had reported that in patients with renal failure who underwent haemodialysis, there was progressive increase in the ceruloplasmin levels in the serum.

Lughrey et al. [15] studied oxidative stress in haemodialysis and concluded that oxidative stress was more in chronic renal failure cases as compared to controls, but it is further exacerbated by haemodialysis, as is evidenced by increased lipid peroxidation and low antioxidant levels.
The mean plasma ceruloplasmin levels were increased after haemodialysis as compared to the plasma ceruloplasmin levels before dialysis in the cases. However, statistical analysis revealed that there was no significant difference between the plasma ceruloplasmin levels before and after dialysis (table 2).
Increased free-radical production leading to oxidative stress may contribute to the development of cardiovascular complications in haemodialysis patients. The ferroxidase activity of ceruloplasmin forms an important component of antioxidant defense in body fluids. Roxborough et al studied the ferroxidase activity in haemodialysis patients and observed a reduction in ferroxidase activity in patients undergoing haemodialysis as compared to controls. Following dialysis, the ferroxidase activity rose significantly, with a significant difference still remaining in the ferroxidase activity between the controls and the patients.. The ferroxidase activity of ceruloplasmin is impaired in renal failure. Inhibition of the ferroxidase activity of ceruloplasmin in dialysis patients may contribute to increased oxidative stress in these patients [16].

Abnormalities in copper metabolism and their influence on iron handling in renal failure are complex. It requires an

additional study before their importance can be defined.

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